Appendix E

Jacinth-Ambrosia Mine Closure Plan

Jacinth-Ambrosia Environmental Management Plan

Mine Closure

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CONTENTS

JACINTH AMBROSIA

TABLES

FIGURES

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1. INTRODUCTION

1.1. Purpose

This Jacinth-Ambrosia Mine Closure Plan (MCP) has been prepared in accordance with the Mining Lease (ML) conditions for the Jacinth-Ambrosia (J-A) Mineral Sands Mine, located in the Eucla Basin, 900 km from Adelaide, South Australia (Figure 1). The purpose of this MCP is to provide detail on Iluka's approach to closure and completion of the J-A mining operations. The MCP provides a systematic approach for Iluka to follow through the closure planning process for J-A. Specifically, the MCP provides a process to ensure:

- all statutory obligations are fulfilled, and successful relinquishment of all relevant leases/tenements/licenses/authorities is achieved;
- disturbed land is effectively rehabilitated to a condition that supports a sustainable post-mining land use;
- Iluka's social license to operate is maintained whereby opportunities to enhance the environmental values of the land are maximised and potential social implications are identified and adequately addressed post-closure;
- site closure activities are undertaken in a cost-effective and timely manner;
- relevant stakeholders are consulted to provide feedback throughout the closure planning process; and
- potential social impacts related to closure are minimised where reasonably practical.

The preparation of this MCP is consistent with the requirements of the Department for Energy and Mining (DEM) Minerals Regulatory Guidelines MG2b: Preparation of a program for environment protection and rehabilitation (PEPR) for metallic and industrial minerals (excluding coal and uranium) in South Australia.

1.2. Scope

The MCP covers activities undertaken on Mining Lease 6315 (ML6315), Extractive Mineral Lease (EML6316) and Miscellaneous Purposes Licences (MPL) 110 (borefield, pipeline and access road), MPL111 (airstrip and village accommodation) and Canberra Road MPL (161). The MCP is a standalone document, however, should be considered a companion document to the J-A Rehabilitation Management Plan and Program for Environment Protection and Rehabilitation (PEPR).

1.3. Acronyms

The acronyms used throughout this MCP are outlined in Table 1.

Table 1 Acronyms

Acronym	Expansion
AARD	Aboriginal Affairs and Reconciliation Division
ACR	Annual compliance Report
ALT	Aboriginal Lands Trust
ARI	Average recurrence interval

Acronym	Expansion
BSC	Biological soil crust
BOM	Bureau of Meteorology
CCS	Cater Care Services
Civil Aviation Safety Authority	CASA
DEM	Department for Energy and Mining
DEW	Department for Environmental and Water
DFAT	Department of Foreign Affairs and Trade
DIT	Department of Infrastructure and Transport
EML	Extractive Mineral Lease
EPA	Environment Protection Authority
FWCAC	Far West Coast Aboriginal Corporation
GRA	Gypsum Resources Australia
HDPE	High-density polyethylene
HMC	Heavy Mineral Concentrate
J-A	Jacinth-Ambrosia
JARMS	J-A Research and Monitoring Summary
KPS	Kalgoorlie Power Systems
LFA	Landscape Function Analysis
mAHD	Elevation in metres with respect to the Australian Height Datum
MARP	Mine and Rehabilitation Plan
MCP	Mine Closure Plan
ML	Mining Lease
ModCod	Modified Co-disposal of tailings
MPL	Miscellaneous Purposes Licence
MUP	Mine unit plant
PEPR	Program for Environmental Protection and Rehabilitation
RAMP	J-A Research and Monitoring Programs

Acronym	Expansion
REX	Regional Express
RO	Reverse Osmosis
SACOME	South Australian Chamber of Mines and Energy
SMU	Soil management unit
TSF	Tailings Stockpile Facility
WCP	Wet concentrator plant

1.4. Planning for mine closure

Mine closure planning is a continuous process throughout the life of the mine and the MCP will be progressively reviewed throughout the life of the mine. Iluka's general approach to the preparation of Closure Plans involves the preparation of Conceptual Closure Plans for those operations where closure activities are more than 5 years away.

Given the operational phase of the J-A Mine, this MCP is considered (in terms of Iluka's internal requirements) conceptual in nature and will be revised during operations before becoming the detailed Mine Closure Plan.

The MCP has been developed in consultation with Iluka's Environment Health and Safety Standard 8 – Rehabilitation and Closure and the approach documented in the Mine Closure information book (DFAT, 2016).

1.5. Closure scenarios

This MCP includes identification of the closure and completion tasks required for a number of closure scenarios across the J-A Mine area, which includes the Mining Lease area (ML), Miscellaneous Purposes Licence areas (MPLs) and Extractive Minerals Lease areas (EMLs). For the purposes of this MCP the definitions outlined in Table 2 are adopted.

Table 2 Definitions

Term	Definition
Decommissioning	The process that begins near, or at, the cessation of mineral production. This term is often used interchangeably with site closure but in this MCP refers to a transition period and activities between cessation of operations and final closure (e.g. building demolition, removal of plant and equipment, removal of services and other infrastructure etc.).
Closure	Closure is deemed complete at the end of decommissioning and rehabilitation and where all current appropriate regulatory obligations have been satisfied. Within this document, the definition will be extended. Three closure

Term	Definition
	scenarios are considered as part of the scope of this MCP: • *Planned closure and completion* – assumes that the mine operates as per the proposed mine life and transitions into closure activities at the end of the planned mine life. • *Sudden unplanned closure* – assumes that an unforeseen or unplanned event occurs that requires the mine to cease operation and potentially limited ability to undertake closure activities (might result in use of the bond). • *Care and maintenance* – assumes that an unforeseen or unplanned event requires the mine to cease operations or the planned mining operations is completed, however, there is potential for the mining operation to recommence or additional operations to commence in the near future. Under this scenario, the site will be maintained in a safe and stable state until either operations recommence, or the site is permanently closed.

1.6. References

This MCP should be read in conjunction with the Iluka documentation outlined in Table 3.

Table 3 Iluka documentation

Document ID	Document title	Description
0016-940010196-699	CR_002_PL_Cultural Heritage	J-A Heritage Management Plan
0016-940010196-391	ENV_004_PL_Dust and Air Quality	J- A Air Quality Management Plan
0016-940010196-364	ENV_005_PL_Fauna	J-A Fauna Management Plan
0016-940010196-389	ENV_006_PL_Fire	J-A Fire Management Plan
0016-940010196-368	ENV_007_PL_Flora	J-A Native Vegetation Management Plan
0016-940010196-406	ENV_008_PL_Groundwater	J-A Groundwater Management Plan
0016-940010196-371	ENV_009_PL_Hazardous	J-A Hazardous Materials Management Plan
0016-940010196-373	ENV_011_PL_Pest Species	J-A Pest Species Management Plan

Document ID	Document title	Description
0016-940010196-476	ENV_014_PL_Radiation	J-A Radiation Management Plan
0016-940010196-379	ENV_015_PL_Surface Water	J-A Surface Water Management Plan
0016-940010196-380	ENV_016_PL_Waste	J-A Waste Management Plan
-	Extractive Mineral Leases Mining and Rehabilitation Program	Mining and Rehabilitation Program
0041-1722145953-583	Jacinth-Ambrosia Program for Environmental Protection and Rehabilitation (PEPR)	Mine approval document
-	Ooldea Road North and Ooldea Bypass Rehabilitation Plan	Ooldea Road and Bypass Rehabilitation Plan
0016-940010196-394	REH_018_PL_Rehabilitation	J-A Rehabilitation Management Plan

The relationship between the MCP and these documents is summarised in Figure 2.

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Figure 1 Location and associated leases of the Jacinth-Ambrosia Mine

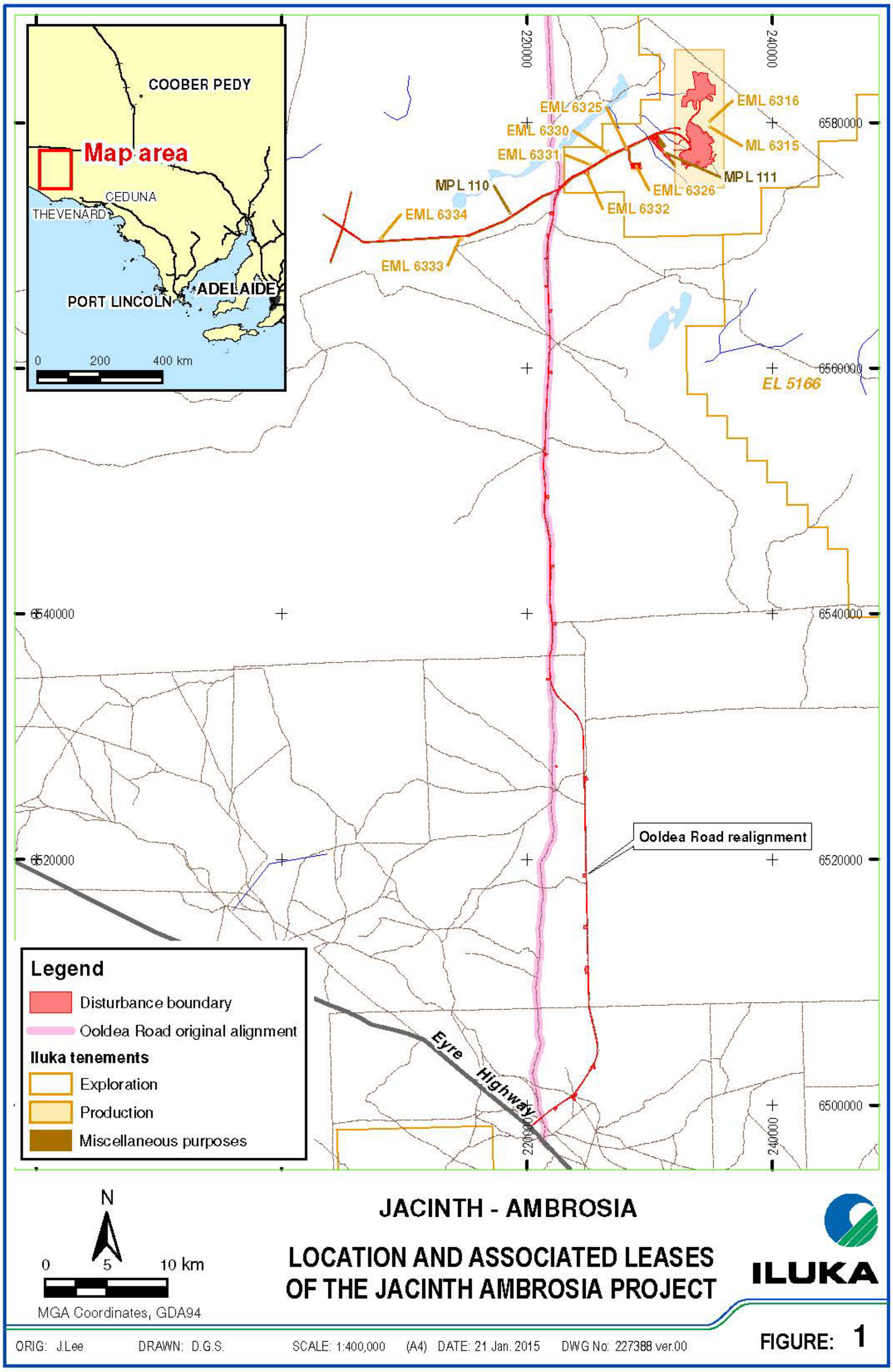

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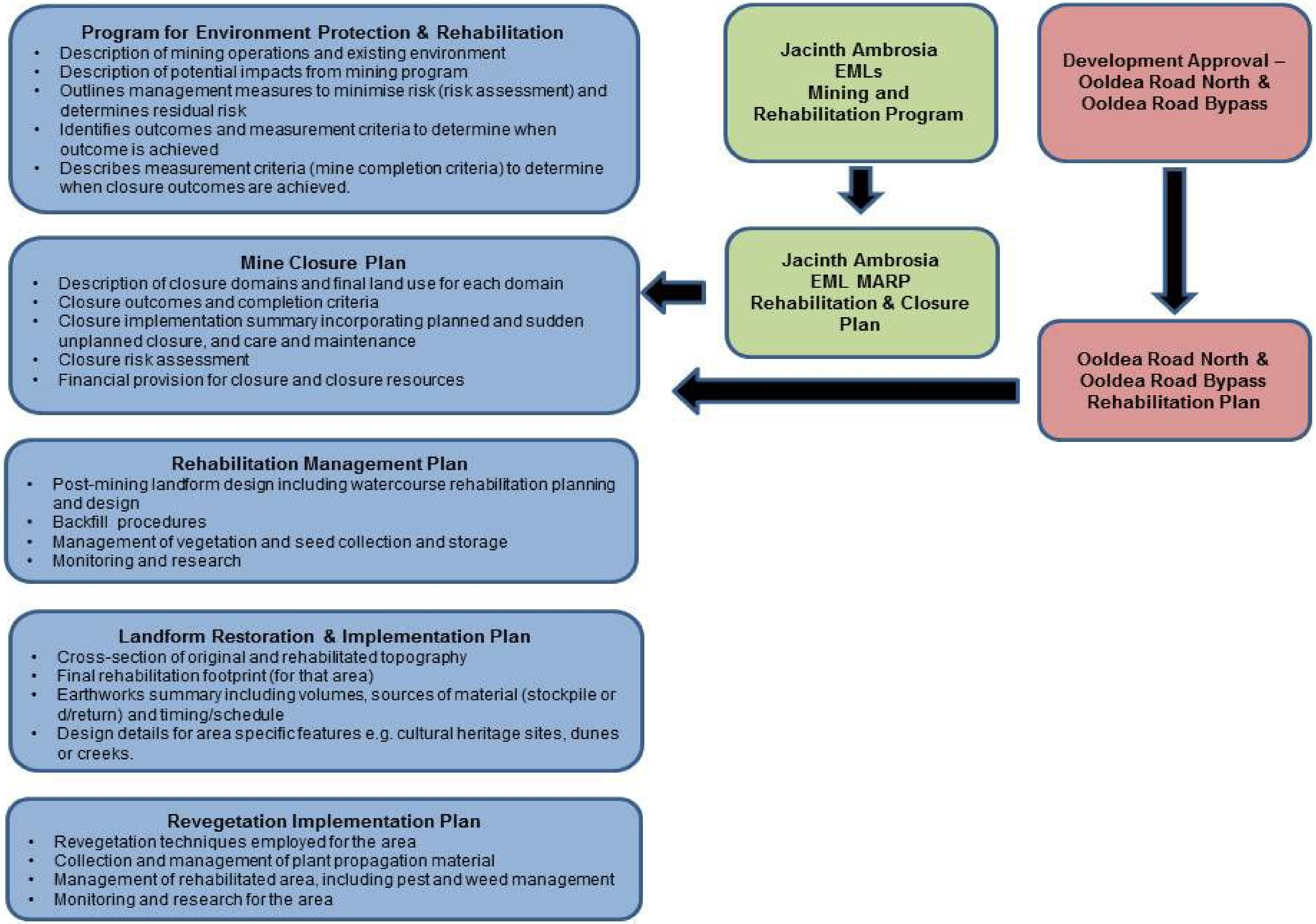
Figure 2 Relationship between the MCP and other approval documentation



2. REGULATORY REQUIREMENTS

2.1. Applicable Legislation

The following legislation, policies, codes and guidelines provide a framework for mine closure activities:

- *Environment Protection Act 1993*;
- *Mining Act 1971*;
- *National Parks and Wildlife Act 1972*;
- *Native Vegetation Act 1991* (and Native Vegetation Regulations 2003 and 2017);
- *Landscape South Australia Act 2019* (and Regulations 2020);
- Strategic Framework for Mine Closure – ANZECC MCA;
- Minerals Regulatory Guidelines MG2b: Preparation of a PEPR for metallic and industrial minerals in South Australia (2020);
- Strategic framework for mine closure (2000) developed by the Minerals Council of Australia and the former Australian and New Zealand Minerals and Energy Council; and
- Leading Practice Sustainable Development Program for the Mining Industry – Mine Closure (2016).

2.2. Lease and licence conditions

Table 4 lists the lease and licence conditions relevant to the tenements that this MCP applies to.

Table 4 Lease and licence conditions

Lease/licence number	Lease and/or licence condition details
ML 6315 EML 6316 MPL 110 MPL 111 MPL 161	The Lessee must ensure that the post mining ecosystem and landscape function is resilient, self-sustaining and indicating that the pre-mining ecosystem and landscape function will ultimately be achieved. The Lessee must ensure that the pre-existing soil profile and function are reinstated. The Lessee must ensure that no demolition, industrial or solid domestic (other than treated sewage) wastes are to be disposed of within the lease. The Tenement Holder must ensure the soil profile and function is restored and capable of supporting the future land use agreed by the Director of Mines or another authorised officer.

3. PROJECT SUMMARY

A brief description of the project details and infrastructure associated with the mine and considered relevant for this MCP are detailed in this section. For additional information, refer to the PEPR.

3.1. Address and contact details

The Iluka contact details are provided in Table 5.

Table 5 Iluka contact details

Corporate Office	Adelaide Office
Level 14, 240 St Georges Terrace Perth Western Australia 6000 Phone +61 8 9360 4700 Fax +61 8 9360 4777	11 Dequetteville Terrace Kent Town SA 5067 Phone +61 8 8300 2000 Fax +61 8 8300 2003

3.2. Mining, Tenure, Land Ownership and Reserves

The Land Tenure and ownership details are provided in Table 6.

Table 6 J-A land tenure and ownership summary

Tenement	Land Ownership	Tenure Details
ML6315	Crown land - Minister for Sustainability, Environment and Conservation	CR 5957/384 – Yellabinna Regional Reserve
EML6316, 6325, 6326, 6330, 6331, 6332, 6333, 6334		CR 5957/384 - Yellabinna Regional Reserve
MPL110		CR 5851/202 - Nullarbor
MPL111		CR 5957/384 - Yellabinna Regional Reserve
MPL 161		CR – 5957/384 – Yellabinna Regional Reserve

3.3. Project description

The J-A Mine is a mineral sand mining operation comprised of two main deposits, Jacinth and Ambrosia. The Jacinth and Ambrosia pits are currently being mined with mining operations concluding in 2029. Ore is mined progressively using dry-mining techniques and excavated by a dozer push and fed into a mining unit plant (MUP). The ore is then pumped to the wet concentrator plant (WCP), producing heavy mineral concentrate (HMC).

Following processing, HMC is transported via Ooldea Road to Port Thevenard. The HMC is then shipped to one of Iluka's mineral separation plants (MSP) for further processing.

Infrastructure and operations within the ML include:

- Mining facilities;
- WCP;
- Tailings dams;
- Power station and solar farm;
- Workshops;

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- Warehouse;
- Administration buildings; and
- A reverse osmosis (RO) plant water supply.

The groundwater borefield, access road, airfield, and worker accommodation village were constructed on developed on the MPL areas. The MPL 161 was established in 2021 for a proposed haul road from the Mine Village to Ambrosia (Canberra Road).
Figure 3 shows the location of the mine and associated infrastructure.

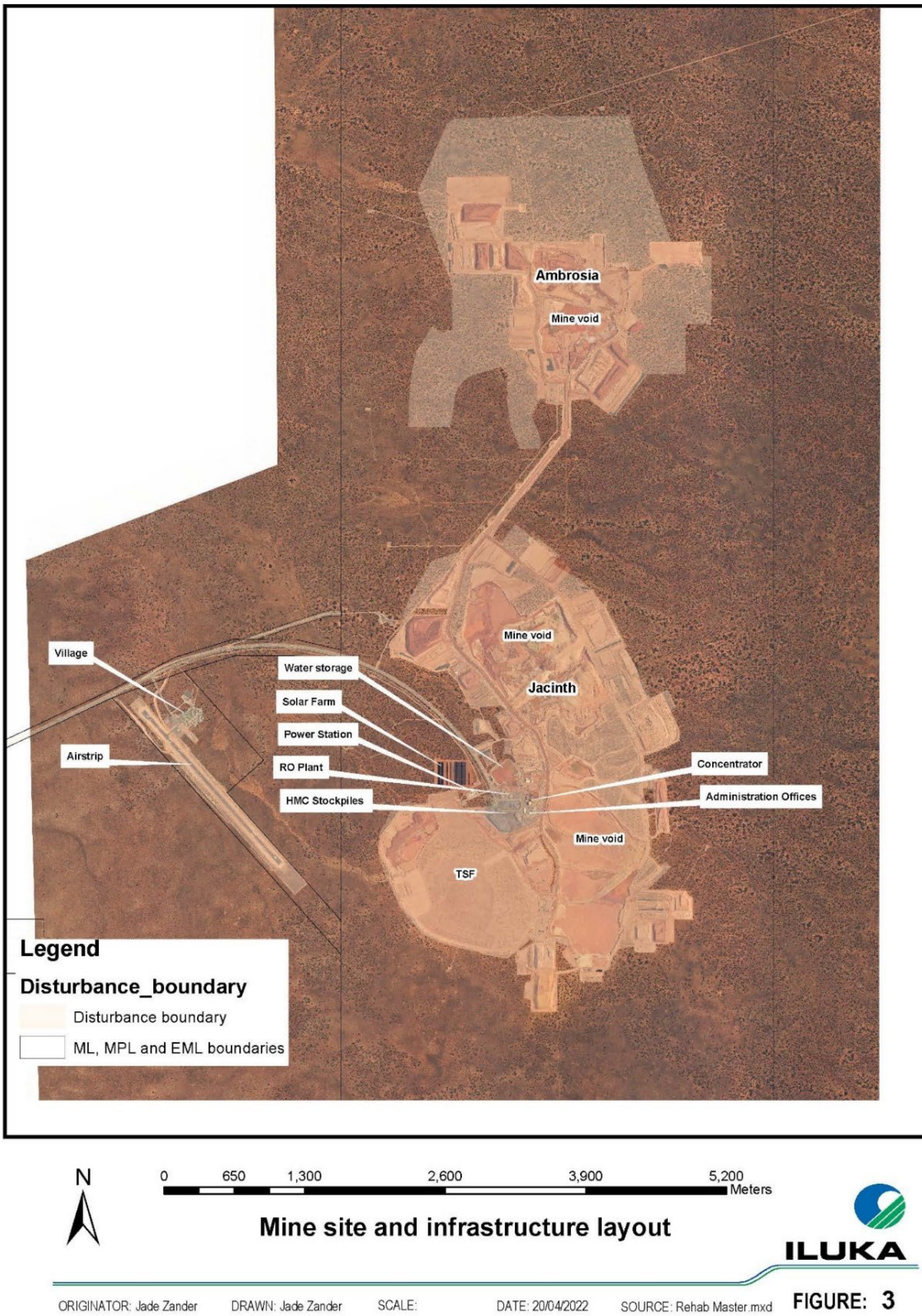
3.3.1. Ooldea Road

To transport HMC from the J-A Mine to Port Thevenard, a 97 km road was constructed. The construction and upgrade works along Ooldea Road were approved in accordance with the *Development Act 1993*. In May 2008, Development Approval (reference 2005/04273/01) was granted for the upgrade and construction of Ooldea Road North and Ooldea Bypass.
As part of construction works, in 2008 part of the existing Ooldea Road was upgraded and realigned in some locations (Figure 1). The entire road was sealed in 2012. The road runs through lands owned by the Department for Environment and Water (DEW) and the Aboriginal Lands Trust (ALT).
The works associated with Ooldea Road upgrade and construction encompassed:

- Establishment and operation (predominately during construction) of groundwater supply bores; and
- Establishment and operation (predominately during construction) of borrow pits.

It is anticipated that a number of water bores and borrow pits will remain open during and post mine operations. Final rehabilitation and closure of these components will be in consultation with the landowner.

Figure 3 Layout of the J-A Mine and associated infrastructure



3.3.2. Mineral Lease – ML6315

This section outlined the infrastructure located within ML6315. A layout of the infrastructure is provided in Figure 3.

Mining Infrastructure:

- Jacinth pit;
- Ambrosia pits;
- MUP; and
- Off-path tailings storage facility (TSF) and on-path TSF.

Processing area:

- WCP including thickener and flocculant plant;
- HMC stockpile area;
- Process water storage dams; and
- Ore and tailings pumping units and pipelines.

Ancillary Mine Infrastructure:

- Borefield;
- RO plant;
- On-site waste transfer station;
- Power station and Solar Farm;
- Operational fuel storage areas;
- Communications and information technology infrastructure;
- Contractor's workshop and laydown facilities;
- Laydown yards;
- Vehicle and equipment wash down facilities;
- Warehousing;
- Sewage treatment facilities;
- Site access roads; and
- Groundwater monitoring bores.

Further infrastructure and operations details are provided in the PEPR.

3.3.3. Miscellaneous Purposes Licence – Village and Airstrip (MPL111)

The following infrastructure is located within MPL111.

Village:

- Accommodation units;
- Laundry facilities;
- Recreation facilities, including court and swimming pools;
- Ancillary buildings (including administration office and check in/out facility for airfield);
- Dry mess and wet mess;

- Access roads and car parks; and
- Sewerage treatment plant.

Airstrip:

- Airstrip (2.5 km in length, 30 m wide runway, 30 m flanks either side);
- Parking apron for aircraft;
- Helicopter parking apron; and
- Drainage lines.

Further details regarding the infrastructure and operations within MPL111 are provided in the PEPR.

3.3.4. Miscellaneous Purposes Licence – Borefield, Pipeline and Access Road (MPL110)

The following infrastructure is located within the MPL110.

Borefield Access Road:

- Unsealed access road (18 km long and 4 m wide);
- 33kV power reticulation line (running from the J-A Mine to the borefield); and
- Water supply pipeline (underground).

Borefield:

- Water supply bores and associated water storage infrastructure (storage bunds, tanks, and turkey's nests);
- Groundwater monitoring bores; and
- Transfer pumping station.

Further details regarding the infrastructure and operations within MPL110 are provided in the PEPR.

3.3.5. Canberra Road (MPL 161)

Approval was obtained to construct a haul road between the J-A Village and the Mine Site, which would enable water carts to collect B-class water and avoid transporting through the J-A Administration areas.

To date, no construction activities have commenced within MPL 161; however, the following infrastructure is proposed:

Canberra Access Road:

- Unsealed access road between the Village and the Mine Lease. Topsoil and subsoil will be stripped and stockpiled and the road will be lined with Secondaries Oversize material.

Further details regarding the infrastructure and proposed haul road are provided within the MPL161 approval.

3.3.6. Extractive Mineral Leases – Borrow pits (EML6325, EML6326, EML6330, EML6331, EML6332, EML6333 and EML6334)

Approval was sought for seven EMLs to use as borrow pits to assist in the construction of the borefield access road and the northern most section of the Ooldea Road. Of the seven EMLs, five were not utilised and the areas remain undisturbed. EML6325 was rehabilitated post use and EML6332 is currently open and used occasionally for road maintenance.
Information regarding the borrow pits has been included to ensure a consistent approach to closure activities across all aspects of the mine operations. Further details regarding the infrastructure and operations within the EMLs located along the borefield access road are provided in the EML MARP.

3.4. History and Current Status of Site

J-A was a green-fields project with construction commencing in 2008 and mining of the Jacinth pit commencing in 2009. The anticipated total area cleared for the J-A mine (ML6315, MPL110 and MPL111) is approximately 1,660 ha, comprising:

- 490 ha *Acacia papyrocarpa* (western myall)/*Eucalyptus oleosa* (red mallee) open woodland;
- 920 ha *Acacia papyrocarpa* (western myall) low open woodland; and
- 250 ha *Maireana sedifolia* (bluebush) and/or *Atriplex vesicaria* (bladder saltbush) low open shrubland.

