Atacama Mineral Sands Project

Mining Lease Proposal
February 2023

Iluka (Eulca Basin) Pty Ltd.

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ILUKA

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CONTRIBUTORS

Iluka would like to acknowledge and thank the following companies and teams who have assisted in the development of the Atacama Mining Lease Proposal and associated studies:

- Eco Logical Australia (ELA)
- Tetra Tech Coffey (Coffey)
- CDM Smith (CDM)
- ATC Williams
- Independent Heritage Consultants (IHC)
- Radiation Consulting Australia (RCA)
- Jacobs
- EMM Consulting (EMM)
- Greenbase
- Alluvium
- WSP
- Hatch
- SA Radiation
- EBS Ecology.

DISCLAIMER

This Mining Lease Proposal has been prepared for submission to the South Australian Minister for Energy and Mining (Anastasios (Tom) Koutsantonis) and the Minister for Climate, Environment and Water (Dr Susan Close) under the *Mining Act 1971* (SA) as well as the Federal Minister for the Environment and Water (Tanya Plibersek) under the *Environment Protection and Biodiversity Conservation Act 1999* (Cth). No one other than these South Australian and Federal Minister(s) should rely on the information contained within this Mining Lease Proposal to make, or refrain from making, any decision.

In preparing the Mining Lease Proposal, Iluka (Eucla Basin) Pty Ltd has relied on information provided by specialist consultants, government agencies and other third parties. Iluka (Eucla Basin) Pty Ltd has not fully verified the accuracy or completeness of that information, except where expressly acknowledged in the Mining Lease Proposal.

The Mining Lease Proposal has been prepared for information purposes only and, to the full extent permitted by law, Iluka (Eucla Basin) Pty Ltd, in respect of all persons other than the South Australian Minister for Energy and Mining and the Minister for Climate, Environment and Water and the Federal Minister for the Environment and Water:

- makes no representation and gives no warranty or undertaking, express or implied, with respect to the information contained in the Mining Lease Proposal
- does not accept responsibility and is not liable for any loss or liability whatsoever arising as a result of any person acting, or refraining from acting, on any information contained in the Mining Lease Proposal

DOCUMENT CONTROL

Version	Description	Prepared by	Reviewed by	Date created
1.0	Atacama Mining Lease Proposal (Final)	Eco Logical Australia & Tetra Tech Coffey	Iluka	23 February 2023

DISTRIBUTION

Version	Issued to	Format	Number of copies	Date
1.0	Iluka, DEM	PDF	1	23 February 2023

DECLARATION OF ACCURACY

The following declaration of accuracy is made in accordance with Regulation 65(8) under the *Mining Act 1971*.

I, Philip Lazzari holding the position of Lead Study Manager – Resource Development for the tenement holder Iluka (Eucla Basin) Pty Ltd, have taken the following steps to review the information in this Mining Lease Proposal Application to ensure its accuracy:

- implemented an audit process against the Atacama Project Mining Lease Application Terms of Reference to ensure the minimum requirements have been addressed
- undertaken an internal process for review, endorsement or sign off by senior management of Iluka (Eucla Basin) Pty Ltd and
- internal peer review by a suitably qualified and experienced company employee.

Name	Position	Signature	Date
Philip Lazzari	Lead Study Manager – Resource Development		23 February 2023

EXECUTIVE SUMMARY

Background

Iluka (Eucla Basin) Pty Ltd (Iluka), a wholly owned subsidiary of Iluka Resources Limited, is the proponent who is submitting this Mining Lease (ML) Application and accompanying ML Proposal (MLP), in respect to the Atacama Mineral Sands Project (the Project).

Iluka Resources is an Australian Stock Exchange (ASX) listed global critical minerals company. Iluka has critical minerals operations in Western Australia (Cataby) and South Australia (Jacinth-Ambrosia (J-A)), as well as mineral processing separation plants in Western Australia (Narngulu and Capel).

The Project is located approximately 290 km north-west of Ceduna on the far west coast of South Australia and 5 km north-east of the existing Jacinth-Ambrosia (J-A) mine site, operating on ML 6315 approved by the Department of Primary Industries and Regions South Australia (PIRSA) (now Department for Energy and Mining (DEM)) on the 4 July 2007.

The Project is situated entirely on state owned Crown Land within the Yellabinna Regional Reserve. As proclaimed under South Australian legislation, the delegated title owner is the South Australian Minister for Environment and Water. The Yellabinna Regional Reserve is managed by the Yumbarra Co-management Board - a partnership between the Far West Coast Aboriginal Corporation (FWCAC) and the Department for Environment and Water (DEW).