A total of 1,473.9 ha of native vegetation was disturbed or removed as of the end of 2021, with a further 300.3 ha anticipated for disturbance for the life of mine. A total of 44 ha was rehabilitated in 2021 and the total rehabilitation footprint is 224.57 ha. (Table 7 and Figure 4).

Table 7 Disturbed and rehabilitated areas to end of year 2021

Domain	Disturbed (ha)	Rehabilitated (ha)	Open areas (ha)
Domain 1: Ooldea Road			
A Borrow Pits	93.56	59.22	34.34
B Water Points	2.77	0.20	2.57
C Ooldea Rd (actual road area 155.7 ha)	155.23	-	155.23
Cultural Track	42.0	-	42.0
Domain 2: MPL 111 Airfield and Village			
A Airfield	40.09	-	40.09

Domain	Disturbed (ha)	Rehabilitated (ha)	Open areas (ha)
B & C Village	10.51	1.70	8.79
Domain 3: MPL110 Borefield and Access Road			
A, B, C Infrastructure	90.13	-	90.13
D Turkey’s Nests, Bores	36.78	3.76	33.02
E Tank Farm 1	2.97	-	2.97
F EMLs, Borrow Pits	16.45	5.43	11.02
Domain 4: ML6315 Mine Site			
A Jacinth Pit	286.98	54.01	232.97
B Ambrosia Pit	97.61	-	97.61
C Tailings Storage Facility (including stockpiles)	133.56	98.92	34.64
D Soil Stockpiles	311.76	-	311.76
E, F, G, H Infrastructure	153.61	1.33	152.28
Domain 5: MPL 161 Canberra Road			
A Canberra Road	0.00	0.00	0.00
Total Area	**1,473.9**	**224.57**	**1,249.42**

Figure 4 Jacinth-Ambrosia disturbed and rehabilitated areas (year end 2021)

3.5. Baseline Information

Key characteristics of the existing environment and ecological function that are specifically relevant to closure activities are described below. A more detailed description of the existing environment within the Project area is provided within the PEPR.

3.5.1. Social

The Eyre region is a large and sparsely populated area that is one of South Australia's most isolated regions. The small town of Ceduna, home to around 3,500 people, is the closest population centre to the Project area. Further demographic information on the local community is provided in the PEPR.

3.5.2. Land Uses

The mine and associated infrastructure is located within the Yellabinna and Nullarbor Regional Reserves (Figure 5). The dominant land uses of the reserves are described as conservation of wildlife, conservation landscape and historic features, Aboriginal land use, mineral exploration and tourism. The Project area does not fall within any local council boundaries and as such is described as located in an out of council area.

3.5.3. Climate

The mine and associated infrastructure is located in Eucla Basin, an arid region experiencing high temperatures and evaporation, and low and irregular rainfall. Further climate details are provided in the PEPR.

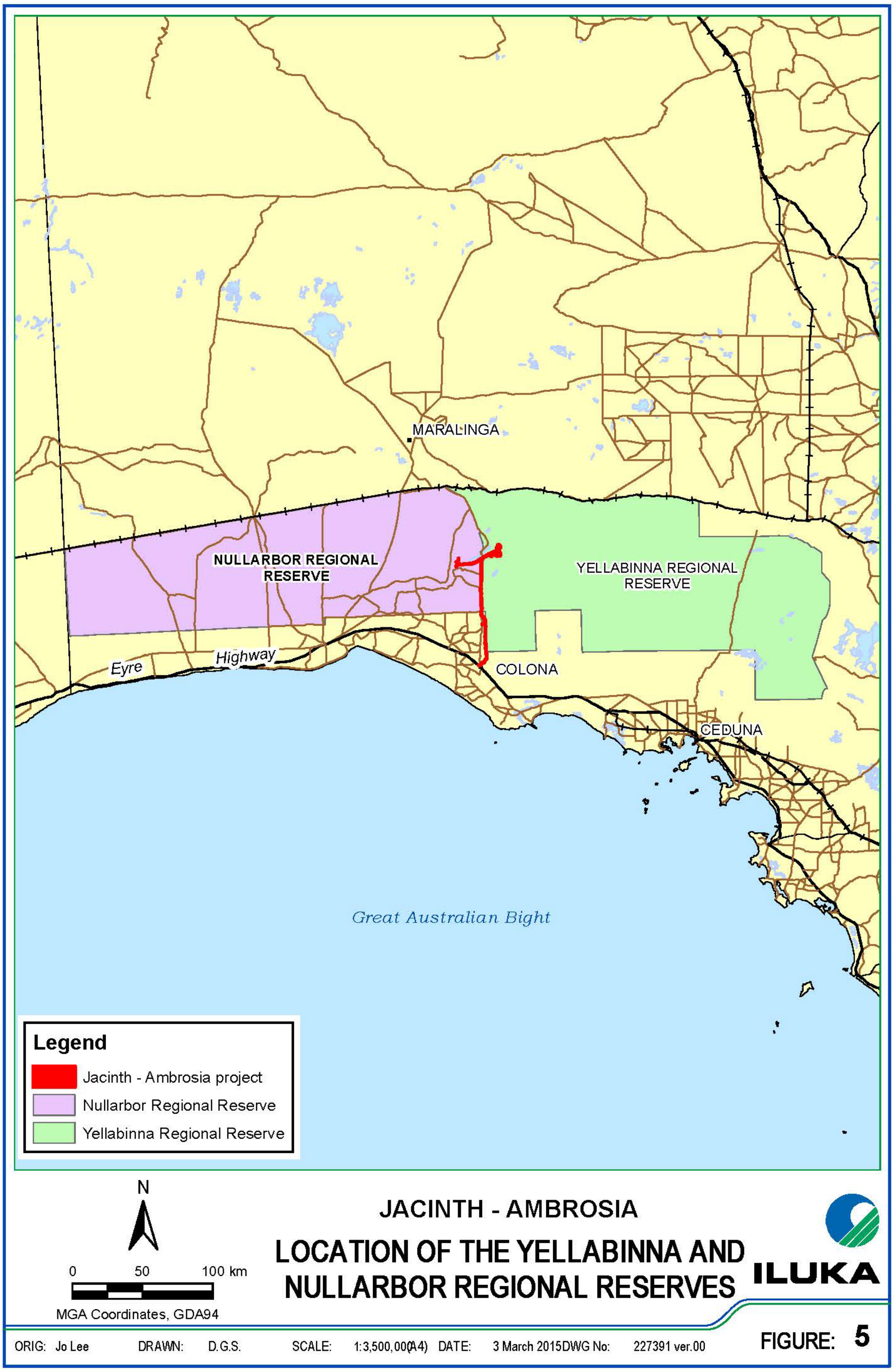
3.5.4. Temperature

Hot conditions are experienced in the region during December to February when daily temperatures generally exceed 30°C. Typical of desert environments, low overnight temperatures are also experienced, with minimum day time temperatures lowered to less than 20°C for several days during winter each year.

3.5.5. Wind

Strong erosive winds (> 30 km/h) are more common during summer. Strong winds are experienced during winter however, infrequent (possibly due to their association with relatively infrequent rainfall events). Summer winds tend to be from a south-south-easterly direction for the majority of the time, whereas the lighter winter winds tend to emanate from an east-north-easterly direction. Since operations commenced, the windiest months at J-A have been from September to December.

Figure 5 Location of the Yellabinna and Nullarbor Regional Reserves



3.5.6. Rainfall and evaporation

J-A is located in an arid environment (~220 mm annual rainfall). Rainfall records from Tarcoola (230 km from J-A) show an average annual rainfall of 175 mm since 1904, varying from 50 mm to 430 mm per annum. On average between 10 mm and 20 mm of rainfall occurs each month with no distinct seasonal trends. Summer and spring tend to receive more rainfall days with more rainfall events > 1 mm compared to autumn and winter. This data indicates that winter and spring rainfall is composed of more frequent and smaller rainfall events whereas summer and autumn receive less frequent and larger rainfall events.

Successive above average rainfall events have only occurred nine times over 107 years of rainfall records at Tarcoola. Successive below average rainfall events (two years or more) are more common, having occurred on fourteen occasions in the same recording period, with the longest ranging between 8 to 13 years. Average annual evaporation has been estimated at 2,483 mm.

3.5.7. Air Quality

The existing air quality at the site is considered to be good with no major industries within 160 km of the site. The existing background level of nitrogen dioxide, sulphur dioxide and carbon monoxide are negligible as the nearest town is over 80 km from the site and the area is only rarely frequented by the public. The existing background dust levels are expected to be high on intermittent occasions due to the dry arid conditions of the surrounding area. However, there are no known measurements of air pollutants in the area.

At the Ceduna and Eucla weather stations, dust storms are observed on average once a year. Ceduna has an average of 110 days a year of haze while the average haze at Eucla is 57 days a year (BOM pers.com. 2007).

3.5.8. Topography

The area consists of several major landforms that influence vegetation assemblages (and consequently faunal communities) present within the area. To the north and east of the project area, the dominant landform feature is the dune fields of Yellabinna Regional Reserve consisting of generally parallel dunes and inter-dune swales, which represent a south-eastern extension of the Great Victoria Desert dune fields. The Ooldea, Paling and Barton Ranges are also topographically elevated areas within Yellabinna Regional Reserve.

The landscape of the Nullarbor Plain to the west of the project area represents a second major landform; it is generally a much less variable environment than the dunefields to the north-east. Overlying rocks of the Eucla Basin, the Nullarbor limestone creates an almost featureless calcrete surface punctuated by small scale variations in relief.

3.5.9. Geology

The J-A mineral sands deposit occurs in Tertiary age sediments of the Eucla Basin. The Eucla Basin includes Tertiary sediments deposited in marine and terrestrial settings in the south-western part of South Australia (Benbow et al. 1995) and extends into adjacent parts of Western Australia. North of the deposit, the Eucla Basin is underlain by the older Palaeozoic Officer Basin. Beneath the deposit and to the east, Eucla Basin sediments overlie the Precambrian Gawler Craton.

At least five marine transgression and regression events have occurred in the Eucla Basin, depositing 40 m to 50 m of sediments, with the most recent event forming the Nullarbor Limestone found in the borefield and pipeline areas. The sedimentary sequence overlies partially weathered granitic and gneissic rocks of the Gawler Craton. The characteristics of the sediments from the various marine regression and transgression events vary sufficiently to form distinct stratigraphic units. The general properties of the various stratigraphic units observed at the Eucla Basin deposits are illustrated in Figure 6.

3.5.10. Soils and Landform

Based on the depositional history of the Jacinth deposit and the morphological characteristics of the soil profiles three distinct soil units, or Soil Management Units (SMU), were identified by SWC as occurring over the Jacinth deposit and TSF areas as follows:

- SMU 1 – Deep calcareous yellow sand;
- SMU 2 – Shallow calcareous sandy loam; and
- SMU 3 – Deep calcareous sandy loam.

The thickness of these soils varies across the project area and individual units may be absent at some locations. Further details on these soil profiles are contained in the PEPR and Rehabilitation Management Plan.

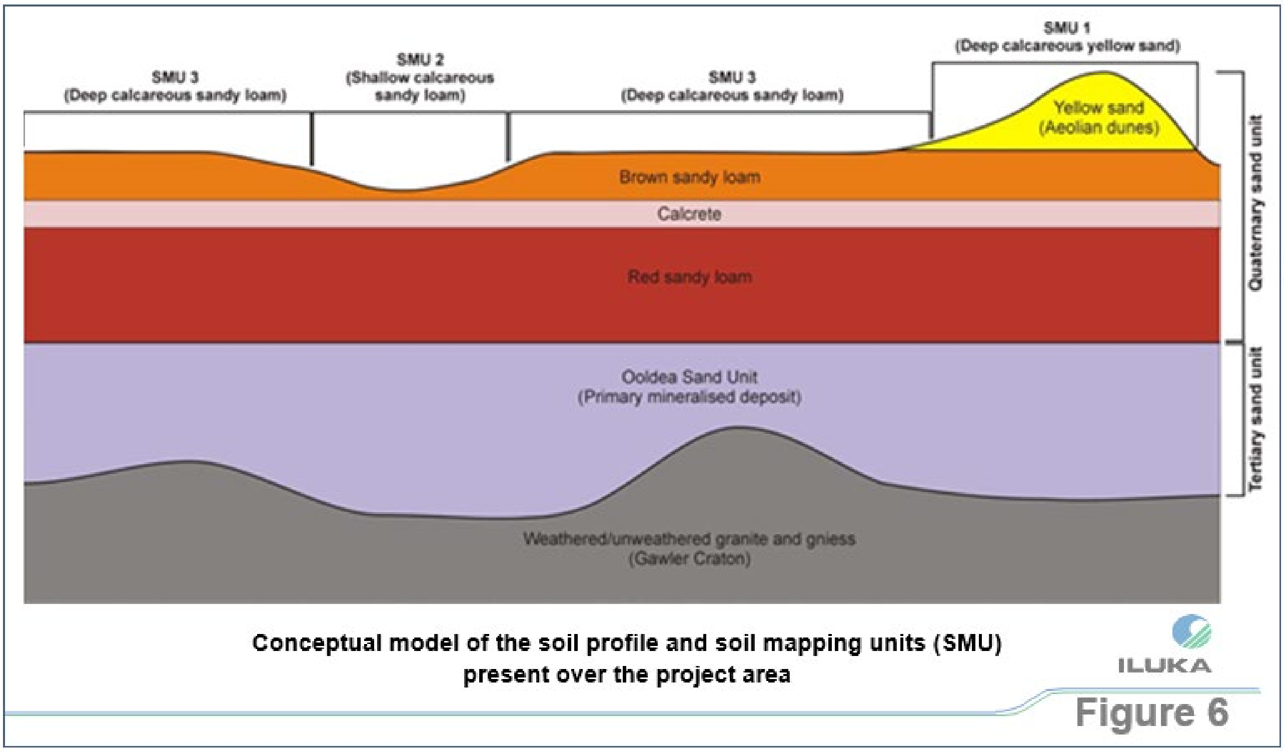
Soil materials

SWC identified six morphologically distinct soil materials within the J-A area. These soil materials are:

- Topsoil;
- Subsoil;
- Yellow sand;
- Brown loam;
- Red loam; and
- Calcrete.

These materials are important as they form the primary material from which the rehabilitated landscape will be created. Further details about these soil types are provided in the Rehabilitation Management Plan, Stockpile Management Procedure and PEPR.

Figure 6 Conceptual diagram of the stratigraphy of the J-A Mine



3.5.11. Cryptogams

Cryptogamic crusts were observed by SWC to be widespread over the land surface in the Jacinth deposit. The distribution of these crusts varied according to SMU with up to 95% coverage of the soil surface in SMU 2 and 3 whilst <10% coverage in SMU 1 (dunal landform).

The importance the cryptogamic crusts for surface soil stabilisation, runoff processes, vertical infiltration of water, soil nutrition and overall arid-zone ecosystem functioning are widely acknowledged (Eldridge and Greene, 1994). Observations from preliminary laboratory work suggest that the cryptogams only occur in these surface crusts and up to 500 mm deep within the soil profile.

3.5.12. Hydrology

J-A is partially located within the Lake Ifould catchment (~73,600 ha). The deposits are approximately 8 km to the east of Lake Ifould; however, the catchment is rimmed by lunettes on its north eastern fringe. These lunettes bordering Lake Ifould create a physical barrier preventing surface water from the J-A catchment entering the lake. A series of smaller playas have formed on the J-A side of the lunettes. When runoff reaches the lower catchment, water is likely to accumulate in the smaller pans where it either evaporates or infiltrates the surface and enters Lake Ifould via the groundwater system.

The eastern tributaries run through both the Jacinth and Ambrosia deposits as well-defined flow paths. Due to the very low rainfall of the area, stream flow is ephemeral and when flows

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do occur, they may only be intermittent. Due to the sparse vegetative cover, stream flows are likely to carry high sediment loads.

3.5.13. Groundwater

The area containing Iluka's water supply is located on the eastern margin of the Eucla Basin in Cainozoic sediments. This palaeochannel is located 41 km from the nearest karst areas and approximately 100 km north of the coast (sea). The closest known stygofauna site to the borefield is in the Nullarbor cave system 500 km west of the Project area.

Data from resource investigations have identified poorly sorted, fluvial sands and gravels containing highly saline and moderately acidic groundwater in an unconfined aquifer that has a known thickness between 40 m and 50 m. The palaeochannel has been identified as being approximately 4 km wide. Initial measurements indicate the gradient of the regional water table is slight, indicating limited flows and therefore limited recharge. Groundwater levels within the palaeochannel aquifer are at 30 mAHD (± 0.5).

The chemical analyses show the test-production wells have sodium chloride-dominated groundwater with significant magnesium sulfate. Because of the high salinity, deep water table and generally low yields there is no recorded use of groundwater other than for road construction and maintenance within search radii of 50 km from the borefield and mine, and 10 km from the access road.

3.5.14. Vegetation, Weeds and Plant Pathogens

The pre-mining flora and vegetation of the J-A Project was surveyed by Badman (2006, 2007) and EBS (2008). Three different vegetation associations were initially identified by Badman (2006a, 2006b) and subsequently mapped by EBS (2008). More recently, vegetation assessments were conducted as part of the Atacama Access Track (from J-A to Atacama) and Canberra Road MPL applications (BlackOak Environmental 2019 a and 2019 b).

An outline of these associations is provided in Table 8 with further details contained in the PEPR.

Table 8 Summary of vegetation associations

Association 1 - *Acacia papyrocarpa* (western myall)/*Eucalyptus oleosa* ssp. *oleosa* (red mallee) open woodland This association is usually associated with low dunes in the eastern and northern sections of the Project area.		
Overstorey Species	**Midstorey Species**	**Understorey Species**
Western myall Red mallee	*Alectryon oleifolius* ssp. *canescens* (bullock bush) *Eremophila scoparia* (broom emubush) *Santalum acuminatum* (quandong)	*Atriplex vesicaria* (bladder saltbush) *Rhagodia spinescens* (spiny saltbush) *Maireana sedifolia* (bluebush)

	Senna artemisioides ssp. *coriacea* (broad-leaf desert senna)	
Association 2 - Western myall low open woodland **The western myall low open woodland is the most extensive of the three vegetation associations and represents a transition between the dunal systems of the Yellabinna land system in the east and the Nullarbor chenopod shrublands in the west.**		
Overstorey Species	**Midstorey Species**	**Understorey Species**
Western myall	Quandong and *Senna* sp. *Santalum spicatum* (sandalwood)	Bluebush Bladder saltbush *Austrostipa nitida* (Balcarra spear-grass) *Eriochiton sclerolaenoides* (woolly-fruit bluebush)
Association 3 - Bluebush and/or bladder saltbush low open shrubland **This vegetation association has the lowest species diversity of the three vegetation associations and is usually situated in depressions between the western myall low open woodlands. This association is representative of the chenopod shrublands found across the Nullarbor Plain (Badman, 2006a).**		
Overstorey Species	**Midstorey Species**	**Understorey Species**
Western myall	Bluebush Bladder saltbush	Balcarra spear-grass Woolly-fruit bluebush *Sclerolaena obliquicuspis* (oblique-spined bindyi)

Vegetation condition and disturbance

Overall the condition of vegetation in the J-A surrounds is considered to be of high quality, with some disturbance from introduced species (rabbit scratching and tracks) has been recorded. Vegetation condition and impact monitoring has been ongoing since operations commenced.

Threatened flora

Santalum spicatum (sandalwood) is listed as Vulnerable under the *National Parks and Wildlife Act 1972*. Trees were found across parts of both the Ambrosia and Jacinth deposits and also in other adjacent areas. It was also located within the vicinity of the southern part of the borefield pipeline corridor. Iluka maintains an ArcMap database of known sandalwood tree locations across the ML.

Weeds

During the baseline surveys conducted by Badman (2006a, 2006b and 2007) seven weed species were recorded, subsequent to this a total of 31 weed species have been detected at J-A or the immediate surrounding region. A complete list of weed species recorded within the

Yellabinna Regional Reserve and within the project area is provided in the J-A Pest Species Management Plan.

3.6. Closure Studies

3.6.1. Backfill Schedule

The life of mine backfill schedule is routinely reviewed. The schedule is used as a planning tool to determine the availability of overburden, subsoil and topsoil for rehabilitation areas over the life of the mine. An example of the 2020 schedule for Jacinth and Ambrosia is shown in Table 9. This schedule is updated annually.

Table 9 Anticipated mine backfill summary (extraction, subject to variation)

Year	Overburden (m^3)	Subsoil (m^3)	Topsoil (m^3)	Strip ratio
Jacinth				
2023	1.3 M	0.05 M	0.05 M	0.3
2029	2.3 M	0.5 M	0.05 M	0.3
2030	4.6 M	0.05 M	0.05 M	0.5
Life of Mine	4.9 M	0.3 M	0.15 M	0.3
Ambrosia				
2027	1.2 M	0 M	0 M	0.8
2028	2.6 M	0.2 M	0.1 M	0.8
2029	2.0 M	0.1 M	0.05 M	0.8
Life of Mine	33.4 M	1.1 M	0.6 M	0.8

3.6.2. Design and Construction of Landforms

A number of studies have been carried out to guide the designs of the final rehabilitated landform, including:

- Migration of salt from tailings into the final soil profile;
- Suitability of rehabilitated soil profile for vegetation growth;
- Likelihood of erosion of the final landform;
- Design of rehabilitated water courses; and
- Pre-disturbance flora and fauna assemblages.

A summary of these studies is outlined in the PEPR. A summary of studies that have been undertaken in support of J-A mine closure is provided in Table 10.

Table 10 Summary of J-A closure studies

Title	Author	Year	Scope of study
Capillary Break			
Rehabilitation of Jacinth-Ambrosia mine	SRK Consulting	2011	What rehabilitated soil parameters are acceptable to Iluka and the South Australian (SA) Regulators i.e. depth and concentration of salt tolerated for each of the profiles currently considered for closure. Assess if a capillary break is required over the ModCod tailings.
Unsaturated zone modeling of water and salt movement in ModCod and overlying overburden materials, Eucla Basin	Soil water Consultants (SWC)	2009	Model water movement in the ModCod material under draining conditions. Determine whether saline water from the ModCod will move upward by capillary action into the overlying overburden material. Determine the effectiveness of a capillary break in reducing or preventing the upward movement of saline water and the thickness of a capillary break required. Identify the key sensitivity parameters affecting the movement of saline water in the ModCod and overburden materials. Provide recommendations for further investigation to quantify the upward movement of saline water from the ModCod into overlying overburden materials, including field investigation.
A review of the requirement for a capillary break in J-A rehabilitation	Iluka	2015	Determine the requirement for a capillary break based on current understanding of the tails and soils environment at J-A.
Groundwater			
Hydrogeological Environmental Impact Assessment, Jacinth-Ambrosia Project	PB	2007	Potential effects of borefield operation on other users. Potential effects of drawdown on karst systems in limestone that may be hydraulically connected to the palaeochannel, particularly to stygofauna and other groundwater dependent ecosystems. Effects of the use of saline water for mineral sands processing, e.g.salinisation/acidification of soils, formation of groundwater mounds, changes to groundwater quality.
Groundwater modelling of tailings seepage	Sinclair Knight Merz (SKM)	2009	Numerical modelling techniques were used to assess whether the tailings drainage water is likely to emerge at the ground surface or to migrate to locations where it is within the rooting depth of native vegetation.
Jacinth Mine Wellfield Groundwater Modelling	Sinclair Knight Merz (SKM)	2011	Numerical groundwater flow modelling of the Jacinth Mine wellfield. This investigation: • delineated the palaeochannel aquifer extent using geophysics and exploration drilling; • characterised aquifer properties using aquifer tests, water quality analyses and numerical modelling; and • estimated potential long term groundwater abstraction rates using predictive numerical modelling.
Jacinth Mine Tailings Groundwater Modelling	Sinclair Knight Merz (SKM)	2011	Numerical groundwater flow modelling of the tailings storage facility (TSF) at the Jacinth Mine. The scope includes: • assembly of relevant data from the TSF; • upgrade of the existing groundwater model to include historical water disposal; • calibration of the model to measured groundwater responses during deposition of tailings; • predictive modelling to estimate the movement of tailings seepage water migrating from the TSF during the course of mining and for some time thereafter; • production of plots of unsaturated zone thickness and unsaturated zone thickness minus a rooting depth specified by Iluka
Hydrogeochemical Aquifer Review, Jacinth-Ambrosia Mine	Land & Water Consulting (LWC)	2016	Detailed review of the hydrogeochemical conditions beneath Iluka's J-A mine site to assess the impacts that tailing seepage has had on the groundwater environment and provide suggested updates to the methodology related to assessing impacts at J-A.
Jacinth-Ambrosia Mine: Geochemistry Review	RGS	2019	A geochemical investigation as part of a review of the PEPR at the J-A mineral sands mine includes that included a review of the mine geochemical data with a view to better understanding the mechanism for observed change in groundwater chemistry and considering the changes likely under the latest life of mine (LOM) tailings plan and following closure when water levels recover.
Jacinth-Ambrosia Aquifer review and groundwater model update	EMM	2019	Review and update various portions of the PEPR to rectify non-conformances related to groundwater, with scope inclusive of: 1. undertaking an updated review and trend analysis of J-A's groundwater levels and hydrogeochemistry in support of recently proposed new PEPR Outcome Measurement Criteria (OMC) and Leading Indicators (LI); and

Title	Author	Year	Scope of study
			2. an update to the J-A mine site numerical groundwater flow model to assist in forecasting areas at risk of non-compliance with existing management trigger levels, which needs to also consider the Ambrosia deposit.
Jacinth-Ambrosia Mine Groundwater Model Update	IGS	2019	Update the JACMIN2.0 groundwater flow model using recent groundwater level observation and mine water balance data (June 2018 to June 2019) and revised Mine Plan data (July 2019 to September 2029). Provide updated model predictions of groundwater levels around the mine for the Revised Mine Plan scenario. Summarise the model predictions in relation to the Site Specific Trigger Levels (SSTLs) for groundwater level outlined in the current J-A PEPR (2015) and revised SSTLs proposed by EMM (2019).
Jacinth Mineral Sands Mine Groundwater Flow Modelling	Jacobs	2020	Upgrade and verify the existing numerical groundwater model for the palaeochannel (borefield) and undertake predictive model analysis to help determine the capacity of the resource to supply water to the Jacinth, Ambrosia and Atacama mines into the future.
Soils			
Pre-mine soil survey for the proposed Jacinth Mine site, Eucla Basin	SWC	2009	Define the distribution of the soils in the proposed Jacinth Mine site. Characterise the physical and chemical properties of soils. Identify soils that may develop adverse soil properties during mining and rehabilitation. Suggest management strategies for the handling and utilisation of these soils during mining and rehabilitation.
Soil Characteristics and Management at the Eucla Basin – Jacinth and Ambrosia Deposits	Outback Ecology	2006	Characterise the existing surface soil profiles, thus providing baseline data for future reference. Define potential soil management units. Identify potentially problematic materials and develop a strategy for soil management. Define criteria for returning clay and sand fractions to the mining void. Describe potential impacts from the return of saline clay and sand fractions to the mine void.
Dune and Creek soil profile Characterisation	Iluka	2014	Determine the depth of yellow sand associated with mallee dune features and creek features. Recommend changes to rehabilitation soil profile related to dune and creek features based on findings.
Creek soil profile for rehabilitation success	Iluka	2020	Determined soil balance of creek sand material at Jacinth-Ambrosia and determined the depth of yellow sand associated with creek features. Recommended changes to rehabilitation soil profile of creek features based on findings.
Landform stability			
Characterisation of materials from the Jacinth Lease	Landloch	2007	Assess erosion and stability characteristics of the soil at the Jacinth Deposit in the Eucla Basin to enable the development of rehabilitation design parameters relating to: Depth of material placement. Slope lengths and gradients. Soil surface stability treatments.
Assessment of potential long-term erosion: SIBERIA landform evolution simulations, Jacinth Ambrosia Project	Landloch	2008	Using landform evolution modelling assess the log-term stability of the rehabilitated landforms at Jacinth Ambrosia. Particular emphasis was placed on the potential for gully development.
Landform and erosion assessment: Jacinth-Ambrosia site	Landloch	2014	Confirm that the inputs to the *Characterisation of Materials from the Jacinth Lease* (2007) accurately reflect erosion potential of actual rehabilitated soil Profile. Utilise the SIBERIA model on the revised TSF design to determine if there are any changes to potential erosion rates from the original modelling (2008). Assess pre-mining Ambrosia landform topography with post-mining landform design (Jacinth & Ambrosia pits) to determine if there are potential impacts to the erosion rate of some or all of the landform and, recommend modifications where significant changes in erosion potential are identified.

Title	Author	Year	Scope of study
Landform Evolution Modelling for Jacinth-Ambrosia	Landloch	2019	Landform evolution modelling at Jacinth-Ambrosia to capture proposed larger volumes of tailings that require storage, resulting in an increased final landform height. Assess performance of the revised landforms by undertaking an assessment of erosion potential using the SIBERIA landform evolution model.
Surface Water			
Lake Ifould – surface water impact	PB	2008	Determine impact to surface water flows to Lake Ifould due to mining operations at J-A.
Jacinth-Ambrosia project – creek diversion	Iluka	2009	Assessed the stormwater flows in the creeks crossing the mine site and reviewed a series of options for stormwater management during the mining operation and following completion of mining activity.
Jacinth-Ambrosia Watercourse Rehabilitation	Alluvium Consulting Australia (Alluvium)	2013	Hydrologic modelling to determine flow rates for a range of ARI events. Hydraulic modelling to identify the pattern and distribution of flow for each ARI event. Geomorphological categorisation and delineation of parameters of watercourses. Development of functional designs for rehabilitation and construction of watercourses. Recommendations for field studies to examine erodibility of the landscape and the effectiveness of erosion controls.
Surface water erosion risk assessment: Proposed lowering of Jacinth-Ambrosia rehabilitated land surface	Alluvium	2014	Compare the pre-mining and post-mining landform design of the mining footprint and identify potential impacts to the surface water features and catchment. Identify landform design parameters that will minimise changes to the surface water catchment and recommend modifications to the design where significant changes to the catchment are identified.
Ambrosia surface water options and risk assessment	Alluvium	2019	Surface water options assessment and risk assessment at Ambrosia to accommodate the expansion of the mining operations to the Ambrosia deposit. To understand water movement at Ambrosia and to assist with the design of infrastructure, mining operations and rehabilitation of the Ambrosia project area. Manage the risks of mining impacts to surface water quality.
Cells 3-6 landform redesign review	Alluvium	2022	Alluvium conducted a review of a proposed change to the landform design in Cells 3-6 at Jacinth south. Assessed performance of the revised landform and watercourses by undertaking erosion modelling.
Flora			
Eucla Basin baseline Vegetation Survey: Jacinth & Ambrosia deposits Infrastructure Corridor Fowlers Bay.	F.J. Badman (Badman Environmental)	2006	Baseline vegetation study of Jacinth and Ambrosia project areas.
Eucla basin vegetation survey: Jacinth & Ambrosia deposits	Badman Environmental	2006	Repeat monitoring carried out during the 2005 baseline survey and comparison of the data from the two years. Assessment of the distribution of the threatened species *Santalum spicatum* (Sandalwood) in and around the mine leases.
Jacinth-Ambrosia project: A vegetation survey of the Jacinth – Ambrosia Wellfield and pipeline corridor	Badman Environmental	2007	Baseline vegetation survey of borefield.
Jacinth-Ambrosia Mine Vegetation Monitoring Observations November	EBS Ecology	2009 - 2015	Annual vegetation monitoring per the requirements of the MARP. Detect the effects of disturbances, observe whether vegetation departs from the desired state and to measure the success of management actions.
Canberra Road Miscellaneous Purposes Licence Vegetation Survey	BlackOak Environmental	2019	Assess the vegetation associations of the proposed Canberra Road Miscellaneous Purposes Licence (in application).
Atacama Access Track Vegetation Survey	BlackOak Environmental	2019	Assess the vegetation associations of the proposed Atacama Access Track (between Jacinth-Ambrosia and Atacama) and prepare Significant Environmental Benefit (SEB) requirements.
Santalum spp. restoration in rehabilitation areas	Iluka	2021	The project was established to re-establish the two *Santalum* spp. (sandalwood and Quandong) into rehabilitation areas and provide recommendations for future rehabilitation outcomes.

Title	Author	Year	Scope of study
Fauna			
Report on Fauna Survey 2005: Part I - Iluka Resources Ltd Mineral Deposit Area, Yellabinna Regional Reserve, South Australia	SKM	2005	Baseline of fauna survey in the J-A project area.
Desktop Review – Borefield Fauna Assessment	Environment and Biodiversity Services (EBS)	2007	Previous reports on species within or near the proposed borefield area were reviewed to determine species which may occur within the survey area.
Jacinth-Ambrosia Spring Fauna Monitoring	EBS Ecology	2008 until 2015 2017,2020 and 2021	Annual spring fauna surveys (2018-2015) per the requirements of the MARP, then biennially thereafter per the requirements of the PEPR. Understand the impacts of the mine operation on fauna communities.

3.6.3. Research Programs

In addition to the rehabilitation programs, a number of research programs have been initiated in collaboration with research partners to assist in providing indications of the likely success of rehabilitation efforts in the long-term. Completed and current research programs are outlined in Table 11.

Table 11 Summary of research programs at J-A

Program	Year	Aims	Collaborations
Completed			
What is the minimum soil profile depth and characteristics to sustain western myall and their associated plant communities	2011-2012	To investigate the spatial distribution of roots and how this relates to soil characteristics for key plant species at J-A; To examine the sources of soil water used by key plants species and characterise their plant-soil-water relationships; and To determine the responses of key species to water availability and increased salinity in natural and reconstructed soil profiles.	University of Adelaide
Salinity effects on germination and seedling growth of key species in a chenopod shrubland.	2012	To study the germination response of seeds of four arid zone species to salinity and water stress; To investigate seedling emergence performance in salinity; To determine if the seedlings can internally regulate osmotic potential; and The overall aim is to determine whether seed germination differs in plant from saline areas to less saline areas.	University of Adelaide
Investigating Seed Ecology Dynamics of Plant Species Native to the Jacinth-Ambrosia Mineral Sands Deposit	2007-2010	Undertake a detailed assessment and review of past restoration practices, with specific focus on those relevant to the Yellabinna region, and evaluate elements likely to provide 'fast-track' research options for the project; Undertake a detailed study of the seed dormancy and germination requirements of the foundation plant species; Initiate propagule collection from plant species identified as threatened or endemic, and commence research to understand seed biology, germination and storage requirements of the identified species; Instigate plant establishment trials including seeding and planting of dominant species under a range of test regimes with specific consideration on the effect that the proposed mining processes will have on soil substrates; Assess size and composition of soil seed banks and sustainability of species in natural communities; Prepare recommendations in relation to topsoil storage during mining and substrate reconstitution post-mining; and Provide plant species establishment guidelines for Iluka Resources Ltd	University of Adelaide, Botanical Gardens of South Australia

Program	Year	Aims	Collaborations
		personnel to use in the restoration of sand mine pits within Yellabinna region.	
Restoration Technology Project	2010-2013	Seed viability and germination after storage; Seed longevity; Effect of saline bore water on germination and growth; Seed and seedling images and fact sheets; and Viability of myall seed after development under one year of elevated groundwater conditions.	Botanical Gardens of South Australia
Biological Soil Crusts at Jacinth-Ambrosia Mine; can they be used to improve ecosystem rehabilitation outcomes?	2010	Survey of crust types and initial experiments with recovery from disturbance.	University of Queensland
J-A Characterisation and growth of cyanobacteria from intact and disturbed biocrusts	2011-2012	Examine the contribution of biocrusts to soil ecosystem function; Identify cyanobacterial community structure; Investigate biocrust recovery following disturbance."	University of Queensland
Activity of cyanobacteria in stockpiles at the J-A mine	2012	Assess if cyanobacteria can survive burial at depth in topsoil stockpiles.	University of Queensland
Investigating the role of biocrusts in weed germination	2012	To assess if there is a correlation between biological soil crusts and weed germination.	University of New South Wales
Root mapping of J-A vegetation	2011	To provide an indication of root depth and soil types that roots grow through in Jacinth pit.	University of Adelaide
Spatial distribution of roots and soil characteristics	2012	Spatial distribution of roots and soil characteristics.	University of Adelaide
Hydraulic redistribution by western myall	2012	Investigate whether deep-rooted species at J-A utilise HR, which may have implications for the long-term success of rehabilitation at the site.	University of Adelaide
Blue drum trial (western myall)	2012	To determine whether western myall trees have the ability to: Survive long-term in a much shallower than normal soil profile; and Be able to grow roots into saline tailings beneath the rehabilitated soil profile and use the soil moisture stored within.	University of Adelaide
Cell 1 trial	2012-2019	To examine whether J-A deep rooted species, *A. papyrocarpa*, *E. oleosa* and *E. gracilis* are able to produce sustainable populations on shallow soil profiles over saline tailings; To determine the effect of shallow soil profiles on plant water use of J-A deep rooted species - *A. papyrocarpa*, *E. oleosa* & *E. gracilis*; To determine whether J-A deep rooted species - *A. papyrocarpa*, *E. oleosa* & *E. gracilis* are able to extract and use moisture from ModCod. If so, where does the salt accumulate, e.g. exclusion at root zone, or uptake, tissue accumulation and loss with subsequent salt accumulation in surface soil; To compare changes in soil chemical and physical characteristics as a result of disturbance.	University of Adelaide
Does *Eucalyptus gracilis* have higher salt tolerance than *Eucalyptus oleosa*?	2012	To assess if mallee growing in the bed of Lake Ifould have more salt tolerance than the mallee growing at J-A.	University of Adelaide
Stockpile aging and viability	2016	Mycorrhiza fungi presence in aged stockpiles.	University of Adelaide
Stockpile aging and viability	2016	Seed viability in aged stockpiles.	South Australian Seed Conservation Centre (Botanic Gardens of South Australia)
Soil microbiome	2016 – 2017	Assessment and interpretation of rehabilitation on functional soil microbiome.	University of Adelaide
Soil stabilisation	2016 – 2017	Glasshouse based assessment of soil biological crust formation and impact of soil stabilization treatment on revegetation soils.	University of Adelaide

Program	Year	Aims	Collaborations
Current			
M. sedifolia seeding triggers	2017-2019 And repeat experiment from 2020-2023	To determine seeding trigger of *M. sedifolia* trialling different watering regimes. And an assessment of risks associated with utilizing seed from different seed zones.	University of Adelaide
M. sedifolia germination and viability experiment	2019	To determine the optimum storage conditions of *M. sedifolia* seed. To determine whether the viability cut test method is backed by actual germination and emergence of *M. sedifolia* seed collected from the region surrounding J-A.	-

3.7. Gap Analysis and Further Studies

The research and monitoring programs for J-A are reviewed biennially and anticipated programs for the following two-year period described in the J-A Research and Monitoring Program (JA RAMP). Additional studies (to those described above) proposed include:

- Determine the potential to manufacture topsoil or subsoil suitable for rehabilitation purposes through the addition of BSC, microbes/fungi from onsite bioreactors and seed; and
- Investigate the sand requirements for dune restoration.

The results of all research programs are reported biennially in the J-A Research and Monitoring Summary (JARMS).

4. STAKEHOLDER CONSULTATION

Iluka is committed to ongoing consultation with its stakeholders to achieve sustained mutual benefits for the life of the Project. Ongoing consultation has and will continue to occur with Iluka, residents and communities, government (State and Local), development boards, indigenous groups and local business owners and operators.

The quality and transparency of Iluka's consultation with key stakeholders has been a key underpinning for the continuation of Iluka's mining and processing operations throughout Australia and in establishing its credentials in new areas of operation. It will undertake its engagement activities in accordance with the following priorities:

- Communication: open and meaningful engagement;
- Transparency: provision of clear, timely and agreed information;
- Collaboration: support of community initiatives to reach beneficial outcomes;
- Inclusiveness: early recognition to understand and involve our stakeholders; and
- Integrity: conduct engagement in a manner that fosters mutual respect and trust.

4.1. Stakeholder Identification

Prior to the commencement of mining, a series of workshops were held to identify, prioritise and characterise stakeholders for Eucla Exploration, Projects and J-A Operations. A summary of the stakeholders identified is summarised in Table 12.

Table 12 Summary of stakeholders for the J-A Project

Group	Organisation/Members
Landholders	Far West Coast Traditional Lands Associations (FWC) – Liaison Committee, Governing Committee, Executive Committee; Department for Environment and Water (DEW); and Phillip Price – Tripitaka.

Group	Organisation/Members
Near neighbors	Aboriginal Lands Trust (landowner southern half of Haul Road).
Community	Ceduna residents and businesses; Schools; TAFE; Penong residents and businesses; Nundroo residents and businesses; Streaky Bay residents and businesses; Smoky Bay residents and businesses; Thevenard Ratepayer's Association; Ceduna youth hub; Emergency Services: Royal Flying Doctor Service; Ceduna Hospital; Country Fire Service; SA Ambulance; Volunteers; and SAPOL.
Environmental groups	Conservation Council of SA; Australian Conservation Foundation; Nature Conservation Society; Nature Foundation SA; Landscape Board South Australia Alinytjara Wilurara EP Natural Resources Management Board; University of Adelaide; Wilderness Society; Wombat: Wombat Awareness Organisation; Val Salmon; and Brigitte Stevens.
Indigenous Groups/Communities	Far West Coast Aboriginal Corporation (FWCAC); Yalata; Scotdesco; Oak Valley; Koonibba; Town Camp; and Indigenous Coordination Centre.
Local/Regional Government	District Council of Ceduna; Mayor; Eyre Regional Development Board; and Outback Communities Authority.
State Government	Department for Environment and Water (DEW); Department for Energy and Mining (DEM); South Australian Native Title Services (SANTS); South Australian Environment Protection Authority (EPA); Aboriginal Affairs and Reconciliation Division (AARD); Department of Infrastructure and Transport (DIT); Member for Flinders – State;

Group	Organisation/Members
	Premier of South Australia; Minister for Trade, Tourism and Investment; Minister for Industry and Skills; Minister for Energy and Mining; Minister for Primary Industries and Regional Development; Minister for Environment and Water; and Minister for Transport, Infrastructure and Local Government.
Federal Government	Civil Aviation Safety Authority (CASA); Department of the Environment and Energy; and Member for Grey – Federal.
Iluka/internal	Employees; Exploration; and The Smith Family.
Land/infrastructure agencies/companies and/or contractors/partners	Dog Fence Board; Flinders Ports; One Rail Australia; Ceduna Landfill; Ceduna Can and Bottle; Phillip Price; Gypsum Resources Australia (GRA); Viterra; Kalari; Piacentini and Son; Kalgoorlie Power Systems (KPS); Cater Care Services (CCS); and Regional Express (REX).
Other	South Australian Chamber of Mines and Energy (SACOME); Minerals Council; and Eyre Peninsula Mining Alliance.

4.2. Closure Committee

The Native Title Mining Agreement, section 18.1(d) requires establishment of a Mine Closure Committee with the FWCAC. The formation of the Mine Closure Committee will occur after mining activities cease and at the beginning of closure activities.

4.3. Consultation Strategy

The Eucla Basin Stakeholder Engagement Plan identifies consultation activities to engage with and receiving feedback from stakeholders, as well as for considering community issues and concerns relating to the J-A Project.

In addition to these activities, specific closure related consultation may involve the following activities:

- Continuing the existing relationships with external stakeholders and involving these stakeholders in discussions about post mine land use and beyond;
- Ensuring that the community is kept informed of significant development and understands the timetable for closure;
- Liaising with key agencies to minimise disruptions to services and mitigate adverse community impacts;
- Addressing possible uncertainty and anxiety in the community and workforce about closure;
- Assisting the local communities identify and to utilise opportunities presented by mine closure; and
- Investigating opportunities to establish programs to provide benefits beyond the life of the mine.

4.4. Stakeholder Feedback

Any engagement with stakeholders that has relevance to the J-A Project is recorded in Iluka's stakeholder data management system, Consultation Manager.

5. DESCRIPTION OF CLOSURE DOMAINS AND LAND USE

Determining the final land use after mining has ceased is a critical component in the development of the MCP. As previously described, the current land use in the Project area and surrounding region is for conservation purposes (Yellabinna and Nullarbor Regional Reserves).

The Project area has been divided into a number of closure domains from which an assessment of land capability following mining can be undertaken. These closure domains generally reflect the components during operations; however, some components have been combined in the closure domains due to their similarities in land capability. Closure domains and final land use for each domain is described below.

Figure 7 to Figure 10 provide location details for the domains.

5.1. Domain 1 – Ooldea Road

For the purposes of closure, the Ooldea Road domain has been further delineated into the following sub-domains:

- Borrow pits;
- Water points; and
- Ooldea Road.

Ooldea Road is intended to remain a public road post-mining. The borrow pits and water points will be rehabilitated to recreate a safe, stable, vegetated landform that is consistent with surrounding conditions.

5.2. Domain 2 – Ooldea Road

For the purposes of closure, the airfield and village domain has been further delineated into the following sub-domains:

- Airstrip;
- Accommodation village; and
- Drainage lines.

Domain 2 will be rehabilitated to recreate a safe, stable, vegetated landform that is consistent with surrounding conditions and suitable for biodiversity conservation, passive tourism and traditional Aboriginal land uses. However, the final land use of the airstrip will be negotiated with the FWCAC and DEW and may remain if requested.

5.3. Domain 3 – Borefield and access road

For the purposes of closure, the borefield and access road domain has been further delineated into the following sub-domains:

- Access Road;
- Power transmission line;
- Borefield infrastructure;
- Water supply pipeline;
- Tank farm 1; and
- Borrow pits (located on adjacent EMLs).

Domain 3 will be rehabilitated to recreate a safe, stable, vegetated landform that is consistent with surrounding conditions and suitable for biodiversity conservation, passive tourism and traditional Aboriginal land uses. The subterranean component of the water supply pipeline will remain in-situ and not expected to impact on the closure outcomes.

5.4. Domain 4 – Mine site

For the purposes of closure, the mine site domain has been further delineated into the following sub-domains:

- Jacinth Mine Area;
- Ambrosia Mine Area;
- Tailings Storage Facility;
- Overburden storage areas;
- Process plant site (including HMC stockpile areas);
- Offices, workshops and communications tower; and
- Exploration drill sites and access tracks.

Domain 4 will be rehabilitated to recreate a safe, stable, vegetated landform that is consistent with surrounding conditions and suitable for biodiversity conservation, passive tourism and traditional Aboriginal land uses.

5.5. Domain 5 – Canberra Road

Domain 5 will be established when the proposed Canberra Road earthworks commence. At the time of preparation of this document, the proposed area was undisturbed. Domain 5 will have a single subdomain, A Canberra Road.

Domain 3 will be rehabilitated to recreate a safe, stable, vegetated landform that is consistent with surrounding conditions and suitable for biodiversity conservation, passive tourism and traditional Aboriginal land uses.