For more information on the Project location please refer to **Section 1.**

Regulatory framework

EPBC Act

The *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) is the Australian Government's principal environmental legislation in place for the protection and management of Matters of National and Environmental Significance (MNES). The EPBC Act is administered by the Department of Climate Change, Energy, the Environment and Water (DCCEEW).

The Project was referred to DCCEEW in June 2022 [ref EPBC 2022/09289] and in November 2022 was determined to be a Controlled Action under Section 75 of the EBPC Act. The relevant Matter (the controlling provision) is threatened species and communities (Section 18 and 18A of the EPBC Act). In particular, the following MNES species:

- *Leipoa acellata* (Malleefowl) (Vulnerable EPBC Act and Vulnerable *National Parks and Wildlife Act 1972* (NPW Act))
- *Sminthopsis psammophila* (Sandhill Dunnart) (Endangered EPBC Act and Vulnerable NPW Act)
- *Hibbertia crispula* (Ooldea Guinea-flower) (Vulnerable EPBC Act and Vulnerable NPW Act).

DEM is assessing this MLP as an accredited assessment on behalf of the Commonwealth under Section 87 of the EPBC Act. This assessment provides for a single environmental assessment process conducted by the

State, with DCCEEW providing comment on the MLP during the public commentary period and reviewing the Response to Submissions. At the completion of the assessment, DEM's Assessment Report will be provided to DCCEEW, assessing the likely impacts of the Project on MNES.

The Commonwealth Minister for the Environment and Water will then make an approval decision. On approval, a Decision Notice will be issued, including implementation conditions to be applied to the Project under Federal legislation.

Construction and operation of the Project may not commence until the Minister for Environment and Water has made an approval decision.

For more information on the EPBC Act regulatory framework please refer to **Section 2**, for baseline information relating to the MNES please refer to **Section 3.9 and 3.10** and for the MNES environmental significance assessment please refer to **Section 8.**

Mining Act

The *Mining Act 1971* (Mining Act) is the principal legislation for mining regulation in South Australia and is administered by DEM on behalf of the Minister for Energy and Mining. As the Project Area is located within the Yellabinna Regional Reserve, which is managed by the Yumbarra Co-management Board, under Section 43A (2) of the NPW Act, the MLP application needs to be approved by the Minister for Environment and Water as well as the Minister for Energy and Mining.

The Mining Act provides a two-stage assessment prior to construction and mining being able to commence. The first stage being the granting of a ML (after the assessment and approval of this document) and the second being an approved Program for Environment Protection and Rehabilitation (PEPR).

For more information on the Mining Act regulatory framework as well as other relevant State based legislation, please refer to **Section 2.**

Environmental and social baseline

A detailed environmental and social baseline has been collected for the Project since 2014 and is described in the baseline section.

For more information on the description of the environmental and social baseline relevant to the Project please refer to **Section 3.**

Project summary

The key elements of the project are outlined in the table below.

Project element	Description
Project disturbance	Approximately 2,057 ha of native vegetation will be cleared within the Atacama Project Area. Approximately 130 ha of native vegetation will be cleared within ML 6315 and ML 111.

Project element	Description
Mining method	Progressive dry mining of four open pits, with progressive rehabilitation.
Mining rate	Approximately 185 Mt of overburden and 25 Mt of ore over the LOM. Approximately 4.1 Mt of Heavy Mineral Concentrate (HMC) will be produced for transport over the LOM.
Mine life	Approximately seven (7) years including overburden stripping. J-A's total mine life will be extended by approximately four (4) years due to the processing of the Atacama deposit.
Commodities	Heavy mineral sands.
Processing	Processing in the Project Area is restricted to primary screening of material through the Mining Unit Plant (MUP), material is then slurry pumped to J-A for processing through the existing wet concentrator plant (WCP) and then through a newly installed wet high intensity magnetic separator (WHIMS) wash plant.
Tailings Storage Facility	There will be no tailings storage facilities located at the Project Area. A self-supported sand tailings stockpile will be constructed at J-A for the storage of sand tailings material from Atacama. This will result in a landform change post closure. Fine tailings (<53 micron) will be co-disposed with sand material within the Ambrosia voids consistent with the current approved J-A backfill plan.
Power demand and supply[1]	No power supply will be installed at the Project Area, with the exception of generators during construction and lighting towers during operations. Power will be sourced from the onsite (diesel/ solar) power station at J-A. The diesel and solar capacity is proposed be upgraded to allow for approximately 17,000 MWh of additional power to be supplied in a given year.
Water demand and supply[2]	Two ponds will be constructed in the Project Area – a 2.5ML RO pond and a 2.5ML process storage pond. There will be no water abstraction within the Project Area. The existing wellfield located approximately 40 km west from the J-A mine will provide water for the Project. The wellfield will supply an annual average of approximately 13.2 ML/day to meet the demand of both J-A and Atacama. Dust suppression at Atacama will be made up of approximately 1.5 ML/day of process water. A further 1.0 ML/d of RO water will be used for dust suppression, rehabilitation, amenities, and workshop requirements. The RO plant at J-A will be upgraded to allow for this use.
Operating hours	Mining will occur 24 hours a day, 7 days a week.
Transport and logistics	There is no transportation of HMC from the Project Area. While the production life at J-A will be extended there will be no annual increase in truck movements via the existing route from J-A to Port Thevenard. The same trucking route will be used.
Workforce	There will be no camp facilities within the Project Area. The camp at J-A will be expanded to accommodate the increase in staff, which will be approximately 300-350 further full time equivalent (FTE) roles during operations depending on roster patterns.

[1] Power consumption will change through the course of the study as design definitions improve.

[2] Water use will change through the course of the study as design definitions improve.

Project element	Description
Radiation	Low levels of uranium and thorium mineralisation are associated with the Atacama ore bodies as well as the waste (tailings) material (0.16-0.65 Bq/g and 0.01-0.1 Bq/g respectively) compared to up to 0.6 to 1.7 Bq/g (magnetic concentrate (ilmenite)) and 3.7 to 5.0 Bq/g. (non-magnetic concentrate (zircon)) which will both be stored at the J-A ML and not within the Project Area.

For more information on the description of the Project (construction, operation and closure) please refer to **Section 4.**

Native vegetation clearance and State offsetting

Native vegetation clearance will be required as part of the construction and operation of the Project. This will be done to the minimum extent necessary and will be progressive over the LOM. Rehabilitation will be undertaken progressively to the extent possible in order to minimise the area of disturbance which is open at any one time during the operation.

A Conceptual Footprint has been provided throughout this document, noting that the Conceptual Footprint includes a 50 m buffer.

A total area of 2,187 ha of native vegetation will need to be cleared to accommodate the mine and associated infrastructure. Of this, 2,057 ha occurs within the Atacama Project Area (referred to as the Conceptual Footprint), and 128 ha within ML 6315 (J-A) and a further 2 ha on MPL 111 (camp). None of the native vegetation observed in the Project Area or on ML 6315/ MPL 111 are listed as hosting Threatened Ecological Communities (TECs) under the EPBC Act. Native vegetation clearance relating to the J-A tenements (ML 6315 and MPL 111) will be managed through the PEPR process.

Iluka has formed a working group with the Far West Coast Aboriginal Corporation (FWCAC) which has been investigating how a partnership between both groups would work to achieve an SEB for the Project. This might occur through the establishment of an on-ground offset via the purchase or leasing of land within the FWCAC's Native Title Area. To achieve the SEB Iluka would engage the FWCAC's services to deliver on-ground management of the land for the required 10-year management period.

At this stage the concept to achieve the SEB would include:

- The establishment of a Management or Heritage Agreement to secure the land acquired by Iluka for ongoing conservation which would be approved by the South Australian Minister for Environment and Water.
- The development of a 10-year SEB Management Plan by Iluka which would be endorsed by the South Australian Minister for the Environment and Water.
- A contract between Iluka and the FWCAC for the delivery of the outcomes detailed within the SEB Management Plan.

For more information on native vegetation clearance relating to the Conceptual Footprint and State offsetting please refer to **Section 4.9.**

Closure

All infrastructure will be removed prior to closure, unless agreed with the Landholder.

Following rehabilitation of the Conceptual Footprint, the final landform at Atacama will look much like the pre-mining landscape, except for areas in which the four pits and the adjacent roads cut into and removed dune crests. These dune crests will not be returned during rehabilitation.

This will result in a permanent landform change.

Once rehabilitation is completed and the tenement has been successfully surrendered by Iluka, the land will revert back to a Regional Reserve.

For more information on the how the Project will look at closure please refer to **Section 4.10.**

Consultation and engagement

Iluka already has an active presence with stakeholders due to the operation of the J-A mine for over a decade within Yellabinna Regional Reserve. Iluka aims to engage (or continue to engage) with a diverse range of stakeholders in an open, inclusive and meaningful manner regarding Atacama.

Consultation and engagement with stakeholders has been occurring since late 2019 on the Project.

For more information on the consultation process and details of consultation that has occurred up to the submission of this document please refer to **Section 5.**

Assessment of environmental and social effects

Iluka has undertaken an impact assessment of key environmental aspects as per the guidance provided in the Minerals Regulatory Guideline MG2a - *Preparation of a mining application for metallic and industrial minerals* (MG2a).