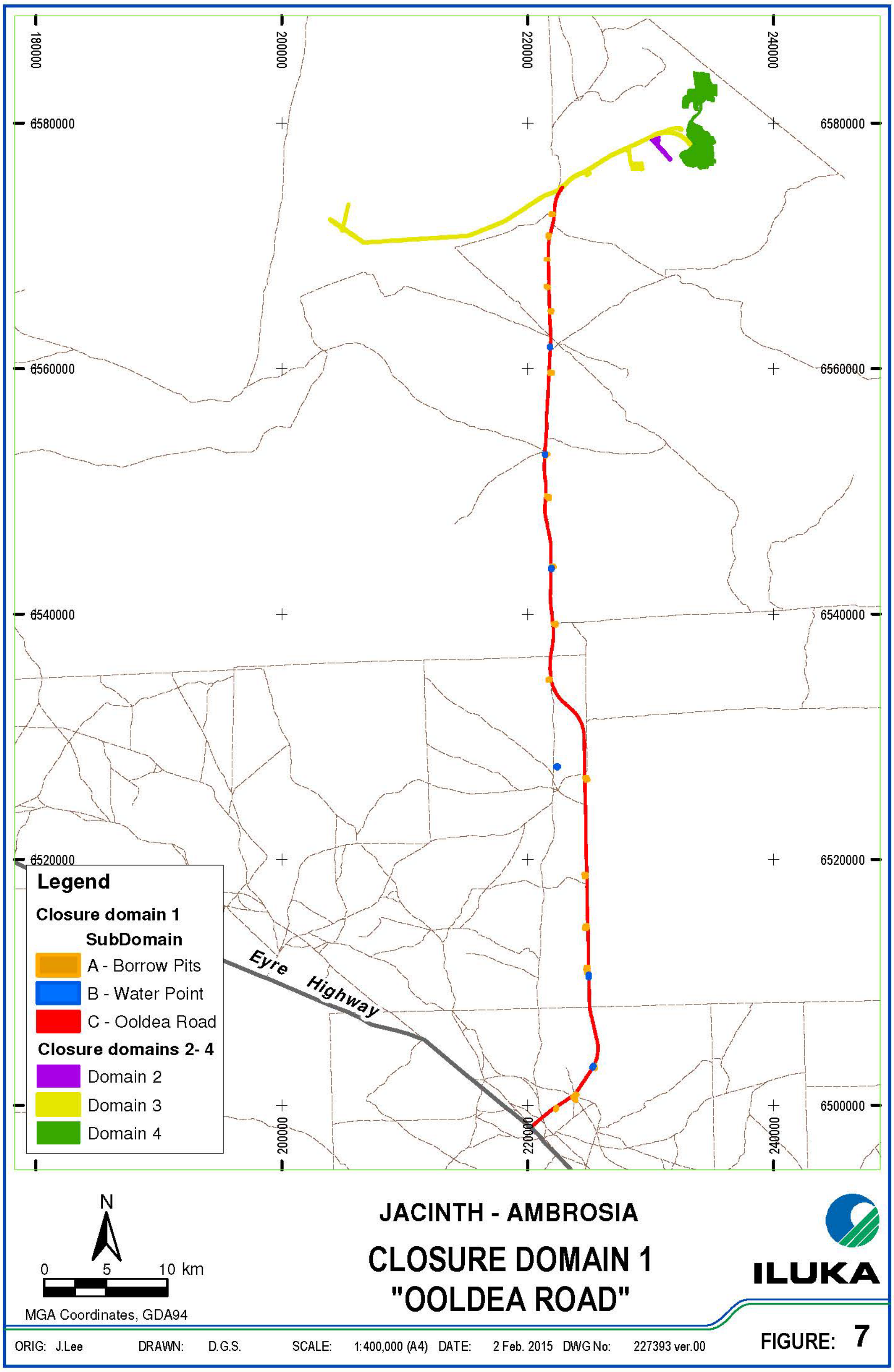

Figure 7 Closure Domain 1 – Ooldea Road

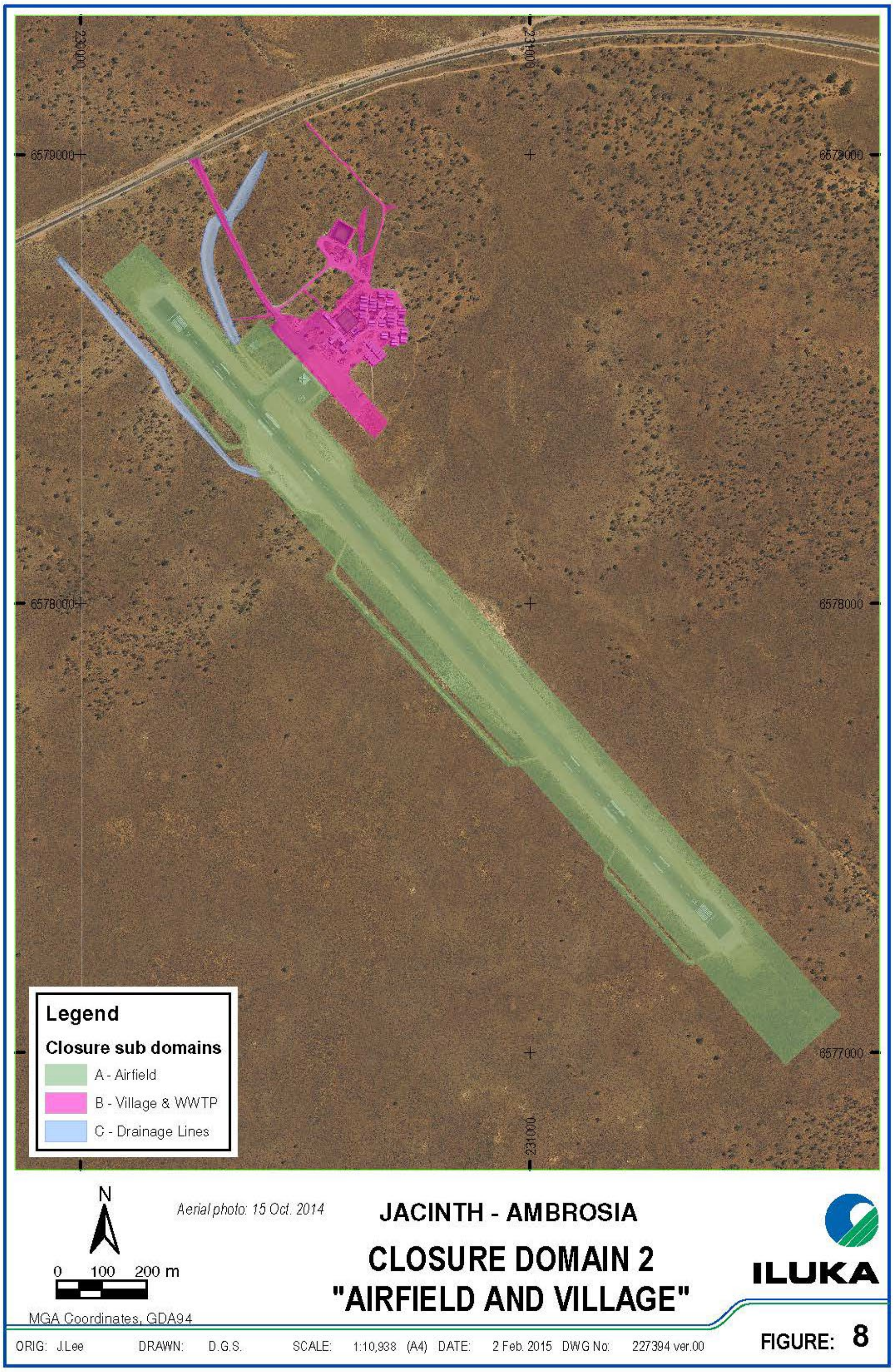

Figure 8 Closure Domain 2 – Airfield and village

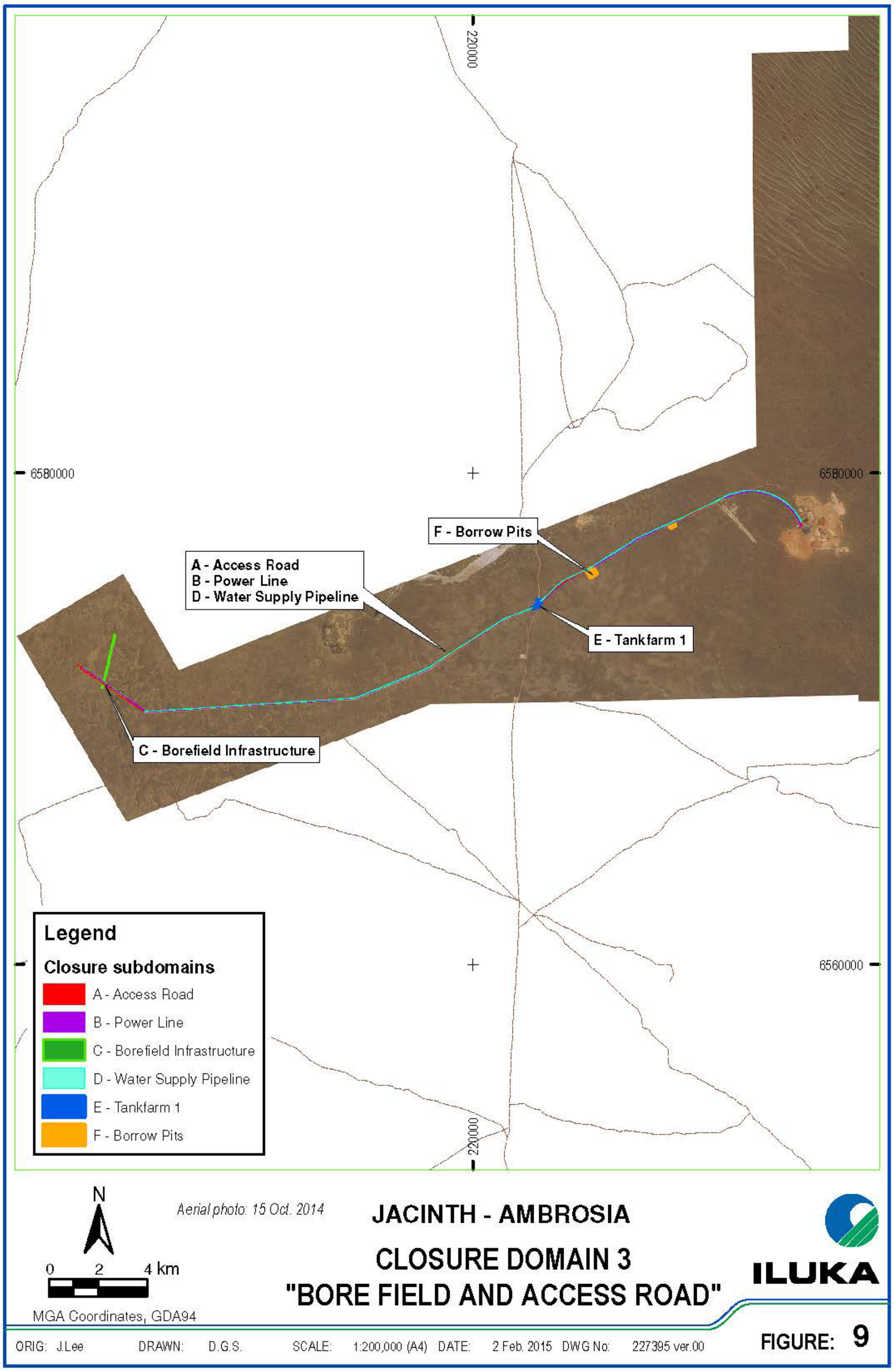

Figure 9 Closure Domain 3 – Borefield and access road

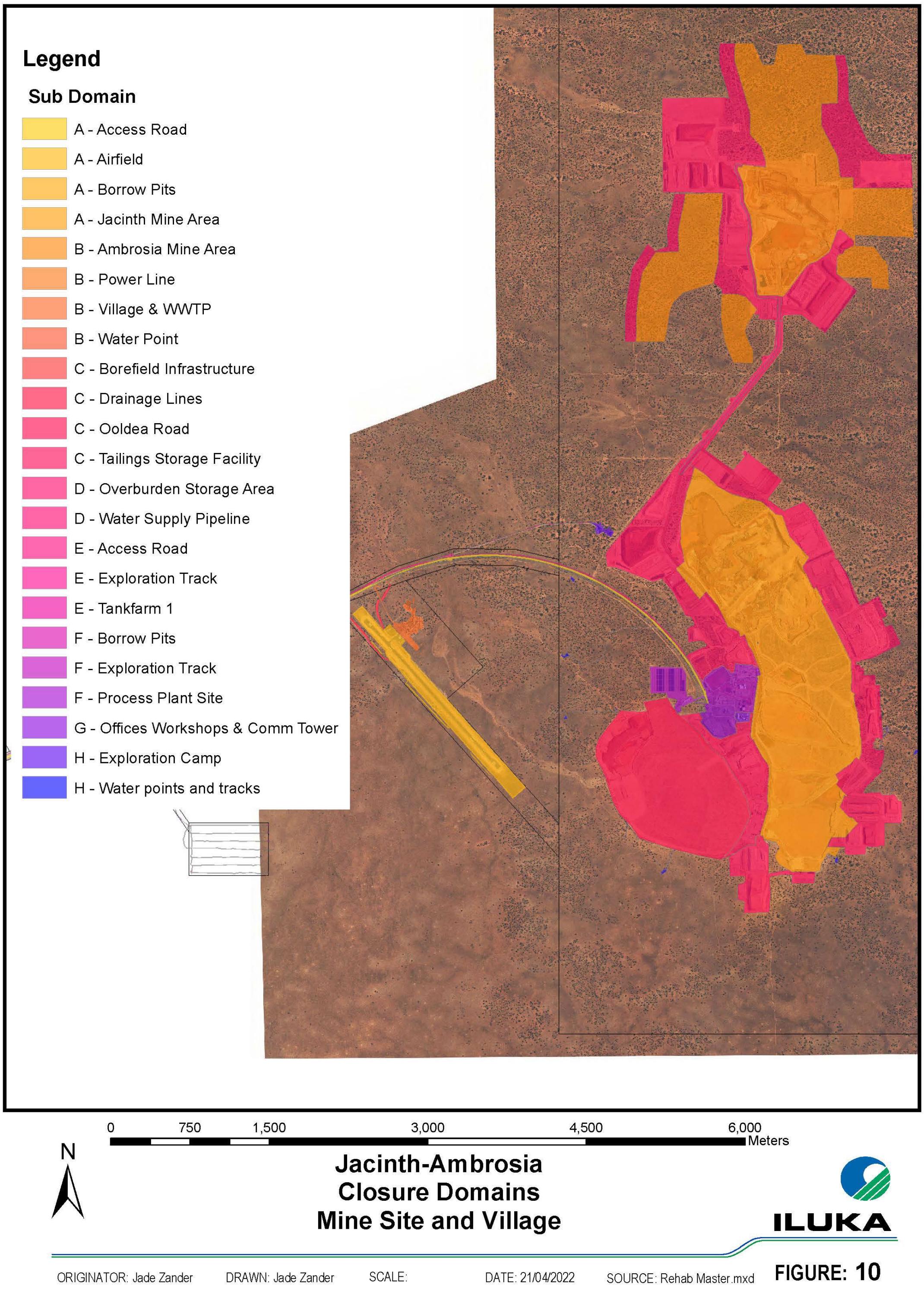

Figure 10 Closure Domain 4 – Mine Site

6. POTENTIAL SOCIAL IMPACTS

The closure of J-A will have economic and social impacts associated with it. These impacts will include:

- loss of employment opportunities;
- reduced business opportunities; and
- reduced partnerships/sponsorships.

Further discussion regarding the management of social impacts related to the closure of J-A is provided in the J-A Stakeholder Management Plan.

7. POTENTIAL ENVIRONMENTAL IMPACTS

The closure of J-A operations will have environmental impacts associated with it. The potential environmental, economic and social impacts considered relate to risks for each domain that may remain after mine closure. Potential impacts do not take into consideration the proposed avoidance, mitigation and management measures that will be implemented by Iluka.

7.1. General Site Closure

A number of potential impacts may occur across most or all of the planned closure domains; comprising:

- Air quality
    - Decrease in air quality due to dust emissions from disturbed and poorly rehabilitated land.
- Fauna
    - Increased abundance of introduced species; and
    - Reduced species abundance and/or diversity compared to baseline.
- Flora
    - Reduced species abundance and/or diversity compared to baseline;
    - Introduction of new weed species and increased weed density and distribution; and
    - Failure to achieve self-sustaining vegetation in rehabilitation areas, leading to reduced ecological function in these areas.
- Soils
    - Operational contamination of soils from naturally occurring radioactive material, hydrocarbon or saline water application resulting in contamination of soils used in rehabilitation, hence reducing viability and ability to support vegetation growth.
- Surface water and groundwater
    - Contamination of surface water and/or groundwater resources due to seepage from land contaminated by mining operations; and

  - Altered flow regimes due to changes in landform, with consequent downstream impacts as a result of diversion and/or retention.
- Landscape and visual amenity
  - Altered landscape and reduced visual amenity, particularly as a result of failure to achieve closure outcomes successfully.

Potential impacts related specifically to individual closure domains are described below.

7.2. Domain 1 – Ooldea Road

There are no additional potential impacts expected due to the closure of Ooldea Road, which will remain as a public road after mine completion.

7.3. Domain 2 – Airfield and village

There are no additional potential impacts expected due to the closure of Domain 2.

7.4. Domain 3 – Borefield and access road

- Soils
  - Increased salinity levels, due to increased salinity levels from saline water spills and the use of saline bore water for dust suppression on the bore field road.
- Flora
  - Reduced species abundance and/or diversity due to increased salinity levels from saline water spills and the use of saline bore water for dust suppression on the borefield road.
- Groundwater
  - Bores may not be appropriately decommissioned, resulting in uncontrolled release and loss of groundwater, leading to localised reduction in groundwater levels.

7.5. Domain 4 – Mine site

- Surface water
  - Failure of final landform results in increased sediment loads in surface water flows.
- Soils
  - Increased salinity levels, due to increased salinity levels from saline water spills and the use of saline bore water for dust suppression on the haul roads.
- Flora
  - Reduced species abundance and/or diversity due to increased salinity levels from saline water spills and the use of saline bore water for dust suppression on the haul roads; and
  - Reduced species abundance and/or diversity due to altered soil profiles and/or interaction with highly saline tails.
- Surface water

    - Altered flow regimes due to changes in landform, with consequent downstream impacts as a result of diversion and/or retention.

7.6. Domain 5 – Canberra Road

- Surface water
    - Altered flow regimes due to changes in landform, with consequent downstream impacts as a result of diversion and/or retention.

7.7. Care and Maintenance

Additional potential impacts due to a decision to place the site in care and maintenance are generally related to incomplete rehabilitation of stockpiles, tails storage facilities and open pit voids, comprising:

- Air quality
    - Decrease in air quality due to dust emissions from incomplete rehabilitation.
- Fauna
    - Fauna deaths due to entrapment in open pits; and
    - Attraction of grazing animals to water, with consequent changes to the species composition and condition of adjacent vegetation.
- Groundwater
    - Groundwater mounding due to in pit water affecting the quality of groundwater resources.
- Flora
    - Decrease in vegetation health due to seepage from tails storage facilities leading to groundwater mounding.
- Public safety
    - Access to open pit voids to public.
- Surface water
    - Altered flow regimes from baseline due to open voids and incomplete waterway rehabilitation, with consequent downstream impacts as a result of diversion and/or retention.

7.8. Sudden Unplanned Closure

Additional potential impacts due to sudden unplanned closure are generally related to incomplete rehabilitation of stockpiles, tails storage facilities and open pit voids, comprising:

- Air quality
    - Decrease in air quality due to dust emissions from incomplete rehabilitation.
- Fauna
    - Fauna deaths due to entrapment in open pits; and
    - Attraction of grazing animals to water, with consequent changes to the species composition and condition of adjacent vegetation.
- Groundwater

    - Contaminants in pit water affecting the quality of groundwater resources.
- Flora
    - Decrease in vegetation health due to unmanaged seepage from tails storage facilities leading to groundwater mounding.
- Public safety
    - Access to open pit voids to public.
- Surface water
    - Altered flow regimes from baseline due to open voids and incomplete waterway rehabilitation, with consequent downstream impacts as a result of diversion and/or retention.

8. OBJECTIVES, OUTCOMES AND COMPLETION CRITERIA

The objectives of the planned mine closure process are to ensure the:

- Pre-existing soil profile and function are reinstated;
- The post mining ecosystem and landscape function is resilient, self-sustaining and indicating that the pre-mining ecosystem and landscape function will ultimately be achieved;
- No net adverse impacts from site operations on native fauna in lease area and adjacent areas;
- Groundwater systems are not impacted by mine closure activities;
- Land is physically safe for people to access; and
- Cultural heritage is protected.

8.1. Closure Outcomes and Completion Criteria

The closure outcomes and measurement criteria have been developed based on the current understanding of the J-A environment and rehabilitation trials to date. It is anticipated that these criteria will be reviewed and updated biennially based on the results of research and progressive rehabilitation on site. These criteria are detailed in the PEPR and summarised in Table 13.

It is anticipated that all the criteria described here will apply for both planned and unplanned closure, however, closure outcomes and criteria will not apply for any care and maintenance period until such time that it is determined that the site will move into closure. Environmental management as described in the PEPR will continue during any care and maintenance period.

The approval of Ooldea Road upgrades was in accordance with the Development Act and the Mine Closure Plan is not required to address the closure activities associated with Ooldea Road. However, closure activities associated with Ooldea Road have been included in this Plan in order to ensure that a coordinated and consistent approach to closure is undertaken for both the mine and associated infrastructure. Iluka will use the outcomes and completion criteria described to determine the final and appropriate closure of Ooldea Road.

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Table 13 Closure outcomes and related closure measurement criteria

Outcome	Criteria ID	Leading indicator criteria	Project Phase	Measurement Criteria					
				What will be measured and form (method) of measurement	**Locations**	**Outcome achievement**	**Frequency**	**Control or baseline data**	**Responsibility**
No public injuries or deaths resulting from mine operations traffic or unauthorised access that could have been reasonably prevented	C3[1]	NA	Closure	Site audit of infrastructure type, disposal location, and record of removal off-site	All domains.	All plant, equipment and mine related infrastructure has been removed from site	At closure, and/or prior to lease relinquishment	NA	Site Manager Rehabilitation Specialist
	C4	NA	Closure	Site audit of safety and compliance certificates (or similar records) for any retained infrastructure Negotiation and sign-off from landowners (DEW and Far West Coast Aboriginal Corporation (FWCAC)) on relinquishment/handover of retained infrastructure	All domains.	All retained infrastructure is safe and stable	At closure, and/or prior to lease relinquishment	NA	Site Manager ERCR Manager Rehabilitation Specialist
No disturbance to aboriginal artefacts or sites of significance unless prior approval under the relevant legislation is obtained	C9	NA	Closure	Desktop audit to compare pre-mining cultural heritage site reinstatement	All domains	All heritage sites restored to pre-mining vegetation associations, and all artifacts restored to original position (or as agreed with FWCAC)	At closure and/or prior to lease relinquishment	NA	Rehabilitation Specialist ERCR Manager
				Domain audit/inspection by heritage custodians	Disturbance areas within tenement boundaries				Community Relations Advisor HSEC Manager

[1] Note the C3 measurement criteria excludes/does not apply to:

- The subterranean portion of the J-A water supply pipeline - refer Section 8.14 - J-A Mine Closure Plan;
- Buried mine-site tailings drainage infrastructure - refer Section 8.15 - J-A Mine Closure Plan; and
- Infrastructure that may be relinquished to third-parties for post-mining use (e.g. Ooldea road) - refer Sections 8.12 and 8.13, J-A Mine Closure Plan.

Outcome	Criteria ID	Leading indicator criteria	Project Phase	Measurement Criteria					
				What will be measured and form (method) of measurement	**Locations**	**Outcome achievement**	**Frequency**	**Control or baseline data**	**Responsibility**
No introduction of new weeds or plant pathogens, nor increase in abundance of existing weed species in the lease area and adjacent areas caused by mining operations	C11	NA	Closure	Weed survey to measure the diversity and abundance of weed species	Watercourse monitoring sites (upstream and downstream)	Weed species diversity and abundance at closure to be consistent with control sites	Following completion of active rehabilitation. Annually, for a minimum of 5 years	Baseline LFA surveys undertaken following rehabilitation Baseline vegetation surveys of the Project area conducted by Badman (2006a, 2006b, 2007).	Rehabilitation Specialist
No increase in abundance of pest animal species in the lease area and adjacent areas caused by mining operations.	C13	NA	Closure	Fauna survey of the abundance of pest animal species	Fauna monitoring sites	Pest animal abundance at closure to be consistent with control sites	Following completion of active rehabilitation Annually, for a minimum of 5 years	Baseline fauna surveys of the Project areas conducted by SKM (2006a)	Rehabilitation Specialist
Soil profile and function is restored and capable of supporting agreed land use	C15	NA	Closure	Test drill holes (co-located with groundwater monitoring locations) Note: Monitoring locations, when installed, will be provided in the ACR	Domains 4A, 4B and 4C	Soil profile is restored in accordance with Table 29 (PEPR) indicative soil profile	Once, 3 years after tailings are complete for each pit	Baseline soil investigations completed by Outback Ecology (2006) and Soil Water Consultants (2007 & 2008)	Rehabilitation Specialist
Soil profile and function is restored and capable of supporting agreed land use	C17	NA	Closure	Landscape function analysis (LFA) monitoring BSC (minimum age class 2) as described in Field guide for landscape function analysis for environmental monitoring and assessment, Minerals Regulatory Guidelines (DMITRE 2013)	Rehabilitated areas Each rehabilitated area per year will contain a minimum of two LFA site for the first 5 years of rehabilitation works. Final LFA regime to be determined based on results.	BSC profile and function is restored	1, 2 and 5 years post-rehabilitation	Baseline soil investigations completed by Outback Ecology (2006) and Soil Water Consultants (2007 & 2008)	Rehabilitation Specialist

Outcome	Criteria ID	Leading indicator criteria	Project Phase	Measurement Criteria					
				What will be measured and form (method) of measurement	**Locations**	**Outcome achievement**	**Frequency**	**Control or baseline data**	**Responsibility**
Soil profile and function is restored and capable of supporting agreed land use	C20	NA	Closure	Soil sampling during test hole drilling as described in Criteria C15 Analysis of soil salinity (electrical conductivity, EC) using 1:5 soil:water extract (per method 4A1, Rayment & Lyons 2011)	In-pit rehabilitation areas and off-path TSF (Domains 4A, 4B and 4C, as detailed in Section 3.12.1 PEPR)	No salinisation of rehabilitated soil profile due to capillary rise	Once, 3 years after tailings are complete for each pit	Baseline hydrogeological investigations completed by SKM (2006b) and PB (2005, 2007 & 2008) Pre-mining physio-chemical characteristics of the soil materials summarised in Table 9 (PEPR)	Rehabilitation Specialist
	C21	NA	Closure	Analysis of soil salinity (electrical conductivity, EC) using 1:5 soil:water extract (per method 4A1, Rayment & Lyons 2011)	Domains 3 and 4 (as detailed in Section 3.12.1 PEPR)	Surface site contamination (salinity) does not exceed control site conditions	Once, prior to lease relinquishment	Baseline hydrogeological investigations completed by SKM (2006b) and PB (2005, 2007 & 2008) Pre-mining physio-chemical characteristics of the soil materials summarised in Table 9 PEPR	Rehabilitation Specialist
Soil profile and function is restored and capable of supporting agreed land use	C22	NA	Closure	A gamma surface radiation survey carried out using appropriate methods (consistent with ARPANSA guidelines)	All rehabilitated areas in Domains (as detailed in Section 3.12.1 PEPR).	The average dose rate (RS-125 contact dose rate) over the rehabilitated areas does not exceed 90 nSv/h (i.e. twice the maximum dose rate measured over the pre-mining area) and dose rates for U, Th and K40 do not exceed the following limits: U (4.4 ppm), Th (16.2 ppm) and K40 (1.8%)	Once, prior to lease relinquishment	Baseline radiation survey for Ambrosia conducted by SA Radiation (2018) Background surface gamma radiation as per Section 4.2.1, Iluka Resources J-A *Radiation and Radioactive Waste Management Plan* (as lodged with the SA EPA Radiation Protection Branch)	Environmental Specialist
	C23	NA	Closure	Dust deposition monitoring	Domains 2, 3 and 4 (as detailed in Section 3.12.1 PEPR) Prior to closure, dust gauge sites will be established at agreed locations with DEM. Location of control sites will be determined based on the results of	Fugitive dust emissions from the rehabilitated landscape are consistent with control sites	Monthly for 12 months following closure	NA	Rehabilitation Specialist

Outcome	Criteria ID	Leading indicator criteria	Project Phase	Measurement Criteria					
				What will be measured and form (method) of measurement	**Locations**	**Outcome achievement**	**Frequency**	**Control or baseline data**	**Responsibility**
					operational dust deposition monitoring (i.e. beyond extent of known operation fugitive dust)				
No demolition, industrial or solid domestic wastes (other than treated sewage) are to be disposed on-site	C25	NA	Closure	Domain audit and reporting	All Domains	No demolition, industrial or solid domestic wastes (except biosolids and residual infrastructure designated in Section 8.0 of J-A *Mine Closure Plan*, are to be disposed or left on-site A bioremediation program will be conducted in accordance with the BMP.	Once, at closure, and/or prior to lease relinquishment	NA	Rehabilitation Specialist
No demolition, industrial or solid domestic wastes (other than treated sewage) are to be disposed on-site	C26	NA	Closure	Domain audit and reporting	All Domains	No demolition, industrial or solid domestic wastes (except biosolids and residual infrastructure designated in Section 8.0 of J-A *Mine Closure Plan*, are to be disposed or left on-site	Once, at closure, and/or prior to lease relinquishment	NA	Rehabilitation Specialist
Post mining ecosystem and landscape function is resilient, self-sustaining and indicating that the pre-mining ecosystem and landscape function will ultimately be achieved	C29	NA	Operations Closure	Landscape Function Analysis (LFA) monitoring of: • soil cover; • basal cover of vegetation; • litter cover; • BSC; • crust entirety; • erosion type and severity; • deposited materials; • surface roughness;	Rehabilitated areas (Domains 3 and 4 – areas within Domains 1 and 2 subject to agreement with final landholder) as detailed in Section 3.12.1 PEPR) Each rehabilitated area per year will contain a minimum of two LFA site for the first 5 years of rehabilitation works Final LFA regime to be determined based on results	Rehabilitated systems are trending towards pre-disturbance landscape function based on comparison with control sites	1, 2, 5 and 10 years post-rehabilitation during operations 1,2 and 5 post-rehabilitation at closure	Baseline soil investigations completed by Outback Ecology (2006) and Soil Water Consultants (2007 & 2008) Baseline vegetation surveys of the Project area conducted by Badman (2006a, 2006b, 2007	Rehabilitation Specialist

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Outcome	Criteria ID	Leading indicator criteria	Project Phase	Measurement Criteria					
				What will be measured and form (method) of measurement	**Locations**	**Outcome achievement**	**Frequency**	**Control or baseline data**	**Responsibility**
				• surface resistance to disturbance; • slake testing; • soil texture; and • vegetation diversity and abundance.					
No net adverse impacts from site operations on native fauna abundance or diversity within the lease area and adjacent areas	C31	NA	Closure	Site audit of rehabilitated water storage facilities	All domains	Open water storage facilities backfilled and rehabilitated	Once, at mine closure, prior to relinquishment	NA	Rehabilitation Specialist
No net adverse impacts from site operations on native fauna abundance or diversity within the lease area and adjacent areas	Refer to C29	Apply C29 to measure that appropriate habitat is restored for faunal species.	Operations Closure	Refer to Section 5.12.6, C29 PEPR					
Post mining ecosystem and landscape function is resilient, self-sustaining and indicating that the pre-mining ecosystem and landscape function will ultimately be achieved	C34	NA	Closure	Water course monitoring – modified Before-After Control Impact (BACI) Methodology as per J-A watercourse rehabilitation report including: Comparison of imagery for changes in vegetation growth and evidence of erosion Cross-section survey to capture measurement of creek bed dimensions Longitudinal profile to capture topography of channel centre line	Upstream monitoring sites and rehabilitated watercourses	Erosion rates of rehabilitated watercourses are comparable with upstream control sites	1,2 and 5 years and after stream flow events following upstream and downstream creek connection	Upstream control sites per Figure 49 PEPR	Rehabilitation Specialist

Outcome	Criteria ID	Leading indicator criteria	Project Phase	Measurement Criteria					
				What will be measured and form (method) of measurement	**Locations**	**Outcome achievement**	**Frequency**	**Control or baseline data**	**Responsibility**
				Record of flood debris line/high water mark Erosion pins on creek bank Measurement of BSC and vegetation growth on bank and creek bed					
Post mining ecosystem and landscape function is resilient, self-sustaining and indicating that the pre-mining ecosystem and landscape function will ultimately be achieved	C35	NA	Operations Closure	Surface water quality monitoring – stage samplers, including measurement of EC, turbidity and pH[2]	Upstream and downstream monitoring sites per Figure 49 PEPR	Water quality in downstream creeks comparable with upstream control sites	Opportunistically, after significant flow events	Upstream control sites as per Figure 49 PEPR	Environmental Specialist Rehabilitation Specialist
The extraction and use of groundwater does not adversely affect environmental processes or beneficial users that are reliant on that groundwater system This outcome relates only to Domain 3 (MPL 110) (Jacinth borefield palaeochannel aquifer) No relevant sensitive environmental receptors or beneficial uses of the palaeochannel aquifer exists other than the J-A mine	C38	NA	Closure	SWLs (mAHD) measured using calibrated water level meter (dipper)	Borefield groundwater production and monitoring wells per Figure 50 PEPR Domain 3 (MPL 110)	Aquifer total drawdown is not greater than SKM (2011) model post closure predictions	Quarterly, for a minimum of three years post closure	Baseline hydrogeological investigations completed by SKM (2006b) and PB (2005, 2007 & 2008)	Environmental Specialist

[2] Concentration limits to be determined, and agreed upon with DEM prior to closure, once sufficient upstream data has been collected.

Outcome	Criteria ID	Leading indicator criteria	Project Phase	Measurement Criteria					
				What will be measured and form (method) of measurement	**Locations**	**Outcome achievement**	**Frequency**	**Control or baseline data**	**Responsibility**
(refer Section 2.12 PEPR and 5.15.5 PEPR									
The extraction and use of groundwater does not adversely affect environmental processes or beneficial users that are reliant on that groundwater system This outcome relates only to Domain 3 (MPL 110) (Jacinth borefield palaeochannel aquifer) No relevant sensitive environmental receptors or beneficial uses of the palaeochannel aquifer exists other than the J-A mine (refer Section 2.12 PEPR and 5.15.5 PEPR)	C39	NA	Closure	Desktop review of observed SWLs against SKM (2011) borefield palaeochannel aquifer closure model predictions Note: SKM (2011) aquifer drawdown model (Scenario 1) considered a constant 377 L/s demand throughout the life-of-mine resulting in ≥20 m (maximum 23 m) drawdown from pre-mine levels	Borefield groundwater production and monitoring wells per Figure 50 PEPR Domain 3 (MPL 110)	Desktop closure model validation and closure model update (recalibration) undertaken at required intervals	Model update (recalibration) once at Closure.	Baseline hydrogeological investigations completed by SKM (2006b) and PB (2005, 2007 & 2008) Aquifer drawdown model developed by SKM (2011)	Environmental Specialist
Groundwater systems outside of the extent of the mine workings are not altered by the disposal of process water in the pit This outcome relates only to Domain 4 (ML6315)	C43	Annual review of observed SWLs against the predicted quarterly modelled SWL trends for closure (JACMIN2.0)	Closure	Groundwater levels (mAHD/mBGL)	Groundwater monitoring wells, including: Canberra, MBN07, MB08D, MBN11, IH06, MBN01D, MBN02, MBN03, MNB04, MB10D, MBN06, MBN09, MBN10, MB05D, MB06D, MB07, MBN08D, MB16S, MB16D, MB17D, MB18S, MB18D, MB01S, AMB01D, AMB01D-old, AMB02, AMB03, AMB05, AMB06, MBC2, MBC3, MBC4, MBC5, MB018, MB02S & D, MB01S, MBN12, IH39, MB04 &/or IH58, MB11S & D, and MB09S & D.	Groundwater levels are recovering in line with most recent modelled predictions post closure	Once, at the completion of three years of groundwater monitoring (Criteria ID C44)	Baseline hydrogeological investigations completed by SKM (2006b) and PB (2005, 2007 & 2008) Site groundwater model updated by Jacobs (2017), EMM (2019) and IGS (2019)	Environmental Specialist

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Outcome	Criteria ID	Leading indicator criteria	Project Phase	Measurement Criteria					
				What will be measured and form (method) of measurement	**Locations**	**Outcome achievement**	**Frequency**	**Control or baseline data**	**Responsibility**
Groundwater systems outside of the extent of the mine workings are not altered by the disposal of process water in the pit This outcome relates only to Domain 4 (ML6315)	C44	Annual review of observed SWLs against the predicted quarterly modelled SWL trends for closure (JACMIN2.0)	Closure	Groundwater levels (mAHD/mBGL)	Groundwater monitoring wells, including: Canberra, MBN07, MB08D, MBN11, IH06, MBN01D, MBN02, MBN03, MNB04, MB10D, MBN06, MBN09, MBN10, MB05D, MB06D, MB07, MBN08D, MB16S, MB16D, MB17D, MB18S, MB18D, MB01S, AMB01D, AMB01D-old, AMB02, AMB03, AMB05, AMB06, MBC2, MBC3, MBC4, MBC5, MB018, MB02S & D, MB01S, MBN12, IH39, MB04 &/or IH58, MB11S & D, and MB09S & D.	Groundwater levels are recovering in line with most recent modelled predictions post closure	Quarterly, for a minimum of three years post closure	Baseline hydrogeological investigations completed by SKM (2006b) and PB (2005, 2007 & 2008) Site groundwater model updated by Jacobs (2017), EMM (2019) and IGS (2019)	Environmental Specialist
	Refer to C19	Apply C19, which measures that groundwater levels do not impact upon soil quality for rehabilitation purposes	Closure	Refer to: Section 5.9.6 (C19)					
Fuel and liquid chemical (hazardous materials) are bunded and managed in accordance with relevant EPA guidelines to prevent spillage and leakage to the environment.	C47	NA	Closure	Domain audit Soil sampling of target sites and management of any impacted soils in accordance with the National Environment Protection (Assessment of Site Contamination) Measure 1999 ('ASC NEPM') Classification for off-site disposal as per SA EPA Information Sheet (March 2010): Current criteria for the classification of waste – including Industrial and Commercial Waste (Listed) and Waste Soil	Village/Aerodrome Domain 2 (MPL 111) Mine Site Domain 4 (ML 6316) (refer Figure 40 PEPR) Example target sites for assessment during Domain audit: Hazardous materials storage areas Workshop areas Waste storage areas Refuelling areas Wash bay areas	No soil contamination in areas used for storage and handling of hazardous materials	At closure and/or site relinquishment	NA	Environmental Specialist

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Outcome	Criteria ID	Leading indicator criteria	Project Phase	Measurement Criteria					
				What will be measured and form (method) of measurement	**Locations**	**Outcome achievement**	**Frequency**	**Control or baseline data**	**Responsibility**
The reconstructed landform is consistent with surrounding topography	C48	NA	Closure	Topographic survey of rehabilitated site compared with approved design (comparison of RLs)	Domain 4A (Jacinth Pit)	No point in the rehabilitated landscape greater than 178 mAHD (+1 m of the highest designed mAHD) for Domain 4A No point in the rehabilitated landscape less than 124 mAHD (the lowest designed mAHD) for Domain 4A	At closure and/or site relinquishment. (repeat after remedial work, if necessary)	NA	Mining Engineer Rehabilitation Specialist
	C49				Domain 4C (off-path TSF)	No point in the rehabilitated landscape greater than 178 mAHD (+1 m of the highest designed mAHD) for Domain 4C			
	C50				Domain 4B (Ambrosia Pit)	No point in the rehabilitated landscape greater than 160 mAHD (+1 m of the highest designed mAHD) for Domain 4B No point in the rehabilitated landscape less than 118 mAHD (the lowest designed mAHD) for Domain 4B			

9. CLOSURE IMPLEMENTATION SUMMARY

The J-A Project will be progressively rehabilitated over the life of mine. Rehabilitation of infrastructure associated with construction commenced in 2010 and rehabilitation of the mine pits commenced 2013. Rehabilitation activities are anticipated to be carried out annually over the life of the mine with the overarching aim to rehabilitate in equal proportions to those disturbed each year.

This plan outlines the closure strategies for various contingencies, including planned closure and completion, sudden unplanned closure and care and maintenance.

9.1. Planned Closure and Completion

9.1.1. Social

The Social Impact Assessment (Elton Consulting 2020) outlines a range of social impacts and controls for closure.

With the planned closure of the J-A mine it is anticipated that the following activities would be carried out at a minimum:

- Provide support for employees including upskilling workforce (i.e. national tickets) to move to other jobs, counseling services, mentoring;
- Encouraging and supporting sustainable business strategies with local business;
- Share information with community and stakeholders including information sessions, notifications in local papers, meet with stakeholders; and
- Prepare a social implementation plan (within 5 year of the end of production).

More detailed information regarding the social aspects of the closure process are discussed in the J-A Stakeholder Management Plan.

9.1.2. Decommissioning

It is anticipated that decommissioning of infrastructure and equipment will commence when all mining operations have ceased. This MCP will be reviewed prior to the termination of mining operations and the following decommissioning activities described:

- Demolition, decommissioning (and/or relocation) of plant and infrastructure (including underground services and footings);
- Construction of final landforms and drainage structures;
- Consultation with stakeholders;
- Handover process for infrastructure as agreed with other parties; and
- Finalise the post closure monitoring and maintenance program.

9.1.3. Domain 1 - Ooldea Road

Sub Domain A – Borrow Pits

The following activities shall be undertaken as part of the closure activities associated with the borrow pits associated with Ooldea Road:

- Disconnection and termination of services (e.g. generators);
- Demolition and removal of buildings, crushers, etc.;
- Removal of concrete pads and footings;
- Where relevant, identify areas that may have been impacted by saline water or hydrocarbon spillage;
- Sampling and analysis of soils (in areas identified as being potentially impacted) to confirm chemical parameters are within suitable limits for the proposed post-mining land use;
- Layback of borrow pit walls to accepted angles;
- Reinstatement of overburden, subsoil and topsoil;
- Land forming, profiling, and ripping (deep or shallow);
- Seeding; and
- Rehabilitation management and monitoring activities until successful relinquishment is achieved.

Sub Domain B – Water Points

The following activities shall be undertaken as part of the closure activities associated with the water points associated with Ooldea Road:

- Disconnection and termination of services (e.g. generators);
- Demolition and removal of above ground infrastructure, e.g. pumps, sheds, above ground piping;
- Capping and/or removal of water bore casings;
- Where relevant, identify areas that may have been impacted by saline water or hydrocarbon spillage;
- Sampling and analysis of soils (in areas identified as being potentially impacted) to confirm chemical parameters are within suitable limits for the proposed post-mining land use;
- Spreading of cleared vegetation over soil surface;
- Levelling and raking of surface to tie the surface topography in with surrounding soil and drainage patterns (including turkey nest dams);
- Seeding; and
- Rehabilitation management and monitoring activities until successful relinquishment is achieved.

Sub Domain C – Ooldea Road

Closure and rehabilitation activities associated with Ooldea Road will be undertaken as outlined in the Ooldea Road North and Ooldea Bypass Rehabilitation Plan.

9.1.4. Domain 2 – Airfield and village

Sub Domain A – Airstrip

The airstrip is an infrastructure asset that may be retained on site following consultation with the landowner. In the event that the airstrip is to be removed, the following activities shall be undertaken as part of the closure activities:

- Removal and disposal of saline sediments from airstrip pavement and relocating at depth within the void on site;
- Reinstatement of overburden, subsoil and topsoil;
- Land forming, profiling, and deep ripping;
- Seeding; and
- Rehabilitation management and monitoring activities until successful relinquishment is achieved.

Sub Domain B – Accommodation Village (including Sewage Treatment Facilities)

The following activities shall be undertaken as part of the closure activities associated with the accommodation village:

- Disconnection and termination of services, including power lines;
- Demolition and removal of buildings and facilities;
- Removal of concrete pads and footings;
- Emptying of tanks and pipe work;
- Removal of underground tanks and piping;
- Remediation/removal and disposal of contaminated material (hydrocarbons, etc.);
- Reinstatement of overburden, subsoil and topsoil;
- Land forming, profiling and deep ripping;
- Seeding; and
- Rehabilitation management and monitoring activities until successful relinquishment is achieved.

Sub Domain C – Drainage Lines

The following activities shall be undertaken as part of the closure activities associated with the drainage lines established as part of the airfield development:

- Where relevant, identify areas that may have been impacted by saline water or hydrocarbon spillage;
- Sampling and analysis of soils to confirm chemical parameters are within suitable limits for the proposed post-mining land use;
- Layback of drainage lines to accepted angles;
- Reinstatement of overburden, subsoil and topsoil;
- Land forming, profiling, and deep ripping;
- Seeding; and
- Rehabilitation management and monitoring activities until successful relinquishment is achieved.

In the event that the airfield is to be retained after closure drainage lines associated with the airfield will be designed and developed for long term protection of the airfield from surface water erosion. Final design and development will be determined in consultation with the landowner prior to closure.

9.1.5. Domain 3 – Borefield and access road

Sub Domain A – Access Road

The following activities shall be undertaken as part of the closure activities associated with the access road:

- Removal and disposal of saline sediments from the access road and relocating at depth within the void on site;
- Reinstatement of overburden, subsoil and topsoil;
- Land forming, profiling, and deep ripping;
- Seeding; and
- Rehabilitation management and monitoring activities until successful relinquishment is achieved.

If it is considered (following negotiations with landowners) that part or all of the mine access road remains, these activities will be amended to reflect the required scope of work.

Sub Domain B – Power Transmission Line

The following activities shall be undertaken for the transmission line located within the MPL:

- Disconnection and termination of services;
- Collection and removal of transmission lines off site;
- Removal of concrete pads and footings;
- Reinstatement of subsoil and topsoil;
- Seeding; and
- Rehabilitation management and monitoring activities until successful relinquishment is achieved.

Sub Domain C – Bore Field Infrastructure

The following activities shall be for the bore field infrastructure:

- Disconnection and termination of services (e.g. generators);
- Demolition and removal of above ground infrastructure, e.g. pumps, sheds, above ground piping;
- Removal and disposal of HDPE liners;
- Capping and or removal of water bore casings;
- Where relevant, identify areas that may have been impacted by saline water or hydrocarbon spillage;
- Sampling and analysis of soils to confirm chemical parameters are within suitable limits for the proposed post-mining land use;
- Spreading of cleared vegetation over soil surface;

- Levelling and raking of surface to tie the surface topography in with surrounding soil and drainage patterns (including turkey nest dams);
- Seeding; and
- Rehabilitation management and monitoring activities until successful relinquishment is achieved.

Sub Domain D – Water Supply Pipeline

The following activities shall be undertaken for the water supply infrastructure:

- Dewatering of pipeline, pumps and dams;
- Disconnection and termination of services, including powerlines;
- Demolition and removal of above ground infrastructure e.g. pumps, sheds, above ground piping;
- Capping and/or abandonment of wells;
- Removal of concrete pads and footings;
- Removal of underground tanks and piping and associated infrastructure;
- Remediation/removal and disposal of contaminated material (salt contaminated);
- Reinstatement of overburden, subsoil and topsoil;
- Land forming, profiling and ripping (deep or shallow);
- Seeding; and
- Rehabilitation management and monitoring activities until successful relinquishment is achieved.

The underground water pipeline will be retained in-situ.

Sub Domain E – Tank Farm 1

The following closure activities shall be undertaken as part of the closure activities associated with Tank Farm 1:

- Dewatering of pipeline, pumps and dams;
- Disconnection and termination of services, including powerlines;
- Demolition and removal of above ground infrastructure, e.g. pumps, sheds, above ground piping;
- Capping and/or abandonment of wells;
- Removal of concrete pads and footings;
- Removal of underground tanks and piping;
- Remediation/removal and disposal of contaminated material (salt contaminated, hydrocarbons, etc.);
- Removal and disposal of HDPE liners and associated infrastructure;
- Reinstatement of overburden, subsoil and topsoil;
- Land forming, profiling, and ripping (deep or shallow);
- Seeding; and

- Rehabilitation management and monitoring activities until successful relinquishment is achieved.

The infrastructure located at Tank Farm 1 was predominately construction related and some infrastructure has been removed.

Sub Domain F – Borrow Pits (EMLs)

The following closure activities shall be undertaken for the borrow pits located adjacent the bore field access road:

- Layback of pits to accepted angles;
- Reinstatement of overburden, subsoil and topsoil;
- Land forming, profiling, and dripping (deep or shallow); and
- Seeding.

Further details regarding the rehabilitation of these borrow pits is contained in the EML MARP.

9.1.6. Domain 4 - Mine site

Sub Domain A – Jacinth Mine Area

The following closure activities shall be undertaken:

- Reinstatement of overburden, subsoil and topsoil;
- Ripping, seeding; and
- Rehabilitation management and monitoring activities until successful relinquishment is achieved.

In-pit TSF sub-tails drainage infrastructure (generally comprising drainage pipes) will remain in situ.

Sub Domain B – Ambrosia Mine Area

The following closure activities shall be undertaken:

- Reinstatement of overburden, subsoil and topsoil;
- Ripping, seeding; and
- Rehabilitation management and monitoring activities until successful relinquishment is achieved.

In-pit TSF sub-tails drainage infrastructure (generally comprising drainage pipes) will remain in situ.

Sub Domain C – Tailings Storage Facility

The following activities shall be undertaken as part of the closure activities associated with the TSF:

- Reshaping of batters and storage facility walls;
- Reinstatement of overburden, subsoil and topsoil;
- Land forming, profiling, and ripping (deep or shallow);
- Seeding; and
- Rehabilitation management and monitoring activities until successful relinquishment is achieved.

Sub Domain D – Overburden storage areas

The following closure activities shall be undertaken:

- Removal of overburden (to be used in other closure activities);
- Reinstatement of subsoil and topsoil;
- Land forming, profiling and ripping (deep or shallow);
- Seeding; and
- Rehabilitation management and monitoring activities until successful relinquishment is achieved.

Sub Domain E – Access Roads

The following closure activities shall be undertaken:

- Removal of road signage, etc. and disposal off site;
- Where relevant, identify areas that may have been impacted by saline water or hydrocarbon spillage;
- Sampling and analysis of soils to confirm chemical parameters are within suitable limits for the proposed post-mining land use;
- Reinstatement of overburden, subsoil and topsoil;
- Land forming, profiling and ripping (deep or shallow);
- Seeding; and
- Rehabilitation management and monitoring activities until successful relinquishment is achieved.

Access roads are an infrastructure asset that may be retained on site following consultation with the landowner.

Sub Domain F – Process Plant Site

The following closure activities shall be undertaken:

- Disconnection and termination of services, including powerlines;
- Demolition and removal of buildings, crushers, conveyors, etc.;
- Removal of concrete pads and footings;
- Removal of underground tanks and piping;

- Remediation/removal and disposal of contaminated material (radioactive, salt affected, hydrocarbons, etc.), with salt affected material to be relocated at depth within the void on site;
- Emptying of dams, and removal and disposal of HDPE liners and associated infrastructure;
- Reinstatement of overburden, subsoil and topsoil;
- Land forming, profiling and ripping (deep or shallow);
- Seeding; and
- Rehabilitation management and monitoring activities until successful relinquishment is achieved.

Sub Domain G – Offices, Workshops and Communication Tower

The following closure activities shall be undertaken:

- Removal of all hazardous materials and disposal off site;
- Disconnection and termination of services;
- Demolition and removal of tower;
- Demolition and removal of buildings and facilities;
- Removal of concrete pads and footings;
- Removal of underground tanks and piping;
- Remediation/removal and disposal of contaminated material (e.g. hydrocarbons)
- Validation (sampling and analysis) of the removal of contaminated soil;
- Reinstatement of overburden, subsoil and topsoil;
- Ripping, seeding; and
- Rehabilitation management and monitoring activities until successful relinquishment is achieved.

The communications tower is an infrastructure asset that may be retained on site following consultation with the landowner.

Sub Domain H – Exploration Drill Sites, Access Tracks and Water Points

The following activities shall be undertaken as part of the closure activities associated with the exploration drill sites and access tracks:

- Remediation/removal and disposal of contaminated material (drill cuttings, hydrocarbons, etc.), with salt affected material to be relocated at depth within the void on site;
- Emptying of mud pits, and removal and disposal of HDPE liners and associated infrastructure;
- Reinstatement of overburden, subsoil and topsoil;
- Tyre dragging, brushing and disguising of access tracks;
- Land forming, profiling, and ripping (deep or shallow);

- Seeding; and
- Rehabilitation management and monitoring activities until successful relinquishment is achieved.

9.1.7. Domain 5 – Canberra Road

Sub Domain A – Canberra Road

The following activities shall be undertaken as part of the closure activities associated with the Canberra Road:

- Removal and disposal of saline sediments from the access road and relocating at depth within the void on site;
- Reinstatement of overburden, subsoil and topsoil;
- Land forming, profiling, and deep ripping;
- Seeding; and
- Rehabilitation management and monitoring activities until successful relinquishment is achieved.

9.2. Sudden Unplanned Closure

In the event of a sudden unplanned closure it is anticipated that all closure activities described above (planned closure and completion) will be carried out however the mine may enter a phase of care and maintenance (described below) while stakeholders are consulted, and preparation and planning for decommissioning and closure is carried out.

9.3. Care and Maintenance

The mine may be required to be placed in care and maintenance due to an unforeseen or unplanned event. In the event that a care and maintenance phase is required:

- All non-essential services and mining equipment will be removed;
- Any hazardous materials, such as hydrocarbons, will be reduced to minimum levels or moved to an alternative site or company for storage and/or use;
- Infrastructure retained on site will be made safe;
- All landforms will also be made safe and stable;
- Drainage will be maintained, and erosion monitored to ensure stability of landforms;
- Existing security measures for site access will be reviewed and modified as required to control access to the site and secure remaining infrastructure;
- Any monitoring required as per the PEPR or mining lease conditions will continue; and
- Iluka will undertake a series of stakeholder consultation sessions to outline the care and maintenance phase of the project and inform stakeholders if and when the care and maintenance phase is anticipated to end.

9.4. Environmental Management During Closure

All environmental management during the closure process will be carried out in accordance with the J-A PEPR which is supported by the plans outlined in Table 3.
Each of the Iluka plans includes:

- The relevant outcomes and criteria;
- Commitment and details of control and management measures;
- Details of legal requirements (including lease conditions and other relevant requirements); and
- Monitoring details (e.g. frequency, scope, parameters etc.).

10. RISK ASSESSMENT

This chapter contains a residual risk assessment for the proposed closure outcomes detailed in Section 8 - Objectives, Outcomes and Completion Criteria.
Iluka is committed to maintaining a whole of business approach to the management of risks, which is governed by the Risk Management Policy and associated standards and procedures, contained within the Risk Management System. The system ensures risks are:

- Systematically identified and appropriately treated; and
- Communicated to the appropriate levels.

The risk management process has been adopted from the Australian Standard AS/NZ ISO31000 Risk Management. Risk analysis involves identification of the causes and impacts of individual risks and determining risk ratings based on the potential consequences and likelihood that the risk event occurs. The risk assessment identifies and ranks risks into relevant levels (low, moderate, high and extreme) and guides the avoidance, mitigation and management measures proposed to manage these risks (higher levels of risk require more intensive mitigation and management measures).

10.1. Closure Options

Within each of the domains and (often) for each aspect of the Project, different options are available with respect to decommissioning and closure activities. Depending on the nature of the area and infrastructure these options include complete removal of infrastructure, partial removal of infrastructure, infrastructure to remain in-situ.

10.2. Closure Risk Assessment

Table 14 summarises the residual risks associated with not meeting the stated interim closure outcomes. A brief discussion of each of the risk assessments and outcomes is provided. This is also recorded in the PEPR.

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Table 14 Summary of residual closure risk

Aspect	Outcome	Risk ID	Risk to achieving outcome	Likelihood	Consequence	Residual Risk	Domain	CCID
Heritage	No disturbance to aboriginal artifacts or sites of significance unless prior approval under the relevant legislation is gained	CR1	Loss of information (cultural heritage site locations)	Rare	Moderate	Low	All	C9
Public safety and traffic	No public injuries or deaths resulting from mine operations traffic or unauthorised access that could have been reasonably prevented	CR2	Mining related infrastructure not required for the post mining land use remains on-site without approval	Rare	Moderate	Low	All	C3
		CR3	Mining related infrastructure remaining in situ is not safe for hand over to land owner (e.g. borefield pipeline)	Rare	Moderate	Low	1C, 2A, 2C, 3D	C4
Waste management	No demolition, industrial or solid wastes disposed of within rehabilitated site	CR4	Unapproved disposal of demolition and waste materials on-site	Rare	Minor	Low	All	C25
							All	C26
Groundwater	Groundwater systems outside of the extent of the mine workings are not altered by the disposal of process water into the pit.	CR5	Groundwater levels result in salt migration into clean overburden	Unlikely	Moderate	Moderate	3	C38
							3	C39

Aspect	Outcome	Risk ID	Risk to achieving outcome	Likelihood	Consequence	Residual Risk	Domain	CCID
							4	C43
							4	C44
Visual amenity	The reconstructed landform is consistent with surrounding topography	CR7	The post mining topography does not adequately integrate with the surrounding 'natural' topography	Rare	Moderate	Low	4A	C48
							4C	C49
							4B	C50
Surface water	Post mining ecosystem and landscape function is resilient, self-sustaining and indicating that the pre-mining ecosystem and landscape function will ultimately be achieved	CR10	Surface water flows are not restored in final landform	Unlikely	Moderate	Moderate	All	C34
		CR9	Reduction in surface water quality	Unlikely	Negligible	Low	All	C35
Soil	Soil profile and function is restored and capable of supporting agreed land use	CR11	Inadequate volumes of overburden, subsoil or topsoil	Unlikely	Moderate	Moderate	4	C15

Aspect	Outcome	Risk ID	Risk to achieving outcome	Likelihood	Consequence	Residual Risk	Domain	CCID
		CR6 CR12	Contamination of soils (salinity, hydrocarbons, NORM)	Unlikely	Negligible	Low	2,4	C47
							All	C22
							4	C20
							3,4	C21
		CR13	Failure of BSC to regenerate	Rare	Moderate	Low	All	C17
		CR14	Unstable soil surfaces resulting in erosion (wind)	Rare	Negligible	Low	2,3,4	C23
Native vegetation	Post mining ecosystem and landscape function is resilient, self-sustaining and indicating that the pre-mining ecosystem and landscape function will ultimately be achieved	CR16	Reduction in species richness and densities due to introduced species	Unlikely	Minor	Low	All	C29
Fauna	No net adverse impacts from site operations on native fauna abundance or diversity within the lease area and adjacent areas	CR17	Reduction in habitat and resources resulting in decreased diversity and/or abundance of native fauna.	Unlikely	Minor	Low	All	C31

Aspect	Outcome	Risk ID	Risk to achieving outcome	Likelihood	Consequence	Residual Risk	Domain	CCID
Pest species	No introduction of new weeds or plant pathogens, nor increase in abundance of existing weed species in the lease area and adjacent areas caused by mining operations	CR15	Reduction in species diversity and abundance (recalcitrant species)	Unlikely	Minor	Low	All	C11
	No increase in abundance of pest animal species in the lease area and adjacent areas caused by mining operations	CR16	Increased diversity and/or abundance of pest animal species	Rare	Minor	Low	All	C13

10.2.1. Risk Assessment Justification

CR1 Loss of information (cultural heritage site locations)

The J-A *Cultural Heritage Management Plan* (CHMP) outlines the ongoing monitoring and management of cultural heritage. The plan outlines procedures when cultural heritage objects are identified and the management of culturally significant sites. Cultural heritage objects in areas of disturbance have been identified and relocated in accordance with the CHMP and all areas identified in the cultural heritage GIS database. Areas of cultural heritage significance will be rehabilitated to the original land use.

The likelihood of unauthorised damage to cultural heritage object or sites would be considered rare, and the consequence moderate. The residual risk is low.

CR2 Mining related infrastructure not required for the post mining land use remains on site without approval

Iluka maintain, review and update closure liabilities throughout mine life for each project. It is considered rare that mining infrastructure would remain on site without approval or unless specifically requested by the landholder. If remaining infrastructure was not removed the cost imposed on Iluka to remove the assets would be moderate (1M – 10M). The residual risk is low.

CR3 Mining related infrastructure required for the post mining land use is not safe for hand over to landowner

All Iluka infrastructure is engineered and designed to Australian Standards (where appropriate) and designed to withstand heavy vehicle traffic (Ooldea Road and Access Road) and regular use (airfield). Ongoing maintenance of remaining infrastructure will become the responsibility of the landowner however Iluka will ensure that the any infrastructure left on site is in suitable condition for immediate use and any supporting infrastructure (i.e. drains, borrow pits) will be safe and stable.

The likelihood that remaining infrastructure is not safe for use is rare and any remedial works would be considered minor. The residual risk is low.

CR4 Unapproved disposal of demolition and waste materials on site

The J-A *Waste Management Plan* outlines the management of waste disposal at J-A during operations and annual waste movements are reported annually in the Annual Compliance Report. Further, removal of waste and demolition materials as part of closure activities are planned and budgeted.

It is rare that any unapproved waste or demolition materials would remain on site at closure. Any materials that remained would be removed at minor cost. The residual risk is low.

CR5 Groundwater levels result in salt migration into clean overburden

Migration of salt into clean overburden would be a result of hydraulic connection between the saline water table (in tails) and the soil surface. Without that connection, drained tails will not be recharged with infiltrating water to such an extent that it poses a salinisation risk to overburden placed above it.

The likelihood of salt migration into clean overburden is unlikely given the management measures outlined in the *Rehabilitation Management Plan*. Areas affected by capillary rise would be limited to discreet locations; however, these locations may require further rehabilitation earthworks, resulting in a moderate consequence. The residual risk is moderate.

CR6 Failure to reduce radiation (gamma) to pre-operational levels at surface

The Jacinth Ambrosia ore body has low levels of uranium (U) and thorium (Th). These concentrations are not high enough for the ore to be considered radioactive; however, the concentration process concentrates the U and Th in the final product (HMC). The J-A *Radiation Management Plan* identifies management measures associated with radioactive materials. At closure all HMC would have been removed from site as product and any contaminated material (soils) collected and buried at depth in the pit (with tails).

Given the ongoing radiation management and closure cleanup activities it would be considered rare that radiation levels would exceed pre-operational levels significantly. Any residual contaminated material would require cleanup at minor expense. The residual risk is low.