The environmental impact assessment has found that some impacts to the environment are likely (i.e. where a source-pathway-receptor (S-P-R) has been confirmed) without mitigation measures in place. In these instances, outcomes have been proposed to manage and reduce these impacts. Outcomes will be confirmed on the granting of a ML, and measurement criteria refined as part of the PEPR process. Outcomes have been proposed for heritage, flora, fauna and native vegetation, soil and land quality, public health and safety, waste, groundwater, surface water, air quality, visual amenity and traffic.

With an absence of social impact guidelines in South Australia, a social impact assessment (SIA) has been undertaken in general accordance with the *2021 Social Impact Assessment Guideline for State Significance Projects* from the New South Wales Department of Planning and Environment (NSW DPE).

The Project will become an extension of the existing J-A operation and as such the two have been combined when assessing social impacts (both positive and negative). The SIA found that the continuity and enhancement of existing controls, in addition to implementing additional measures, will reduce negative impacts and improve positive benefits. These additional measures include a Social Management Plan to establish the ongoing monitoring and evaluation of social impacts with an adaptive management approach to identify any emerging impacts.

The potential positive social benefits expected during construction and operation includes:

- increased employment opportunities for local residents
- increased local procurement and business opportunities
- enhanced community cohesion, wellbeing and active lifestyles as a result of the continuation of Iluka's sponsorship program
- increased employment, education and business opportunities for FWC people
- increased organisational capacity of FWCAC
- increased accessibility of local infrastructure.

For more information on the impact assessment framework please refer to **Section 6** and for more information on results of the impact assessment to meet the requirements of the Mining Act please refer to **Section 7.**

MNES environmental significance assessment

Significant survey effort has been undertaken within the Proposed Action Area since 2014 (for the three MNES Malleefowl, Sandhill Dunnart and Ooldea Guinea-flower) following the relevant Guidelines, hence there is high certainty that each matter has been appropriately quantified for this assessment.

Ooldea-Guinea flower

There are no records of Ooldea Guinea-flower within the Proposed Action Area with the closest record located 5.5 km to the north-east. Whilst some suboptimal habitat is present within the Proposed Action Area, there is no habitat that contains all key features associated with species presence. Due to the lack of records, the lack of required habitat features within the Proposed Action Area, and the proposed mitigation measures (such as weed and pest control), the Proposed Action is unlikely to have a significant residual impact on this species.

Malleefowl

Whilst there have not been any active breeding mounds for Malleefowl recorded within the Proposed Action Area, Malleefowl is known to inhabit and breed in the area to the north-east. The Proposed Action Area lacks the extensive deep litter rafts that are crucial for successful Malleefowl nesting and hence would not be considered as critical breeding habitat. Low numbers of Malleefowl transiently use the Proposed Action Area for foraging or movement through the landscape. Due to the much greater extent of better-quality breeding and foraging habitat adjacent to the north-east of the Proposed Action Area, and the proposed mitigation measures to be implemented (such as targeted revegetation), the Proposed Action is unlikely to have a significant residual impact on this species.

Sandhill Dunnart

Whilst there are no records of Sandhill Dunnart individuals within the Proposed Action Area, one potential (unconfirmed) burrow was recorded on the north-east boundary, and individuals have been recorded in Yellabinna Regional Reserve to the north-east. The habitat within the Proposed Action Area is suboptimal for this species as, due to die-back, coverage of *Triodia spp*. (Spinifex) of sufficient density, age and height is absent. Hence whilst the Proposed Action Area may be used intermittently by a small number of individuals, it is not critical habitat for the species. Due to the much greater extent of dense Spinifex coverage in areas to the north-east of the Proposed Action Area, and the proposed mitigation measures to be implemented (such as weed control and revegetation), the Proposed Action is unlikely to have a significant residual impact on this species.

Offsetting

As the above assessment has demonstrated that there are no significant residual impacts on MNES expected to occur as a result of the Proposed Action, in accordance with (guideline) no offset is required under the EPBC Act .