CR7 The post mining topography does not adequately integrate with the surrounding 'natural' topography (visual amenity)

The design of the anticipated final rehabilitated land surface is shown in the PEPR. The design represents an example of the likely final topography of the rehabilitated site; there may be some minor variations to the land surface presented in the PEPR.

Although variation from the current anticipated landform design is expected it would be rare that the variation would be outside the completion criteria requirements and would likely be restricted to a single rehabilitated site. A reduction in visual amenity would result in reputational loss for Iluka and damage to stakeholder relations, the consequence is considered to be moderate. The residual risk is low.

CR8 Landform surface creates ongoing/unacceptable soil erosion

Final landform design for each rehabilitation cell and the off path TSF is designed and modelled for stability prior to rehabilitation. Modelling considers long term surface water flows and general landform erosion rates. Further progressive rehabilitation of the mining pit offer opportunities for continuous improvements as results from monitoring and research are identified.

Given the ongoing design, modelling and monitoring it is unlikely that a stable landform is not achieved. The consequence of not achieving this outcome is considered to be moderate as progressive rehabilitation allows for early detection of any stability issues and therefore areas that require reworking are likely to be a small portion of the mine and rectifiable during operations. The residual closure risk is moderate.

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CR9 Reduction in surface water quality

Surface water systems in the J-A area are a product of ongoing cycles of erosion and sedimentation generally associated with high levels of turbidity. Due to progressive rehabilitation carried out at J-A, rehabilitated surface water systems will have some time to stabilise before upstream and downstream reconnection and stream flow is limited to high rainfall occurrences (25 years Average Interval Occurrence). Further, the surfaces rehabilitated at mine closure will comprise areas of shallow disturbance (subsoil and topsoil) and minor portions of surface water systems (i.e. where haul roads cross creeks). All surface water system designs are modelled for stability prior to implementation and monitored post rehabilitation.

Given the limited occurrence of surface water flows and progressive rehabilitation it is unlikely that surface water quality downstream will be impacted. Any impacts (if they occur) will be likely limited to surface soils in exposed areas which will require some additional stabilisation. The consequence for downstream environments will be negligible (limited to clean soils in the creek beds). The residual risk is low.

CR10 Surface water flows are not restored in final landform

Surface water flows for the anticipated rehabilitated landform have been modelled to ensure suitable flows, and final landform designs for individual rehabilitation sites will be reassessed where required. All surface water systems will be progressively rehabilitated prior to catchment connection. Although final performance of the rehabilitated creeks surface water systems cannot be confirmed until reconnection and flow the performance of the rehabilitated unconnected surface water system will be monitored and remedial works carried out as required.

Given progressive rehabilitation and ongoing monitoring it is unlikely that surface water flows will not be restored. Further remedial works are likely to be limited to discrete portions of the surface water systems at moderate cost to Iluka. The residual risk is moderate.

CR11 Inadequate volumes of overburden, subsoil or topsoil

A materials movement inventory and life of mine backfill schedule has been prepared and is routinely reviewed. The inventory ensures enough material to supply the anticipated final landform design. Further, a soil balance is prepared annually and presented in the Annual Compliance Report.

The J-A *Vegetation Clearance Procedure* outlines the way in which soil materials are managed. A potential deficit in topsoil and subsoil has been identified due to soil loss and current site research is investigating options to manage material stripping to reduce losses.

Given the current soils management and ongoing research it is unlikely that there will be a deficit of overburden, subsoil or topsoil to achieve the anticipated rehabilitated landform. Any soils deficit is likely to be restricted to discrete rehabilitation sites requiring moderate remedial works. The residual risk is moderate.

CR12 Contamination of soils (salinity, hydrocarbons, metals)

All contaminated soils (due to spills) during operations are collected and managed onsite and/or disposed of offsite, and any HMC contaminated material will be collected and returned to the production system of disposed of in pit. The J-A *Hazardous Materials Management Plan* outlines the procedures related to spill management.

It is unlikely that contaminated areas will remain at closure. Further any contamination would likely be limited to discrete areas and dealt with on an ongoing basis (negligible costs). The residual risk is low.

CR13 Failure of biological soil crust (BSC) to regenerate

Biological soil crusts are important for soil stability at the J-A site. Completed research and ongoing monitoring of stockpiles and rehabilitated areas indicate that the BSC readily return and has been recorded on rehabilitated areas within one year.

It would be considered rare that BSC did not regenerate in rehabilitated areas, however the consequence to soil stability would be significant although limited to discrete areas requiring additional stabilisation works, therefore of moderate consequence. The residual risk is low.

CR14 Unstable soil surfaces resulting in erosion (wind)

The topsoil of rehabilitated sites has shown to develop a physical crust immediately after the application of potable water, and the BSC develops very quickly and early stage (Class 1) crusts have been recorded in rehabilitated sites after two years. Both the physical crust and biological crusts have been shown to withstand wind speeds gusting up to 50 km/h (site observations) with no fugitive dust emissions evident.

It would be unlikely that soil surfaces were unstable and prone to wind erosion after rehabilitation. Any erosive events which occur would be limited to minor areas and rectified with applications of water (or sealant additives) at negligible expense. The residual risk is low.

CR15 Reduction in species richness (recalcitrant species) and vegetation densities

Research and rehabilitation trials for J-A have been continuous from start of operations and gap analysis has outlined opportunities for further investigations to ensure rehabilitation outcomes. Further progressive rehabilitation provides early opportunity for rectifying areas where outcome criteria are not likely to be met.

Given current research and progressive research it is considered unlikely that the required vegetation diversity and abundance will not be achieved at closure. The consequence of not achieving this outcome is considered to be minor as progressive rehabilitation allows for early detection of rehabilitation and therefore areas that require reworking are likely to be a small portion of the mine and rectifiable during operations. The residual closure risk is low.

CR16 Reduction in species richness and densities due to introduced species

The J-A *Pest Species Management Plan* outlines the ongoing management and monitoring of introduced vegetation and fauna species. The presence of all introduced species is mapped and managed throughout operations and reported annually in the ACR. It is important to note that some weed incursion into rehabilitated sites from upstream of J-A is expected and will be managed until site relinquishment.

It is unlikely that densities of introduced species will impact on the species richness and densities of native flora in rehabilitation areas. Further any records will likely be restricted to drainage lines (due to water availability) and managed at minor cost. The residual risk is low.

CR17 Reduction in fauna habitat

The establishment and management of fauna habitat relates directly to vegetation species richness and densities through the provision of food and shelter resources.

11. MONITORING AND MAINTENANCE

This section provides an overview of monitoring and maintenance activities planned to demonstrate progress toward meeting completion criteria. The closure monitoring program is summarised in the PEPR.

11.1. Post Closure Monitoring and Maintenance

Monitoring associated with closure includes a number of elements including:

- Environmental monitoring activities;
- Rehabilitation monitoring activities; and
- Groundwater monitoring activities.

11.1.1. Environmental Monitoring

General environmental monitoring carried out during closure operations includes:

- Identification and mapping of introduced species (flora and fauna);
- Radiation mapping and monitoring;
- Soil contamination surveys; and
- Dust deposition monitoring.

11.1.2. Rehabilitation Monitoring

Rehabilitation monitoring for the Project will include:

- Landform survey;
- Landform function analysis;
- Watercourse monitoring;
- Soil profile assessment;
- Vegetation survey/assessment; and
- Fauna survey/assessment.

Further details of these monitoring programs are provided in the Rehabilitation Management Plan.

11.1.3. Groundwater

Groundwater monitoring for the Project will include the following parameters:

- Flow (volume);
- Depth (m) (standing water levels); and

- Quality (i.e. pH, EC, metals etc).

Further details of groundwater monitoring activities and locations are provided in the Groundwater Management Plan and PEPR.

11.2. Management of Information and Data

Iluka has well established data management protocols to maintain corporate knowledge for each of its mine sites. The primary system used to manage corporate information is known as SharePoint. This electronic system stores and indexes company records including but not limited to:

- Baseline investigations;
- Environmental impact assessment documents and environmental management plans;
- Peer reviews of technical reports;
- Approval documentation;
- ACRs;
- Detailed land restoration implementation plans; and
- Rehabilitation monitoring reports.

Other information systems used by Iluka include:

- The rehabilitation portal available through Iluka's intranet for easy access to key rehabilitation and closure documentation;
- ArcMap contains spatial including all areas mined and rehabilitated, previous and remaining infrastructure, and post-mining landform and land use; and
- Iluka's Rehabilitation and Closure Provisioning Database.

12. REPORTING AND REVIEW

12.1. Reporting

Lease condition 7 for ML6315, EML6316 and MPLs 110 and 111 requires Iluka to provide to DEM an Annual Compliance Report (ACR) detailing operations carried out on the ML, EML and MPLs and demonstrate compliance with the approved PEPR and lease conditions. The ACR must be provided to DEM within two months of the anniversary of the lease grant, unless otherwise agreed.

This report is required to summarise compliance monitoring activities and provide evidence that the lease is compliant with regulatory requirements. As specified in the lease conditions, ACRs prepared by Iluka will be made available to the public.
The ACR is completed as per the Guidelines for miners: preparation of a mining and rehabilitation compliance report (under revision) and includes:

- Summary of the major mining activities undertaken in the reporting year and proposed activities for the following year;
- Summary of environmental management and rehabilitation activities for the reporting year and proposed activities for the following year;
- A summary of consultation and any complaints received from third parties;

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- A statement of compliance with the obligations under the lease conditions, and the approved PEPR for the year;
- Any actions taken to rectify any non-compliance detected either by DEM inspections, or internal monitoring, and actions to prevent recurrence;
- A statement on the effectiveness of any previously undertaken action to rectify non-compliance;
- Any new significant environmental hazards detected during the year, that were not previously documented to DEM (e.g. at the time the PEPR was approved); and
- Significant environmental incidents that have occurred and how these incidents were managed.

12.2. Review

Continual review and optimisation of operational elements during the active mine life will assist with reduction of liabilities (e.g. environmental, public safety) during closure. Internal review of the Mine Closure Plan will be undertaken biennially and will include:

- An assessment of how the MCP measures up against the Iluka EHS Standard – Rehabilitation and Closure; and
- An internal workshop that addresses the application of the MCP moving forward.

Specifically, the internal workshop will:

- Involve the broader mine operations team;
- Review the adequacy of assumptions within the Mine Closure Plan;
- Address actual and proposed changes to operations that may impact the Mine Closure Plan;
- Review outcomes of specialist investigations etc.; and
- Consider the operational changes, plant expansions and progressive rehabilitation activities (in the Context of the eventual mine closure).

An independent review of this MCP will also be undertaken every three years.

13. FINANCIAL PROVISION FOR CLOSURE

Closure cost estimates are prepared and reviewed annually for each Iluka site in accordance with the International Financial Reporting Standards (IFRS). Closure cost estimates are used by Iluka to establish provisions for future closure and rehabilitation activities and residual liabilities.

13.1. Environmental Bond

The rehabilitation liability estimate (environmental bond) for J-A has been prepared using the South Australian Mine Rehabilitation Liability Calculator Tool, per recommendation from DEM. The estimate assumes that a third party undertakes the rehabilitation and decommissioning works at the end of mine life. The bond takes into consideration progressive rehabilitation and is based on the maximum area that will be open at one time (i.e. not rehabilitated) during the life-of-mine. The maximum area open, will be provided annually in the Annual Compliance Report provided to DEM. Further information is provided in the PEPR.

14. CLOSURE RESOURCES

A list of the key resources required during the mine closure process is outlined in Table 15. This list will be revised as part of the ongoing review of the Mine Closure Plan and as a result of benchmarking against other Iluka mining operations that have been or are going through a mine closure process. Provisions for these resources are to be included in the planned mine closure cost estimates.

Table 15 Resources for mine closure

Resource	Responsibility
Key personnel – Closure process	
Site Manager	• Approved Manager to be appointed whilst mining lease is current; • To oversee closure activities on the ground and ensure that machinery and equipment are operated cost effectively (e.g. assigning the appropriate number of personnel to keep machinery working etc.) - (assume 2 to 3 years from commencement of closure).
Rehabilitation Specialist	• To ensure the rehabilitation program meets closure criteria and to undertake ongoing annual rehabilitation monitoring and management.
Environmental Specialist; Indigenous Relations Officer and HR	• To facilitate closure activities in accordance with the Mine Closure Plan and PEPR; • ensure that environmental statutory obligations are met; • undertake stakeholder consultation; • complete the necessary environmental reporting etc.
Health and Safety Specialist	To facilitate the continuation of the Iluka Environment Health and Safety Management System (EHSMS) and to ensure that closure activities are undertaken in a safe manner (assume 1 year from commencement of closure).
Electrical Engineer	To undertake statutory inspections whilst industrial power is operated at the site

Resource	Responsibility
	(assume 1 year from commencement of closure).
Business Analyst	Manage ongoing accounts, disposal of assets, taxation, wages, invoices etc (assume 1 year from commencement of closure).
Store person	Manage and account for the remaining inventory on site (assume 6 months from commencement of closure).
Operators	Approximately 20 operators for up to 2 years to operate equipment.
Project Manager – Care and Maintenance Activities	It is envisaged that an employee will be required to project manage the care and maintenance phase post-closure to ensure that lease relinquishment is achieved in a timely and cost-effective manner (assume 3 years following completion of closure activities).
Key personnel – Knowledge retention	
Long-term operator(s) Long-term staff	Identification and retention of operators/staff that have a long history of the site is critical as they have a thorough understanding of site issues. These operators may be maintained on a casual/permanent-part time basis and brought in as required (e.g. risk assessments etc.).
Documentation to be maintained	
Leases	Mining lease documentation, authorisations and approvals.
Licences	EPA authorisations for prescribed activities, eg. radiation management, etc.
Annual Compliance Reports	Provides details on the environmental management of the site, as well as information regarding leases, licences and consents.
PEPR	The PEPR and associated documents (MCP, RMP), provide details on approved rehabilitation strategies.
Environmental Monitoring Data	Air quality, surface water quality, groundwater quality and meteorological.

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Resource	Responsibility
Environmental Assessments/Environmental Impact Statements	Important to establish baseline/pre-mining environmental status for benchmarking against post-mining conditions.
Rehabilitation Monitoring Records	• Rehabilitation establishment and methodology records; • annual rehabilitation monitoring; and • long-term rehabilitation monitoring reports.
Specialist consultants/contractors	
Land Contamination Consultant	To facilitate the identification and treatment of potential contamination.
Legal Adviser	Lease relinquishment; termination of stakeholder agreements; ongoing biodiversity offset agreements etc.
Demolition Contractor	To undertake demolition works of plant and infrastructure. Must hold appropriate permits for demolition works.
Specialist rehabilitation earthmoving contractor	For final rehabilitation activities.
Ecological consultant	To undertake independent ecological monitoring on rehabilitation areas to verify that closure criteria has been met.
Research institutions	To continue research into the success of various rehabilitation methodologies.

15. DOCUMENT REVISION AND CONTROL

All ERCR documents are reviewed every two years at a minimum or in the event of significant change to operations or process and through this process.

Revision	Date Issued	Reviewer	Approver	Changes Made
10.0	21/04/2022	J. Zander – Rehabilitation Specialist	J. Lee – Environment, Rehabilitation and Community Relations Manager	Biennial review of document. Inclusion of new MPL 161. Updated Figures and formatting to match new template. Inclusion of new Closure Domain – MPL 161.

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Revision	Date Issued	Reviewer	Approver	Changes Made
9.0	10/07/2020	J. Zander – Rehabilitation Specialist	J. Lee – Environment, Rehabilitation and Community Relations Manager	Major review to align with PEPR Updated to new template
8.0	30/04/2019	J. Zander – Rehabilitation Specialist	J. Lee – Environment, Rehabilitation and Community Relations Manager	Review of document to align with PEPR submission
7.0	31/03/2017	T. Law – Rehabilitation Specialist	J. Lee – Environment, Rehabilitation and Community Relations Manager	Biennial review of document and alignment to PEPR (previously MARP)
6.0	31/03/2015	T. Law and J. Lee – Rehabilitation Specialist	N. Travers – Environment, Rehabilitation and Community Relations Superintendent	Biennial review of document and alignment to PEPR (previously MARP)

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Appendix F

Jacinth-Ambrosia Rehabilitation Management Plan

Iluka Resources Limited
ABN 34 008 675 018

Jacinth-Ambrosia Environmental Management Plan

Rehabilitation

Document Number:	0016-940010196-673	**Document Status:**	Approved for use
Date Issued:	10 July 2022	**Review Due:**	10 July 2024
Document Owner:	J-A Rehabilitation		
Document Approver:	Jacinth-Ambrosia Environment, Rehabilitation and Community Relations Manager		

CONTENTS

JACINTH AMBROSIA

1. INTRODUCTION

1.1. Purpose

This Rehabilitation Management Plan (RMP) was developed to manage rehabilitation risks, associated with the operation of the Jacinth-Ambrosia (J-A) mine and related activities. This RMP sets out the operating framework and specific procedures for minimising potential impacts and managing environmental issues associated with rehabilitation of the J-A mine. It was developed in consultation with landholders, regulatory authorities and other relevant stakeholders.

The plan provides information on the following:

- Existing environment;
- Rehabilitation process and general strategies employed during site development, landform restoration and revegetation phases; and
- Monitoring programs that will be used to assess the success of rehabilitation.

A summary of J-A rehabilitation activities is provided in Figure **1**.

The preparation of this plan is consistent with the requirements of the Department for Energy and Mining (DEM) *Minerals Regulatory Guideline MG2a: Preparation of a mining proposal for metallic and industrial minerals (excluding coal and uranium) in South Australia*.

1.2. Scope

The plan covers activities undertaken on Mining Lease 6315 (ML6315), Extractive Mineral Lease 6316 (EML6316) and Miscellaneous Purposes Licences (MPL) 110 (borefield, pipeline and access road), MPL111 (airstrip and village accommodation) and MPL161 (Canberra Road).

The RMP is a standalone document but should be considered a companion document to the J-A Mine Closure Plan, Soil Stockpile Management Plan and Program for Environment Protection and Rehabilitation (PEPR). Also refer to section 1.6. Reference.

Information in the RMP provides a summary of the rehabilitation processes at J-A. Area specific (e.g. pit cells, borrow pits) requirements are provided in greater detail in a Landform Restoration Implementation Plan (LRIP), a Revegetation Implementation Plan (RIP) and J-A Vegetation Clearance Procedure. Refer to Figure 2 for a summary of closure and rehabilitation plans implemented at J-A.

1.3. Acronyms

Table 1 outlines the acronyms referred to throughout this document.

Table 1 Acronyms

Acronym	Expansion
BSC	Biological soil crust
BOM	Bureau of Meteorology
dS/m	DeciSiemens per metre
DEM	Department for Energy and Mining
DEW	Department for Environmental and Water
EB	Eucla Basin

Acronym	Expansion
EC	Electrical conductivity
EML	Extractive Mineral Lease
ESP	Exchangeable sodium percentage
FWCAC	Far West Coast Aboriginal Corporation
GPS	Global positioning system
J-A	Jacinth-Ambrosia
LFA	Landscape Function Analysis
LRIP	Landform Restoration Implementation Plan
mAHD	Elevation in metres with respect to the Australian Height Datum
MARP	Mine and Rehabilitation Plan
ML	Mining Lease
ModCod	Modified Co-disposal of tailings
MPL	Miscellaneous Purposes Licence
MUP	Mine unit plant
PAWC	Plant available water capacity
PEPR	Program for Environmental Protection and Rehabilitation
RIP	Revegetation Implementation Plan
RL	Relative level
RMP	Rehabilitation Management Plan
SMU	Soil management unit
TDS	Total dissolved solids
TSF	Tailings Stockpile Facility
VWP	Vibrating wire piezometer
WCP	Wet concentrator plant

1.4. Applicable Legislation

The following legislation and strategies provide a framework for ongoing management of rehabilitation activities:

- *Mining Act 1971;*
- *National Parks and Wildlife Act 1972;*
- *Native Vegetation Act 1991* (and Native Vegetation Regulations 2003 and 2017);
- *Landscape South Australia Act 2019* (and Regulations 2020);
- Strategic Framework for Mine Closure – ANZECC MCA; and
- Yellabinna and Warna Manda Parks Management Plan 2019.

1.5. Lease and licence conditions

Table 2 lists the lease and licence conditions relevant to rehabilitation that are applicable to the tenements that this RMP applies to.

Table 2 Lease and licence conditions

Lease/licence number	Lease and/or licence condition details
ML 6315 EML 6316 MPL 110 MPL 111 MPL 161	The Lessee must ensure that the post mining ecosystem and landscape function is resilient, self-sustaining and indicating that the pre-mining ecosystem and landscape function will ultimately be achieved. The Lessee must ensure that the pre-existing soil profile and function are reinstated.

Figure 1 Summary of J-A rehabilitation activities

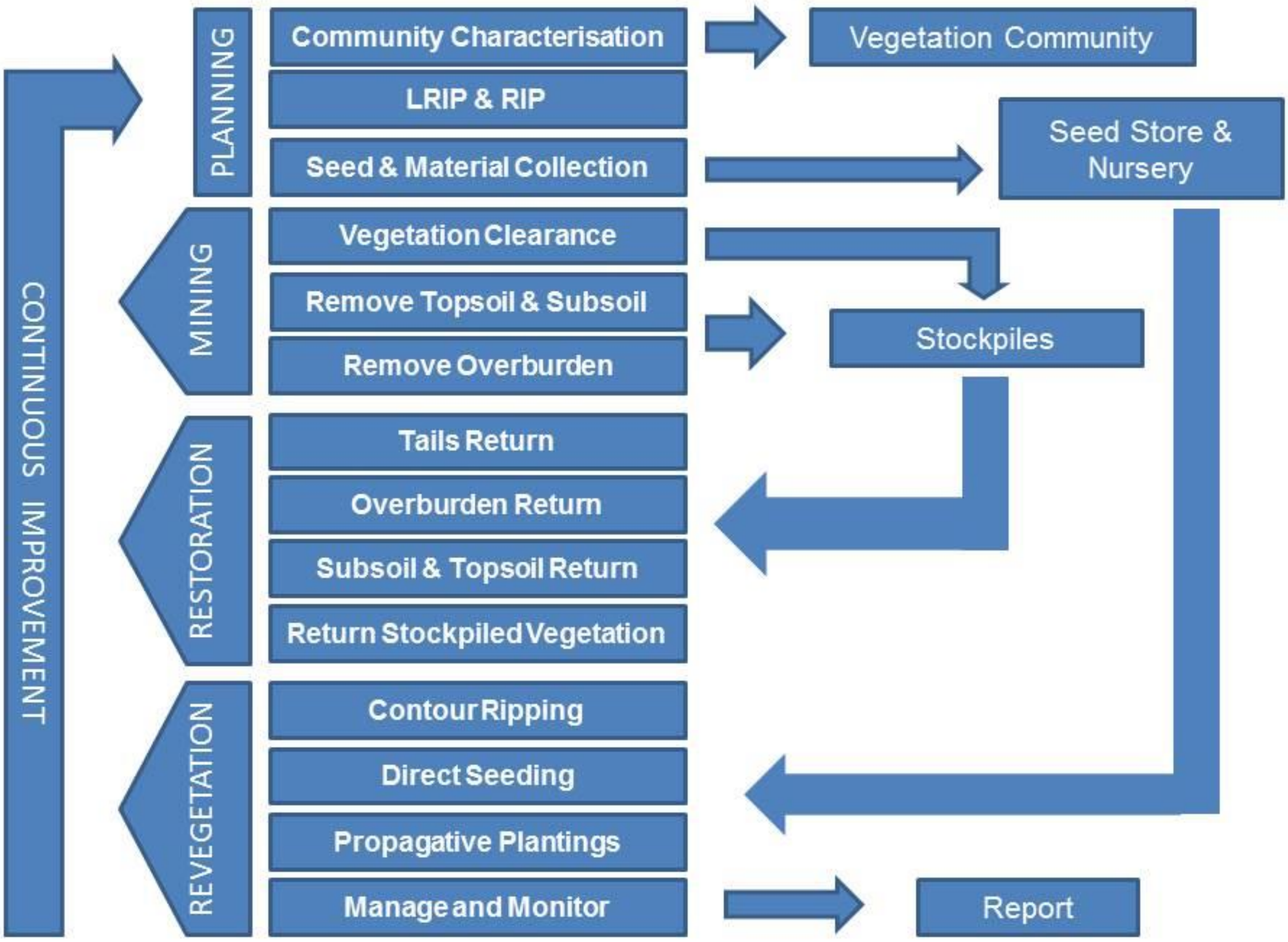

Figure 2 J-A closure and rehabilitation document summary

Program for Environment Protection and Rehabilitation

- Description of mining operations and existing environment
- Description of potential impacts from mining program
- Outlines management measures to minimise risk (risk assessment) and determines residual risk
- Identifies outcomes and measurement criteria to determine when outcome is achieved
- Describes measurement criteria (mine completion criteria) to determine when closure outcomes are achieved.

Mine Closure Plan

- Description of closure domains and final land use for each domain
- Closure outcomes and completion criteria
- Closure implementation summary incorporating planned and sudden unplanned closure, and care and maintenance
- Closure risk assessment
- Financial provision for closure and closure resources

Rehabilitation Management Plan

- Post-mining landform design including watercourse rehabilitation planning and design
- Backfill procedures
- Management of vegetation and seed collection and storage
- Monitoring and research

Soil Stockpile Management Plan

- Management of topsoil/subsoil and overburden excavation
- Management of stockpiles
- Stockpile register
- Monitoring and auditing

Landform Restoration Implementation Plan

- Cross-section of original and rehabilitated topography
- Final rehabilitation footprint (for that area)
- Earthworks summary including volumes, sources of material (stockpile or d/return) and timing/schedule
- Design details for area specific features e.g. cultural heritage sites, dunes or creeks.

Revegetation Implementation Plan

- Revegetation techniques employed for the area
- Collection and management of plant propagation material
- Management of rehabilitated area, including pest and weed management
- Monitoring and research for the area

1.6. References

This procedure shall be read in conjunction with the Iluka documentation referred to in Table 3.

Table 3 Iluka Management Plans and Procedures

Document ID	Document title	Description
0041-1722145953-583	J-A Program for Environment Protection & Rehabilitation (PEPR)	Mine approval document
0041-1722145953-599	REH_017_PL_Mine Closure	J-A Mine Closure Plan
0016-940010196-673	REH_019_PR_Soil Stockpile Procedure	J-A Soil Stockpile Procedure
0016-940010196-389	ENV_006_PL_Fire	J-A Fire Risk Management Plan
0016-940010196-379	ENV_015_PL_Surface Water	J-A Surface Water Management Plan
0016-940010196-364	ENV_005_PL_Fauna	J-A Fauna Management Plan
0016-940010196-368	ENV_007_PL_Flora	J-A Native Vegetation Management Plan
0016-940010196-406	ENV_008_PL_Groundwater	J-A Groundwater Management Plan
0016-940010196-373	ENV_011_PL_Pest Species	J-A Pest Species Management Plan
0016-940010196-409	ENV_007_PR_Vegetation Clearance	J-A Vegetation Clearance Procedure

2. BACKGROUND INFORMATION

Key characteristics of the mine operations and existing environment and ecological function specifically relevant to rehabilitation planning are described within this section. A more detailed description of the mine operations and baseline environment within the J-A area is provided within the PEPR.

2.1. Project Description

2.1.1. General

The mine is comprised of two main deposits, Jacinth and Ambrosia. For information on the mine layout, refer to the Program for Environmental Protection (PEPR). Ore is mined progressively using dry-mining techniques and is excavated by a dozer and fed into a mining unit plant (MUP). The ore is then be pumped to the wet concentrator plant (WCP), producing heavy mineral concentrate.

Co-disposed tails (ModCod) and sand tails are produced by the WCP and were initially disposed at the off-path tailing storage facility. As of 2013 they returned to the pit. Hypersaline (approx. 50,000 mg/L TDS) process water is supplied from the groundwater borefield, thus the tailings by product is salt affected.

2.1.2. Tailing Storage Facility

At the start of production operations an off-path tailing storage facility (TSF) was used for the deposition of mining by-products. The TSF is located to the south-west of the Jacinth pit. The TSF footprint is approximately 100 ha in circumference, and up to 37 m high at the crest.

2.1.3. Process and ancillary mine infrastructure

Processing infrastructure is predominantly located at the process plant and includes the following components:

- Wet concentrator plant (WCP);

- Heavy mineral concentrate stockpile area;
- Process water storage dams;
- Ore and tailing pumping units and pipeline; and
- Water treatment facilities.

The ancillary mine infrastructure includes:

- On-site waste transfer station;
- Power station and solar farm;
- Communications and information technology infrastructure;
- Operational fuel storage areas;
- Contractor's workshop;
- Vehicle and equipment wash down facilities;
- Site access roads;
- Borefield and HMC access roads; and
- Airstrip and Accommodation village.

Additional information on mining activities is provided in the PEPR.

2.2. Existing Environment

2.2.1. Climate

The mine and associated infrastructure are in the Eucla Basin, an arid region experiencing high temperatures and evaporation, and low and irregular rainfall. On average maximum temperatures exceed 30°C from November to March (based on Tarcoola BOM site); the warmer months also experience strong erosive winds which are common from October to January. Rainfall in the region is typical of an arid climate and is typically below 250 mm per year.

2.2.2. Geology

The J-A mineral sands deposit occurs in Tertiary age sediments of the Eucla Basin. The Eucla Basin includes Tertiary sediments deposited in marine and terrestrial settings in the south-western part of South Australia (Benbow et al. 1995) and extends into adjacent parts of Western Australia. North of the deposit, the Eucla Basin is underlain by the older Palaeozoic Officer Basin. Beneath the deposit and to the east, Eucla Basin sediments overlie the Precambrian Gawler Craton.

At least five marine transgression and regression events have occurred in the Eucla Basin, depositing 40 to 50 m of sediments, with the most recent event forming the Nullarbor Limestone found in the borefield and pipeline areas. The sedimentary sequence overlies partially weathered granitic and gneissic rocks of the Gawler Craton. The characteristics of the sediments from the various marine regression and transgression events vary sufficiently to form distinct stratigraphic units. The general properties of the various stratigraphic units observed at the Eucla Basin deposits are illustrated in Figure 4.

2.2.3. Soils

The regolith in the study area is highly heterogeneous, with thickness and physio-chemical characteristics varying significantly spatially, with depth, and between soils. The soil surface is fragile, with the high percentage of fine sand particles in the surface (and some regolith) samples being particularly susceptible to wind erosion. Soil strength measurements indicate that weak soil crusts develop within the topsoil material which offers some protection from wind erosion.

The soil profile above the ore body and barren Ooldea Sands can be broadly sub-divided into soil materials that have been termed brown loam and red loam, occurring beneath topsoil and, in places, dunal sand, termed yellow sand (Soil Water Consultants, 2008). The physicophysio-chemical characteristics of the soil materials can vary significantly (Table 4), especially red loam which represents an amalgam of clay and sand members of the Quaternary Sand Unit. Red loam generally has higher clay content than brown loam and can be dispersive as a result of a higher exchangeable sodium percentage (ESP). Areas of higher pH are generally associated with the presence of calcium carbonate that can manifest as calcrete in the profile, although this is not a continuous layer. Beneath the topsoil, which is non-saline to slightly saline, the soils are classed as slightly to extremely saline. Plant available water capacity (PAWC) is low in topsoil and yellow sand, increasing in the brown loam and red loam layers due to their higher clay content, but PAWC is moderated by the higher salinity of these materials.

Table 4 Summary of key soil properties at J-A

Characteristic	Topsoil/subsoil	Yellow sand	Brown loam	Red loam	Calcrete
Location in profile	Surface to 200 mm	Dunes and creeklines at a variable depth	Generally, underlies subsoil of variable depth	Generally, underlies brown loam at variable depth	Thick (1-2 m) consolidated calcrete or thin (<1 m) layer of calcrete gravels and aggregates. Usually associated with the brown loam profile
Texture	Sand to loamy sand	Sand	Loamy sand to silty loam, clay content increasing with depth	Sandy loam to clay loam, sandy, variable spatially and with depth	-
Salinity (EC1:5, dS/m)	Non to slightly saline 0.01–0.17	Non to slightly saline 0.03–0.06	Slightly to extremely saline 0.2–2.8	Moderately to highly saline 0.7–1.6	-
Salinity (EC 1:5, dS/m)	Non to slightly saline 0.01–0.17	Non to slightly saline 0.03–0.06	Slightly to extremely saline 0.2–2.8	Moderately to highly saline 0.7–1.6	-
PAWC (unit-less)	0.05–0.17	0.06–0.08	0.18–0.28	0.05–0.20	-
Stability (Emerson Class and ESP)	Not dispersive Class 4/6 ESP 1–5%	Not dispersive ESP 10–20%	Generally, not dispersive Class 4/6 ESP 29–30%	Some highly dispersive Class 1 & 2 to 4/6 ESP 36–41%	-

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Figure 3 J-A Mine Site Layout ML 6315

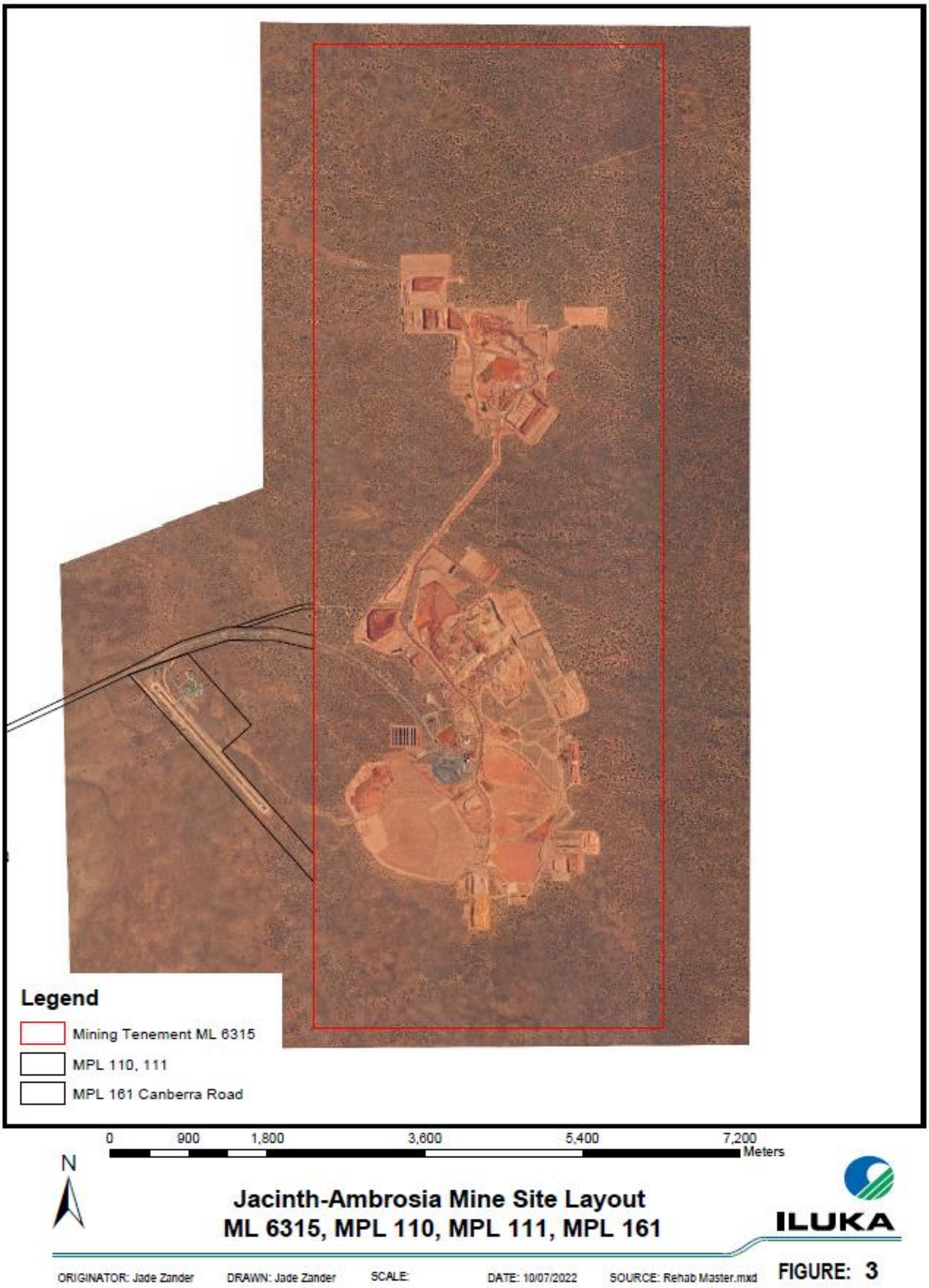
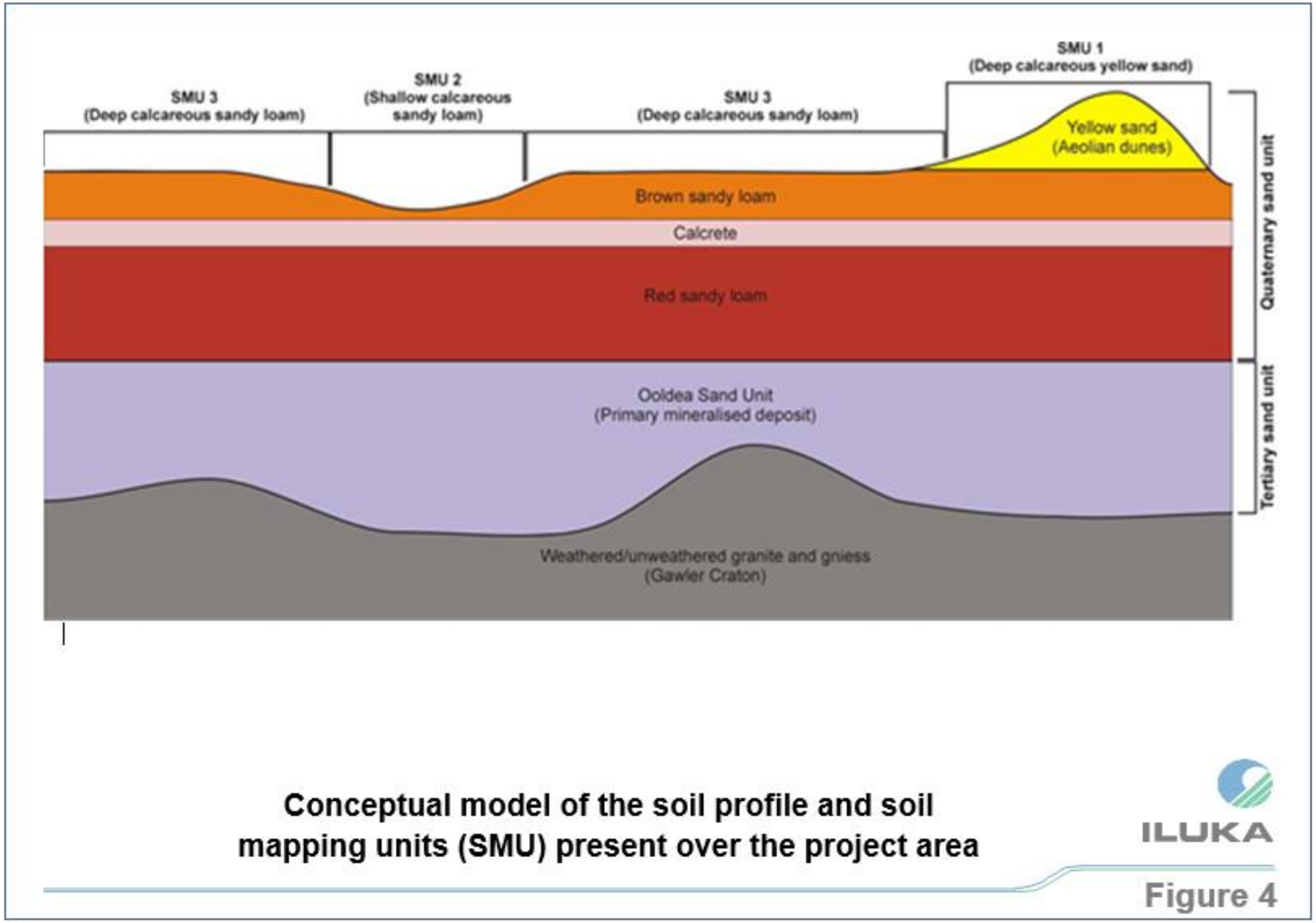


Figure 4 Conceptual model of the soil profile and soil mapping units present at J-A



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2.2.4. Cryptogams

Cryptogamic crusts are widespread over the land surface in the mine area. The distribution of these crusts varied according to soil management unit (SMU) with up to 95% coverage of the soil surface in SMU 2 and 3 whilst <10% coverage in SMU 1 (dunal landform).

The importance of cryptogamic crusts for surface soil stabilisation, runoff processes, vertical infiltration of water, soil nutrition, and overall arid-zone ecosystem functioning are widely acknowledged. Observations from preliminary laboratory work suggest that the cryptogams primarily occur at surface but have been observed up to 0.5 m from surface. (Eldridge and Greene, 1994).

2.2.5. Plant water use

Plant available water capacity in brown loam and red loam is in the ranges from 0.28 and 0.20 (as measured by SRK Consulting, 2011). Brown loam has a higher plant available water capacity than red loam. The rehabilitation profile of 5.5 m thickness of overburden, has a plant available water capacity far in excess of the annual rainfall and enough storage capacity, should it ever be saturated, for many years of plant growth given the conservative water demand of the endemic vegetation. It should be noted however that the soil water characteristic curve allows interpretation of the plant available water due to the soil's matric potential only. The effect of salinity on plant available water (i.e. the osmotic potential component) also needs to be considered.

Brown loam falls into salinity classes 'slightly' to 'extremely' saline, a wider range than red loam which falls in classes 'moderately' to 'highly' saline. Measured values of EC 1:5 (electrical conductivity of a 1:5 soil to water dilution) for brown loam averaged 2.2 dS/m (deciSiemens per metre) with range 0.15 to 4.14 dS/m (site data). Red loam averaged 1.3 dS/m with range 0.8 to 2.0 dS/m (site data). Red loam is sodic, exhibiting a very high exchangeable sodium percentage (Soil Water Consultants, 2008), and prone to dispersion, with some samples in Classes 1 and 2 of the Emerson Aggregate Test (Outback Ecology, 2006).

2.2.6. Surface water

Surface water characteristics of J-A have been studied by SKM (2007) and Alluvium Consulting (2013). J-A is partially located within the Lake Ifould catchment (ca.73,600 ha).

Watercourses exist in a system with an upper catchment functioning as a sediment source zone, a middle catchment functioning as a sediment transport zone and a lower catchment where sediment is deposited. Over the long-term, watercourses adjust their form to achieve a state of equilibrium where rates of erosion are similar to rates of deposition. An abrupt change in a system variable can disturb this balance by initiating a period of excess stream erosion or deposition. This can have significant implications for the ecological, and amenity values of the watercourse.

The J-A watercourses are ephemeral and are shaped by rainfall and flow events that are highly variable both spatially and temporally. When the watercourses do flow, they experience significant transmission losses for smaller and medium-sized flows. These significant transmission losses can result in ongoing cycles of incision and deposition along the watercourse. Vegetation and biological soil crust (BSC) play a crucial role in slope and watercourse bed and bank stability in the J-A catchment.

A geomorphic classification of watercourses in the J-A catchment has been undertaken using the River Styles® framework (Alluvium, 2013), with six River Styles® identified within the J-A catchment (Figure **5**). This approach enables consistent characterisation of watercourses in the region based on common geomorphic forms and processes allowing the identification of common parameters that can be used as the basis for the rehabilitation design of watercourses. The defining attributes and parameters of each River Styles® are explained in detail in the Alluvium Report (2013).

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2.2.7. Vegetation

The vegetation of J-A was surveyed by Badman (2006, 2007) and EBS (2008). More recently, vegetation studies were conducted for exploration or miscellaneous purposes lease applications for the Atacama Access Track (between J-A Mine and Atacama) and the Canberra Road MPL Application (BlackOak Environmental 2019a and 2019b).

Four different vegetation associations were initially identified by Badman (2006a, 2006b); however, only three of the associations occur within the project footprint. The three associations were mapped by EBS during March 2008 (Figure **6**). An outline of these associations is provided in Table 5 with further details provided in the PEPR.

Table 5 Summary of J-A vegetation associations

Vegetation association	Description	Dominant Species	Average tree canopy	Mean species richness
Acacia papyrocarpa low open woodland (myall woodland)	Emergent or very open *Acacia papyrocarpa* (western myall) and chenopod low shrubland understorey	*Maireana sedifolia* (bluebush) *Atriplex vesicaria* (bladder saltbush) *Rhagodia spinescens* (spiny saltbush) western myall *Austrostipa nitida* (balcarra spear-grass) *Eriochiton sclerolaenoides* (woolly-fruit bluebush)	5%	19.5
Nullarbor low shrubland (chenopod shrubland)	Chenopod low shrubland	bluebush bladder saltbush balcarra spear-grass woolly-fruit bluebush *Sclerolaena obliquicuspis* (oblique-spined bindyi)	0	12
Mallee woodlands of Yellabinna dunefield (myall mallee woodland)	Open *Eucalyptus* (mallee) or *Acacia papyrocarpa* (western myall) low woodland. Feature as dune patches within a myall matrix	*Acacia papyrocarpa* (western myall) *Eucalyptus oleosa ssp. ampliata* (red mallee) bladder saltbush bluebush *Maireana trichoptera* (hairy-fruit bluebush) spiny saltbush *Zygophyllum aurantiacum* (shrubby twinleaf) *Triodia scariosa* (spinifex) *Eremophila scoparia* (broom emubush) *Santalum acuminatum* (quandong) *Alectryon oleifolius* (bullock bush)	16%	28

Figure 5 Water course characterisation at J-A

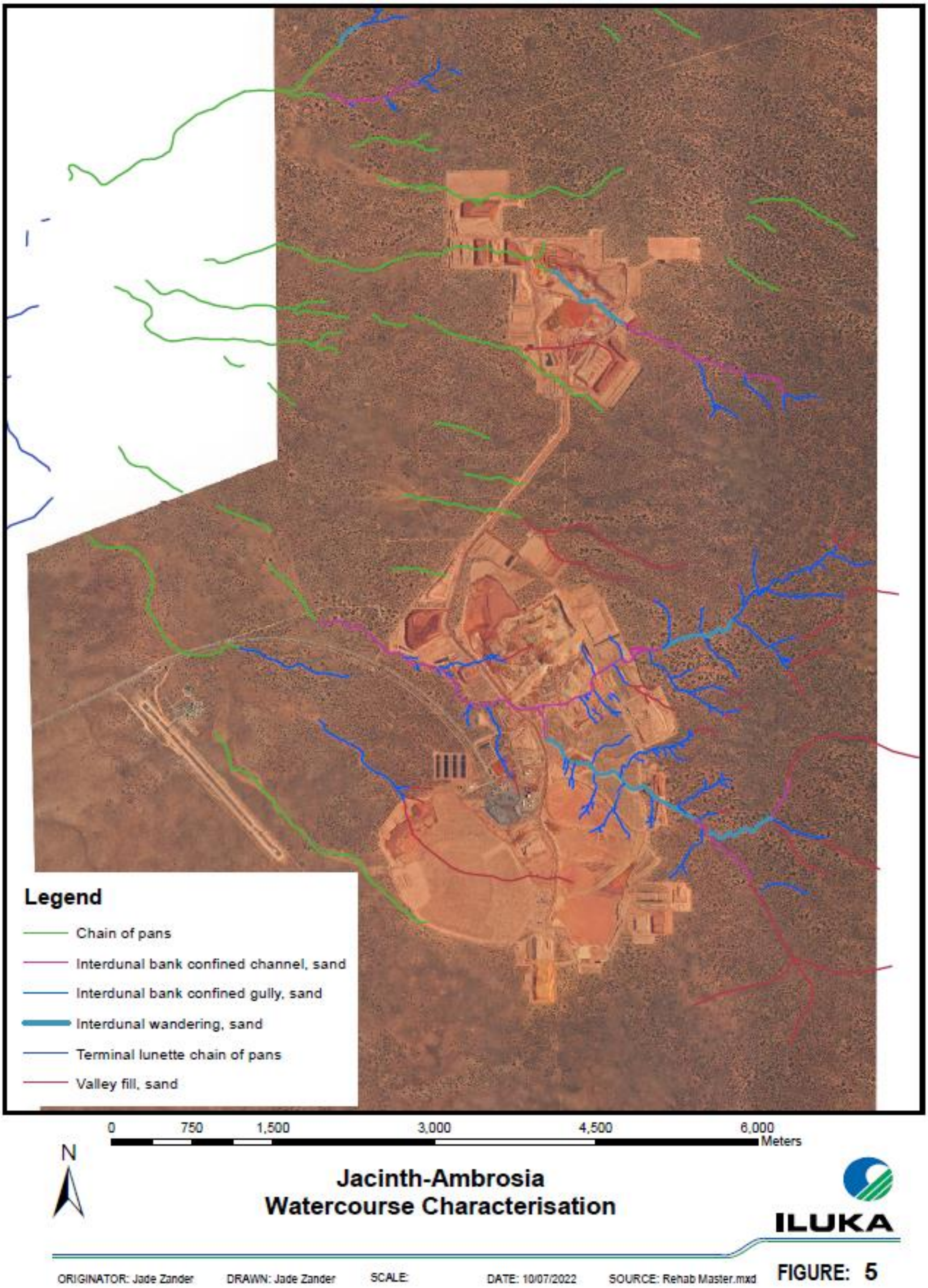

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Figure 6 Vegetation associations present within the Jacinth Ambrosia area

2.2.8. Vegetation disturbance

Disturbance within the Yellabinna and Nullarbor Regional Reserves has been historically limited to introduced fauna (European rabbit and one-humped dromedary camel), Aboriginal use, passive tourism and mineral exploration and as such, the region has retained much of its biological integrity.

2.2.9. Significant flora

Santalum spicatum (sandalwood) is listed as Vulnerable under the *National Parks and Wildlife Act 1972* (SA). Scattered trees are found throughout the project area, across both the Ambrosia and Jacinth deposits and within the vicinity of the southern part of the borefield pipeline corridor. The known locations of sandalwood trees are recorded on an ArcMap database.

2.2.10. Weed species

During the baseline surveys of the project area conducted by Badman (2006a, 2006b, 2007) seven weed species were recorded, subsequent to this a total of 35 weed species have been detected at J-A or the immediate surrounding region. A complete list of weed species recorded within the Yellabinna Regional Reserve and within the project area is provided in the J-A Pest Species Management Plan.

2.2.11. Cultural heritage

Cultural heritage surveys were undertaken for the entire project area (including the ML and associated MPL areas) prior to commencement of operations. The reports associated with these investigations have not been reproduced in PEPR for confidentiality and cultural sensitivity reasons. However, Iluka maintains a database detailing the cultural heritage sites across the mine and surrounding region.

All cultural heritage surveys undertaken as part of the project have involved representatives from FWCAC, Iluka and ACHM or Culture and Heritage. The surveys associated with the ML6315, EML6316, MPL110 and MPL111 revealed a number of cultural heritage sites in which small items (e.g. stone fragments) were identified. An agreement is currently in place with the FWCAC with regard to management and restoration of cultural heritage sites.

3. VEGETATION DSTURBANCE

3.1. Vegetation Clearance

The location and layout of mine infrastructure has been planned to minimise disturbance of native vegetation wherever possible. To further minimise vegetation clearance and associated impacts, vegetation will be cleared as the source areas are required for operations and in accordance with site procedures.
All vegetation clearance will be carried out in accordance with the J-A Native Vegetation Management Plan and J-A Vegetation Clearance Procedure. The plan and procedure consider:

- Permitting system for vegetation clearance;
- Data capture of vegetation clearance areas;
- Seed and vegetative material collection;
- Disturbance minimisation; and
- Stockpiling of vegetation for rehabilitation purposes.

3.2. Excavation and Storage Materials

Direct return of overburden material, red loam, brown loam, subsoil, topsoil and in some instances sand and calcrete is to be carried out where possible. However, if direct return of materials is not possible, then each unit is to be collected, segregated and stored for rehabilitation purposes.

All excavation and storage of overburden materials is to be carried out in accordance with the Soil Stockpile Management Plan and procedure. The procedure considers:

- Permitting and approval;
- Stripping and excavation practices;
- Stockpile location and height;
- Weather considerations;
- Erosion management; and
- The use of stabilisation additives.

4. REHABILITATION EARTHWORKS

Rehabilitation practices are expected to evolve over the life of the project, as part of the process of continual improvement. This Section describes the current expectation for implementation of key rehabilitation practices.

4.1. Rehabilitation Factors

The following factors are critical considerations to the successful rehabilitation of the J-A mine:

- Climate - High temperatures, high evaporation rates and low effective rainfall may limit the period for establishing plants.
- Erosion - Soils are prone to wind erosion, particularly during extreme winds, increasing the risk of erosion of stockpiles and disturbed surfaces. Stockpiles and batters may also be subject to water erosion, depending on rainfall.
- Salinity - Hyper saline process water is utilised for dust suppression as part of operational activities. Its use is restricted to haul roads surrounding the pit boundary and any material that has or will come into contact with processing i.e. ore and tails.
- Sodicity - Some sodic soils are present as red loam. They tend to be highly dispersive and erodible when wet and have properties that inhibit plant growth.
- Compaction - Mine activities may compact soils and cause loss of soil structure, making it difficult for water and plant roots to penetrate.
- Hydraulic conductivity and permeability - Available moisture in the soil varies across the mine area according to soil type. The ability of a soil to contain moisture is related to the available pore space for water and the size and interconnectivity of pores.
  - Sandy soils have high moisture conductivity.
  - Loam and swale materials have higher fines content and lower permeability and thus may contain moisture. This moisture may not be readily accessible to vegetation.
  - While sandy soils tend to have a high proportion of pore space, the ability to hold the water in the profile is limited by the small capillary (surface tension) forces. However, most water retained in a sandy soil profile is available for plant use. Clayey soils may have a high proportion of pore space and higher capillary forces to retain water, but the same high capillary action may limit what is available to plants.
- Organic matter - Soils of the area often contain low levels of organic matter, limiting soil stability and nutrient content.
- Pest plants - Are present in the region and could be further spread by mine activities, adversely affecting native vegetation through resource competition.
- Pest animals - Could reduce the effectiveness of site rehabilitation by feeding on vegetation and disturbing soils.

4.2. Landform Design and Construction

The final landform has been designed to ensure that the final topography integrates with the surrounding undisturbed topography as much as practical (Figure **7**). The design considers the availability of overburden materials, the location of surface water systems and erosion potential of the final surface. The final landform surfaces have been modeled for stability (Alluvium, 2015; Landloch, 2015 and Landloch 2019). Any changes to the landform design must be via the Iluka Change Management Procedure and will require additional risk assessment and/or modelling.

Final rehabilitation vegetation will comprise the three vegetation types identified in the local area (Figure 8):

- Open chenopod shrubland*;*
- Myall open woodland over chenopod shrubland and*;*
- Myall +/- mallee open woodland over chenopod shrubland.