For more information on the MNES environmental significance assessment to meet the requirements of the EPBC Act please refer to **Section 8.**

Other information

Other information is contained within the MLP including:

- exempt land as described in Section 9 of the Mining Act (**Section 1.5**)
- reasonable prospect of access to land (**Section 1.7**)
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E	**Jacinth-Ambrosia Mine Closure Plan**
F	**Jacinth Ambrosia Rehabilitation Management Plan**

1 INTRODUCTION

Iluka (Eucla Basin) Pty Ltd (Iluka), a wholly owned subsidiary of Iluka Resources Limited, is the proponent submitting this Mining Lease (ML) Application and accompanying ML Proposal (MLP), in respect to the Atacama Mineral Sands Project (the Project). The Project Area (the boundary of which is defined in Figure 1-1) is located approximately 290 km north-west of Ceduna on the far west coast of South Australia and 5 km north-east of the existing Jacinth-Ambrosia (J-A) mine site, operating on ML 6315.

This chapter summarises the Project proponent, details the proposed new tenements, describes the existing related tenements for exploration and the J-A mine site and exempt land and relevant landowners.

1.1 Project proponent

Iluka Resources, an Australian Stock Exchange (ASX) listed Global Critical Minerals Company. Iluka have mineral sands operations in Western Australia (Cataby) and South Australia (J-A), as well as mineral processing separation plants in Western Australia (Narngulu and Capel).

Proponent details are summarised in Table 1-1.

Table 1-1 Proponent details

Applicant	Iluka (Eucla Basin) Pty Ltd.		
Applicant percentage share	100%		
Australian Company Number	008 675 018		
Project name	Atacama Project		
Mineral type	Heavy mineral sands		
Mineral(s) to be authorised	Heavy minerals sands		
Primary mineral(s) sought	Heavy mineral sands		
Other mineral(s) sought	None		
Details of the tenement(s) giving authority to apply for the Mining Lease	Exploration Licence (EL) 5947, for more information on Iluka tenements please refer to Section 1.3 and 1.4		
Native title land	The Far West Aboriginal Corporation (SAD6008/98)		
Details of relevant site ownership, consents and agreements	Refer to Section 1.6		
Site location	290 km north-west of Ceduna		
Site contact	Matthew Harding	**Position**	Principal – Approvals SA
Address	Level 17, 240 St. Georges Terrace Perth, WA	**City (Postcode)**	6000
Email	Matthew.Harding@iluka.com	**Phone**	0437 146 220
Website	https://iluka.com		

Consent to receive electronic correspondence (or otherwise)	Yes

1.2 Proposed new Iluka tenements

This MLP contains details for one proposed tenement which is summarised in Table 1-2 and shown in Figure 1-1 and Appendix A. In accordance with Section 56k of the Mining Act the granting of an ML authorises the management and use of extractive minerals produced during the course of carrying out mining operations under the tenement. Iluka may use extractives produced as part of the Atacama Project on the Atacama ML.

The Atacama and J-A Projects will be managed as one operation and as such to allow maximum flexibility Iluka may use secondary oversize and/ or extractives from the J-A related ML/ EMLs on the Atacama ML and at times may use secondary oversize from Atacama on J-A related tenements.

Table 1-2: Proposed new tenements

Proposed tenement	Land tenure	Key project elements summary
Mining Lease		
Atacama Mining Lease (ML)	Plan parcel D67929 A100	Mining, stockpiling, roads, offices, water storage, transportation of product via slurry pump to J-A, and receiving of water and power from J-A. Potential use of extractives as authorised under Section 56k of the Mining Act.