The location and layout of the vegetation types within the rehabilitated matrix considers:

- Preference for direct return of soils in keeping with best practice rehabilitation principles;
- Location of surface water systems to minimise erosion potential;
- Location of threatened vegetation;
- Location of cultural heritage sites;
- Alignment with the Yellabinna Regional Reserve Management Plan and;
- Minimisation of habitat fragmentation.

The soil profile that is reinstated will vary dependent on the vegetation association that is being rehabilitated. Table 6 details the relevant profile thickness according to vegetation association.

Table 6 Soil profile descriptions for vegetation associations

Soil Materials	Thickness of profile (m)		
	Myall/Mallee Woodland	**Myall Woodland**	**Chenopod Shrubland**
Topsoil	0.05	0.05	0.05
Subsoil	0.15	0.15	0.15
Sand[1]	Various	Various	n/a
Calcrete Layer[2]	Various	Various	n/a
Brown loam	Minimum of 2.30 - 5.50[3]	Minimum of 2.30 - 5.50[3]	Minimum of 0.30 1.30[4]
Red loam	0.00 – 3.20[3]	0.00 – 3.20[3]	0.00 – 1.00[4]
Tailings	variable	variable	variable

[1] Yellow sand associated with dune and creek features
[2] Calcrete layer associate with creek features only
[3] Brown and red loam layers together to sum to 5.50 m thickness, but the thickness for each layer individually can vary as indicated. Red loam may be excluded from the rehabilitation profile
[4] Brown and red loam layers together to sum to 1.30 m thickness, but the thickness for each layer individually can vary as indicated. Red loam may be excluded from the rehabilitation profile

Figure 7 Proposed post disturbance contours

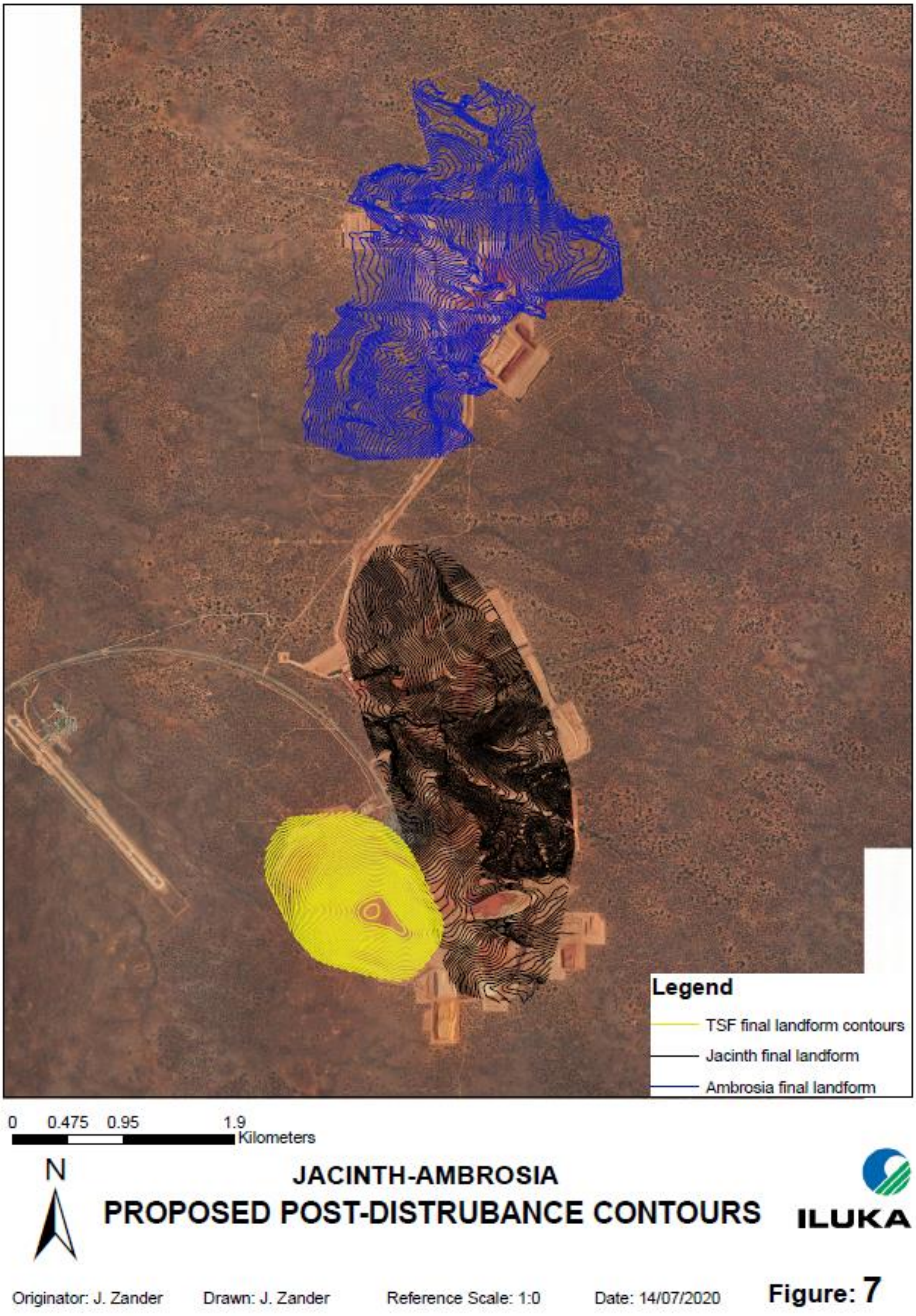

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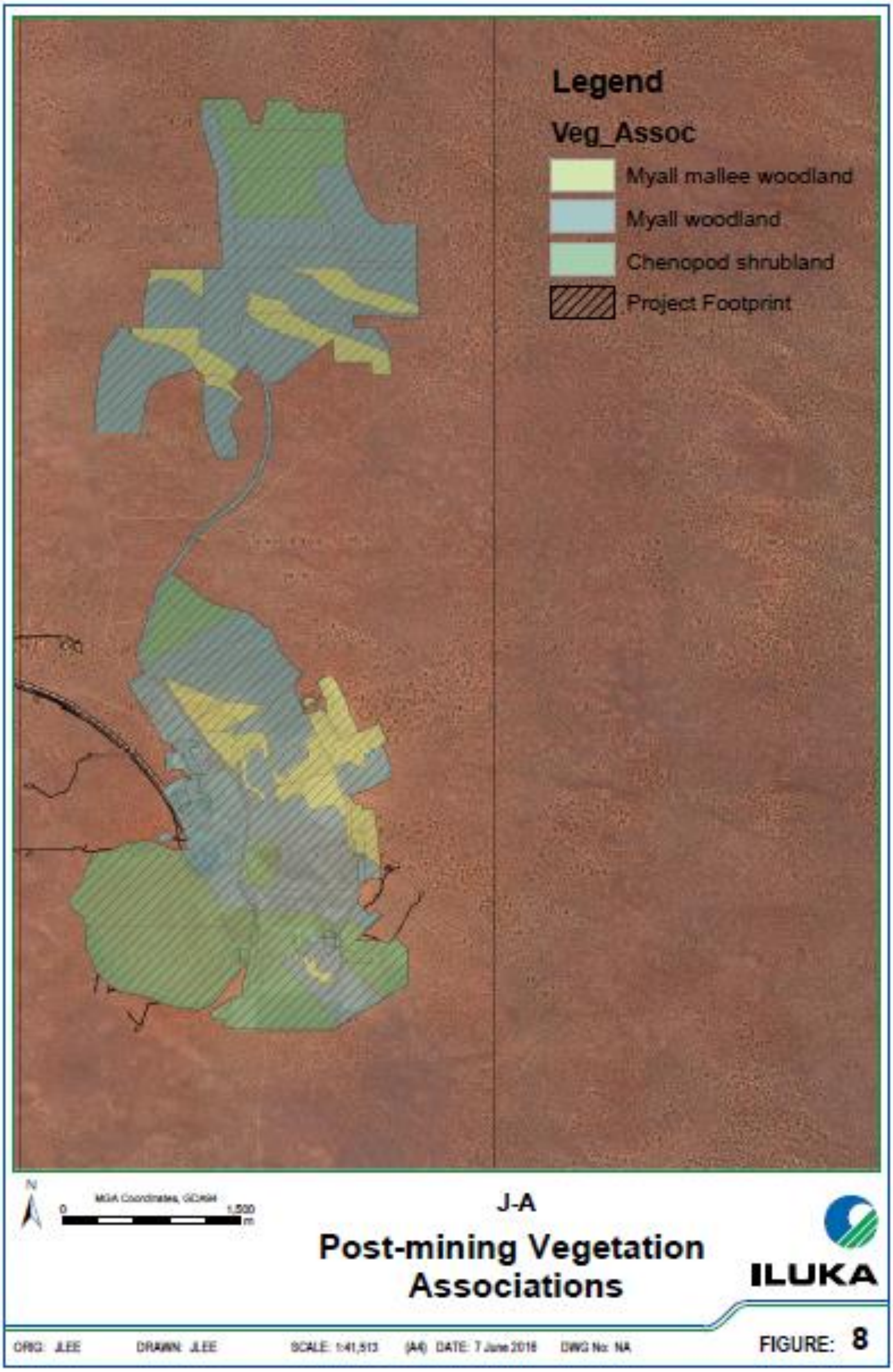
Figure 8 Post-mining landscape vegetation units



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4.3. Planning

Prior to commencing the rehabilitation of each discrete area, a Landform Restoration Implementation Plan (LRIP) is prepared and peer reviewed. As required, surface water management and/or erosion modelling may be outsourced. The LRIP includes information on:

- Key personnel;
- Earthworks schedule;
- Safety requirements;
- Volumes and stockpile sources;
- Formation of dune/creek features;
- Access tracks/signage; and
- drainage and erosion control.

During landform restoration, work will be routinely inspected to ensure that work is being carried out in line with the LRIP.

4.4. Tails Backfill

The mining void is backfilled with a tailings slurry either by ModCod or sand stacking. The tailings is filled to a level that ensures the final design surface can be achieved. After the tails have drained sufficiently it is shaped into the final profile. Drainage of saline process water from the slurry creates a phreatic surface within the tails that requires management.

To prevent the potential salinisation of backfilled soils from tails fill, it is essential to ensure that there is no hydraulic connection between a saline water table and the soil surface. This can be achieved in two ways; a capillary break can be included in the soil profile to create a barrier between the two surfaces, or adequate distance of phreatic surface from the rehabilitated surface. If capillary break is not included in the soil profile then:

- In-pit tailings should be drained to residual water content (3% gravimetric water content), at least at its surface;
- Phreatic surface within the tailings should be deeper than 2.1 m (or 4.5 m for chenopod) from the uncovered tailings surface and be maintained below that level; and
- Final soil surface shall be greater than 6 m above any phreatic surface.

The phreatic surface test pits are excavated once final top of tails surface has been achieved. The test pits are to be uniformly located across the cell surface at a rate of 1 test pit per 2 ha, however additional pits may be included in lower mRL areas. The test pits are to be excavated to a depth of a minimum 2.1 m for myall and mallee vegetation associations and 4.5 m for chenopod vegetation associations. A visual inspection is to be carried out to confirm the phreatic surface level is greater than 2.1 m or 4.1 m (for chenopod vegetation associations) from surface and a photograph of each pit is taken.

Residual moisture content is also determined. Samples are collected at phreatic test pit locations to determine the residual water content has reached 3% gravimetric water content (expressed on a dry weight basis) before application of overburden. The samples are collected at surface prior to excavating the phreatic surface test pit.

Should the gravimetric water content of the tailings surface be greater than 3% than a capillary break is to be installed prior to application of overburden. The capillary break will consist of dry secondary oversize material (secondaries) or dry sand tailings as these materials prevent capillary rise and movement of salt into the overburden profile. The capillary break shall be applied in a layer of 0.35-0.50 m thickness.

Ongoing phreatic surface depth is to be monitored with vibrating wire piezometers (VWP) and monitoring wells where geographically applicable.

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At times it may be necessary to dispose of secondaries from the plant into the tails layer of the cell.

4.5. Overburden

Red loam and brown loam are preferentially sourced direct return from the mining areas, or sourced from stockpiles. Red loam and brown loam are carted to the rehabilitation area using conventional dry mining techniques. When red loam is available, it is applied with a tolerance of ±0.3 m. The final surface of brown loam is trimmed with GPS fitted tractor scoops to a tolerance of ±0.1 m.
Upon completion of dumping and spreading the overburden, each soil profile is surveyed and compared to the approved design to ensure tolerances are achieved.

All red loam and brown loam lifts are ripped to a depth of 1 m using triple straight tynes prior to the placement of the next lift to prevent compaction of the soils. The final top of brown loam surface is not ripped if done in lifts and ripped between lifts; however, for chenopod shrubland rehabilitation areas, brown loam is ripped at the top of brown loam surface as the overburden profile is only 1.3 m total thickness. It is ripped to a depth of 1 m using triple straight tynes prior to the placement of subsoil and topsoil.

4.6. Topsoil and Subsoil

Where consistent with the mining schedule, excavated topsoil and subsoil is directly returned to areas currently being rehabilitated. Where practicable, these soils are replaced to the corresponding post-disturbance vegetation unit. However due to the increase in the final proportion of chenopod shrubland, this vegetation unit will need to utilise topsoil and subsoil from the myall woodland landscape vegetation unit. The topsoil and subsoil balances are reviewed annually to ensure appropriate final topsoil and subsoil replacement depths.

The subsoil and topsoil profiles are trimmed to design and surveyed to confirm that final surface has been achieved. The final profile is ripped to a depth of 0.4 m on the contour to discourage down slope erosion, followed by application of a potable water. This allows the topsoil and subsoil to form a physical crust that stabilises against wind erosion.

Where practicable, topsoil and subsoil are not moved during the months of October to January because of the likelihood of strong winds and wind erosion of topsoil and/or subsoil. Topsoil and subsoil are not to be moved when wind speeds are in excess of 20 km/h.

To prevent compaction and anaerobic conditions, which are likely to impact on soil microbes and cryptogams, topsoil and subsoil are not to be returned to rehabilitation areas, ripped or stripped/stockpiled when the soils are waterlogged post rainfall events. The Rehabilitation Specialist is to be consulted prior to movement of any soil post rainfall events.

4.7. Tree Trash

Vegetation stockpiled from clearance activities is referred to as ‘tree trash’ and is applied to the topsoil upon reinstatement of the soil profile. This material is beneficial in reducing wind and water erosion and it provides micro-habitats for small fauna and invertebrates. Tree trash also acts as a nursery for seeds to germinate.

The method of application is the use of an excavator and tree grab attachment to slew tree trash from dump trucks or paddocked dumped piles onto the ripped final surface. Specific instructions are provided in the Revegetation Implementation Plan (RIP) for each rehabilitation area and in the detailed Site Instruction issued to the Earthmoving Contractor.

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5. REHABILITATION REVEGETATION

5.1. Planning

Prior to commencing the revegetation of each discrete area a RIP is prepared and peer reviewed. The RIP includes information on:

- Safety;
- Key personnel;
- Earthworks schedules;
- Species selection;
- Seed and seedling requirements;
- Pest management; and
- Monitoring requirements.

5.2. Seeding and Planting

Disturbed areas will be revegetated predominantly from the seed bank within the topsoil and supplemented with local provenance native seed. If alternative methods need to be applied e.g. direct seeding, planted seedlings and transplanting of seedlings the decision to collect seed or grow seedlings for rehabilitation will be in accordance with the recalcitrant species flow chart.

The collection and management of seed for revegetation purposes is managed in accordance with the Seed Management Procedure. The procedure includes:

- List of appropriate plant species;
- Management and monitoring of the seed store;
- Management and monitoring of seed collecting and cleaning;
- Species and seed pre-treatment information; and
- Seed quantity calculator.

Some species may be required to be planted as seedlings; dependent on the numbers of individuals required the seedlings can be grown on site or may be outsourced to a member of the Nursery Industry Accreditation Scheme Australia.

6. MANAGEMENT

Iluka will retain responsibility for the management of rehabilitated areas until the mining tenements are relinquished. Rehabilitated areas are routinely monitored by rehabilitation staff to determine the success of rehabilitation techniques and to initiate maintenance activities as discussed in the following sections.

6.1. Erosion Control

All rehabilitation areas require stabilisation to protect against the risk of erosion from wind or water. Management measures will include (but are not limited to):

- Ripping to increase surface roughness and slow wind speed at ground level;
- Spreading of timber and shrub debris harvested during clearing;
- Spraying topsoil/subsoil profiles with potable water during the ripping process (and soil stabilisers where required) to encourage crust establishment; and
- Preventing access to topsoil and subsoil areas once stabilised.

Due to the infrequency of rainfall and subsequent flow events, drainage zones are managed on an as needs basis. Sediment movement associated with stream flow is a natural phenomenon in arid zones, however if excessive sediment movement occurs then supplementary earthworks are undertaken to return the drainage channels to design levels.

6.2. Access

Access tracks are required to facilitate the ongoing maintenance of the rehabilitated areas. These tracks will be kept to a practical minimum and will be designated prior to closure in consultation with DEM and DEW.

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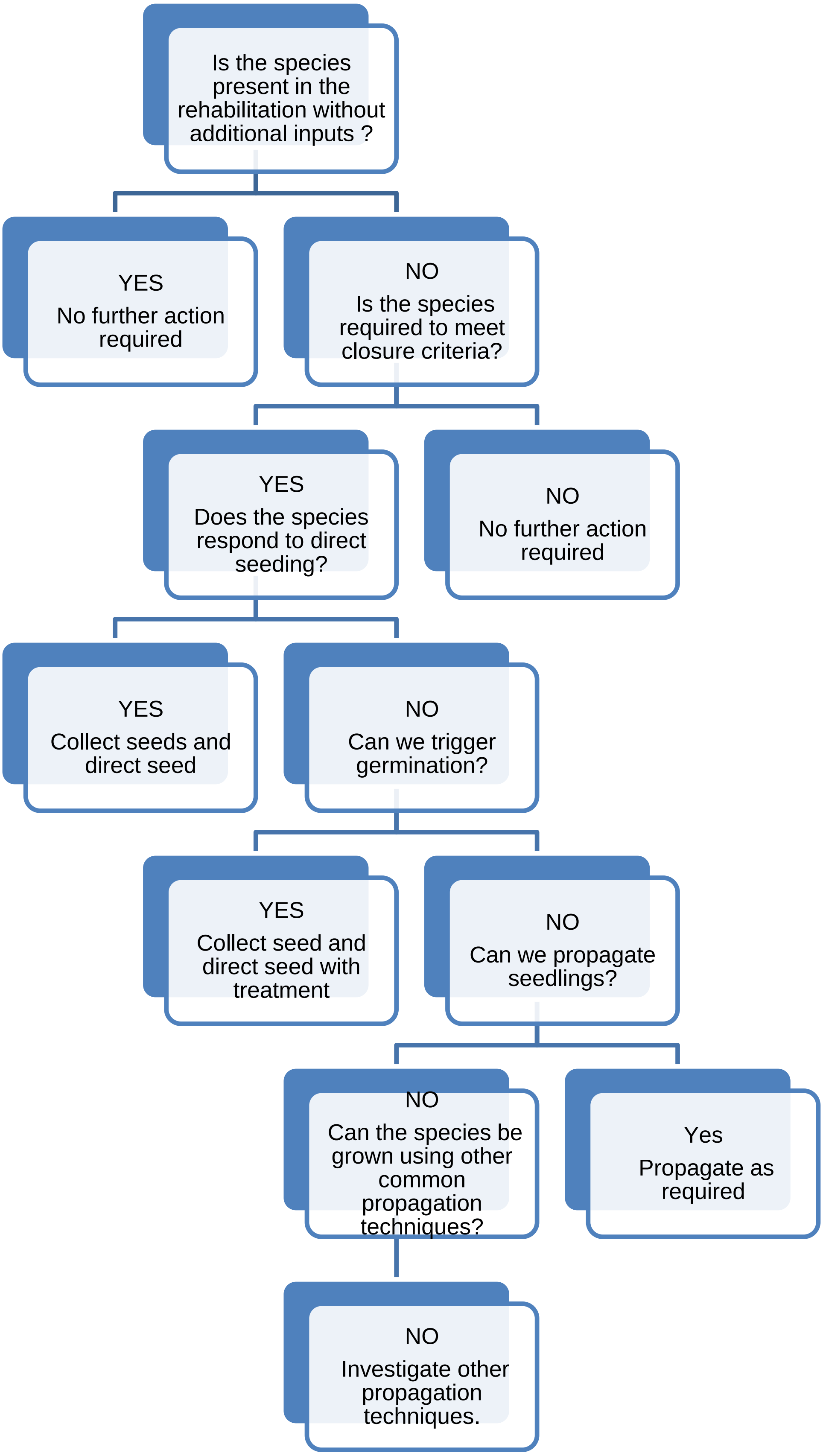
Figure 9 Recalcitrant species flow chart



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6.3. Pest Species

Risk related to pest species is management through the J-A Pest Species Management Plan.

6.3.1. Weeds

Routine inspections and specific vegetation monitoring identify if any weed populations have established within the rehabilitation area. Areas with small numbers of weeds are managed by physical (by hand) removal, with larger populations of weeds spot sprayed with a suitable herbicide.

6.3.2. Pest fauna

Routine inspections and regular monitoring identify if feral animals are present within rehabilitated areas. A management program which incorporates baiting and culling (in collaboration with DEW) is implemented when populations indicate a threat to rehabilitation works.

6.4. Fire

Risk related to fire is managed through the EB Fire Risk Management Plan.

7. PERFORMANCE INDICATORS AND COMPLETION CRITERIA

Closure measurement criteria will be used as the basis for assessment by the regulators when rehabilitation of the project is complete. Iluka will be required to comply with these criteria before bonds and mining tenements can be relinquished by the State for ML6315, EML6316, MPL 110, MPL111 and MPL 161. These criteria are recorded in the PEPR.

7.1. Monitoring

7.1.1. Landform survey

After restoration of the landform, the area is surveyed to determine post-mining topography. Monitoring points are also established to enable long-term assessment of land stability or settling. Tolerance for final reduced level (RL) to be achieved for each of the rehabilitated TSF is as follows:

Jacinth Pit;

- No point in the rehabilitated landscape greater than 178 mAHD (+1 m of the highest designed mAHD for Domain 4A); and
- No point in the rehabilitated landscape less than 124 mAHD (the lowest designed mAHD for Domain 4A).

Off-path TSF:

- No point in the rehabilitated landscape greater than 178 mAHD (+1 m of the highest designed mAHD for Domain 4C).

Ambrosia Pit;

- No point in the rehabilitated landscape greater than 160 mAHD (+1 m of the highest designed mAHD); and
- No point in the rehabilitated landscape less than 118 mAHD (the lowest designed mAHD).

Design conformance records are held by site Mine Surveyor and Rehabilitation Specialist.

7.1.2. Landscape Function Analysis

Landscape Function Analysis (LFA) is a proven technique is used in the semi-arid rangelands for monitoring landscape damage and recovery (Ludwig et al. 1997). Iluka uses LFA, amongst other methods, to monitor rehabilitation success at J-A.

LFA is used as a tool to assess the long-term sustainability of the rehabilitated landforms. The assessment consists of three steps:

- Landscape stratification – a continuous data set is collected along transects oriented down the slope (the dominant direction of resource mobility), with identification and measurement of zones where landscape resources are either shedding (source) or accumulating (sink).
- Soil surface condition classification – landscape zones are assessed by ten soil surface features as per criteria outlined in Tongway and Hindley (1995).
- Vegetation diversity and abundance – quadrats assessed for presence of plant species by point quarter method.

Two LFA monitoring locations are to be established in each of the rehabilitation areas and monitored for the first 5 years of rehabilitation. The final LFA regime will be determined based upon previous monitoring results. LFA monitoring is to be conducted at 1, 2, 5 and 10 years post rehabilitation during operations and 1, 2 and 5 years post rehabilitation at closure.

7.1.3. Photo point monitoring

Photo point monitoring points are established prior to ground disturbance and monitored on annual basis after rehabilitation for visual comparison of pre-mining landscape and post-mining landscape and to visually monitor rehabilitation progress over time. A single photo point monitoring location will be established annually prior to planned clearance activities. Photo monitoring procedures are provided in REH_018_PR_Photo Point.

7.1.4. Soil profile assessment

The top of each final soil profile is surveyed during the rehabilitation process to ensure the soil profile is restored in accordance with the soil profile outlined in the PEPR. All survey records are to be maintained. A final soil profile assessment will be carried out a minimum of 3 years after rehabilitation has completed in each pit (Jacinth, Ambrosia and Off-Path TSF). Assessment of the post-mining soil profile will utilise similar methods to the pre-mining soil survey. Pits or auger holes will be excavated until the co-disposed sandy and clayey tailings, or natural ground, is encountered. The soil profile will be recorded, with all soil horizons described and their location within the profile measured. Physical and chemical parameters (including electrical conductivity) will also be recorded.

The final post-mining assessment of the rehabilitated soil profile will be performed by a suitably experienced specialist. This assessment will not be performed until several years after establishment of the native vegetation. This timing is so that plant root distribution through the profile may be assessed.
Preliminary soil pits or drill holes may be used to allow early confirmation of the soil profile and identification of any limiting factors such as compaction or salt migration from tailings. Early identification of such factors will allow remedial activities to be performed in a timely manner.

7.1.5. Groundwater

Groundwater levels are recorded within the rehabilitated areas by means of monitoring wells and VWPs. The monitoring enables early detection of any changes to groundwater levels as a result of operational activities. This information can then be correlated with any changes in vegetation health.

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Groundwater monitoring related to rehabilitation outcomes comprise:

- Phreatic surface – once off visual assessment/photograph of test pits to confirm that phreatic surface is greater than 2.1 m (mallee and myall vegetation associations) or 4.5 m (chenopod vegetation association) from top of final tails surface before application of overburden. If a phreatic surface is encountered, a capillary break of 0.35-0.50 m dried Secondaries Oversize material will be installed prior to application of overburden.
- Residual moisture content – surface samples collected at phreatic test pit locations to determine residual water content has reached 3% gravimetric water content (expressed on a dry weight basis) before application of overburden.
- Long-term phreatic surface monitoring – VWP and monitoring wells to be installed (on a cell by cell basis) and phreatic surface depth measured on a monthly basis during operations and for a minimum of 3 years once tailing in the pit has ceased.

For further information on groundwater management refer to the J-A Groundwater Management Plan.

8. DOCUMENT REVISION AND CONTROL

All ERCR documents are reviewed every two years at a minimum or in the event of significant change to operations or process and through this process.

Revision	Date Issued	Reviewer	Approver	Changes Made
13.0	10/07/2022	J. Zander Rehabilitation Specialist	J. Lee ERCR Manager	Biennial review of the document. Updated figures throughout.
12.0	09/07/2020	J. Zander Rehabilitation Specialist	J. Lee ERCR Manager	Major PEPR review incorporating soil profile and landform design changes. Updated to new template. Updated figures throughout.
11.0	02/02/2017	T. Law Rehabilitation Specialist	J. Lee ERCR Superintendent	Annual review: updated related docs and procedures, amended figures, removed reference to tables and figures that have been removed in previous version.
10.0	04/08/2016	J. Lee Rehabilitation Specialist	N. Travers ERCR Superintendent	Annual review: removal of duplicated information, identification of new procedures, inclusion of related documents, removed reference to construction of soil stockpiles.
9.0	01/03/2015	T. Law Rehabilitation Specialist	N. Travers ERCR Superintendent	Revised document from from MARP to PEPR.

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