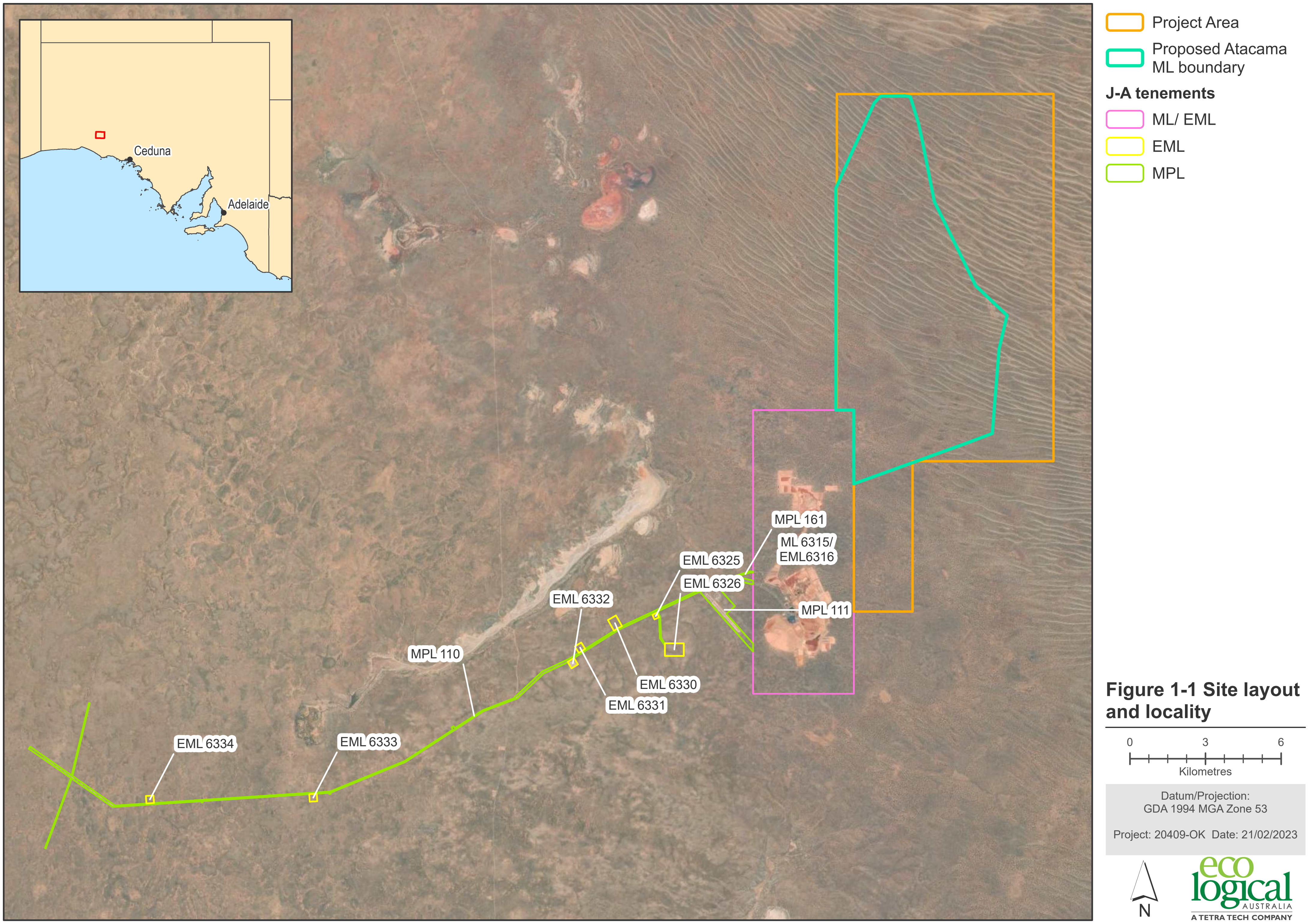

Figure 1-1 Site layout and locality

1.3 Exploration tenements

Iluka currently maintains numerous exploration tenements (Exploration Licenses (ELs)) (Figure 1-2) within South Australia, these are detailed in Table 1-3. The Project sits within EL 5947.

Table 1-3 Active Iluka exploration tenements

Number	Term (years)	Expiry	Location	Commodity
EL 5878	5	18/10/2021 – pending renewal	Barton area	Heavy Mineral Sands; Gold
EL 5879	5	18/10/2021 – pending renewal	Colona area	Heavy Mineral Sands; Gold
EL 5947	5	17/04/2022 – pending renewal	Ooldea Range area	Heavy Mineral Sands
EL 6159	2	28/11/2022 – pending renewal	Lake Tallacootra area	Uranium; Iron Ore; Gold; Nickel; Copper
EL 6251	5	18/04/2023	Nullarbor area	Heavy Mineral Sands; Iron Ore; Gold; Nickel; Copper
EL 6330	5	24/03/2024	Ashville	Heavy Mineral Sands
EL 6329	5	24/03/2024	Peake	Heavy Mineral Sands
EL 6369	5	22/05/2024	Yellabinna area	Heavy Mineral Sands; Nickel
EL 6376	5	24/07/2024	Nundroo area	Heavy Mineral Sands; All Metals
EL 6461	5	03/11/2024	Yellabinna Area	Mineral Sands
EL 6462	5	23/12/2024	Poondinga Area	Heavy Mineral Sands
EL 6542	2	23/08/2025	Fig Tree Corner Area	Heavy Mineral Sands; Gold
EL 6543	2	31/08/2025	Yalata Area	Iron Ore; Gold; Nickel; Minerals Sands; Copper
EL 6544	2	30/11/2025	Yellabinna Area	Palladium; Gold; Nickel; Copper; Platinum
EL 6545	2	30/11/2025	Yellabinna Area	Palladium; Gold; Nickel; Copper; Platinum

1.4 Mining tenements (J-A)

The Atacama Project is located approximately 5 km to the northeast of Iluka's existing J-A mine site which was approved by the Department of Primary Industries and Regions South Australia (PIRSA) (now Department for Energy and Mining (DEM)) on the 4 July 2007.

A summary of the mining tenements associated with the J-A mine site is provided in Table 1-4.

Table 1-4 Mining tenements associated with J-A

Mining Lease			
Number	ML 6315		
Term	21 years		
Expiry	2 July 2029		
Tenure	Crown Land		
Certificate of Title	Crown Record 5957/384		
Name of Lessee/Owner	Minister for Environment and Conservation, the State of South Australia		
Registered Native Title Traditional Owners	The Far West Aboriginal Corporation (SAD6008/98)		
Current land use	Yellabinna Regional Reserve		
Extractive Minerals Leases			
Number	EML 6316 (same boundary as Mining Lease 6315)	EML 6325, 6326	EML 6330, 6331, 6333 and 6334
Term	21 years	21 years	21 years
Expiry	2 July 2029	12 November 2029	27 January 2030
Tenure	Crown Land		
Certificate of Title	Crown Record 5957/384		
Name of Lessee/Owner	Minister for Environment and Conservation, the State of South Australia		
Registered Native Title Traditional Owners	The Far West Aboriginal Corporation (SAD6008/98)		
Current land use	Yellabinna Regional Reserve		
Miscellaneous Purpose Licences			
Number	MPL 110	MPL 111	MPL 161
Purpose	Borefield, pipeline and access road	Air strip and accommodation village	Canberra Haul Road Upgrade
Term	21 years		8 years and 327 days years
Expiry	2 July 2029		3 July 2029
Tenure	Crown Land		
Certificate of Title	Crown Record 5851/202	Crown Record 5957/384	

Mining Lease		
Name of Lessee/Owner	Minister for Environment and Conservation, the State of South Australia	
Current land use	Nullarbor Regional Reserve	Yellabinna Regional Reserve

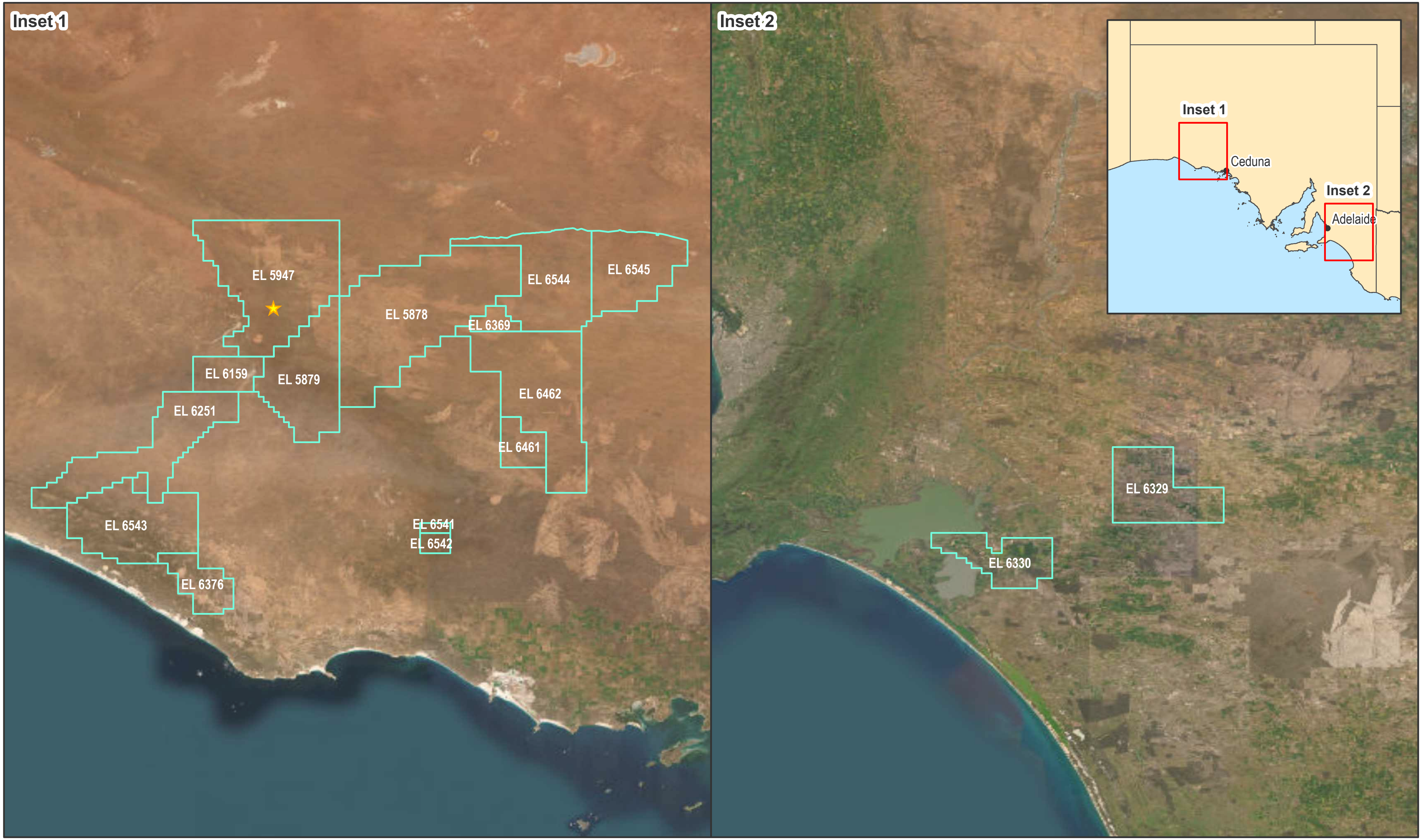

Figure 1-2 Iluka exploration tenements in South Australia

★ Atacama Project

Iluka exploration tenements

N

0 30 60
Kilometres

Datum/Projection:
GCS GDA 1994

Project: 20409-OK Date: 2/8/2023

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1.5 Exempt land identification

There are no areas of identified exempt land (as described in Section 9 of the *Mining Act 1971* (Mining Act)) within the proposed ML boundary. No waiver of exemptions is therefore required (Section 9AA of the Mining Act).

1.6 Landowners

The Project is situated entirely on state owned Crown Land within the Yellabinna Regional Reserve, therefore, as proclaimed under South Australian legislation, the delegated title owner is the South Australian Minister for Environment and Water. The Yellabinna Regional Reserve is managed by the Yumbarra Co-management Board - a partnership between the Far West Coast Aboriginal Corporation (FWCAC) and the Department for Environment and Water (DEW).

The Certificate of Title details for the Project location is Crown Record 5957/384.

1.7 Reasonable prospect of access to land

As described in the *Mining Regulations 2020* Section 30(1)(e)(i) Iluka needs to provide enough information to give confidence that they have a reasonable prospect of access to the land if the Atacama Project is approved.

1.7.1 Native title mining agreement negotiations

The Project is located within the traditional lands of the Far West Coast Aboriginal peoples, recognising the larger unified claim of 6 cultural groups to achieve native title and obtain cultural authority over country.

The identification and management of cultural heritage within the traditional lands of the Far West Coast (FWC) Aboriginal peoples is undertaken in accordance with practices and principles outlined in Iluka's J-A Cultural Heritage Management Plan (CHMP) and the NTMA heritage protocol. Iluka proposes to expand the operation of the ML 6315 CHMP to manage the potential impacts of the Project on the Aboriginal heritage values present within the project footprint.

The J-A CHMP outlines the ongoing monitoring and management of cultural heritage. The plan outlines procedures for implementation when cultural heritage objects are identified and the management of culturally significant sites.

A Part 9B NTMA; pursuant to the requirements of the *Native Title Act 1993* was signed between Iluka Resources and the FWCAC on the 13 December 2007. This NTMA primarily relates to mining and ancillary activities over ML 6315, however, it includes provisions for engagement with the FWCAC and the management of cultural heritage on and off lease. This agreement formalises protocols and systems to enable the parties to work together to achieve mutual benefits. Iluka are currently progressing discussions with the FWCAC to amend the NTMA to include the Project (i.e., the disturbance and mining relating to the Atacama ML) as well as other deposits within the Eucla Basin.

Heritage surveys conducted to date within the Project Area are detailed in Section 3.20. Further heritage surveys of the Project Conceptual Footprint will be undertaken to develop a more complete understanding of the number, type and significance of heritage sites which may occur. This is planned to occur in 2023, after submission of this MLP.

Iluka is committed to ongoing liaison and consultation with Traditional Owners and has established procedures for managing Aboriginal heritage, in addition to training for staff to identify possible sites of cultural significance and take appropriate response action.

2 REGULATORY FRAMEWORK

This section sets out the regulatory framework which relates to the Project, including those relating to State (Mining Act, *Radiation Protection and Control Act 2021* (RPC Act), *Environment Protection Act 1993* (EP Act), *Native Vegetation Act 1991* (NV Act)), and Federal (*Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act)) legislation. These regulations detail both primary and secondary approvals processes.

2.1 Mining Act 1971 (SA)

The *Mining Act 1971* (Mining Act) is the principal legislation for mining regulation in South Australia and is administered by the DEM on behalf of the Minister for Energy and Mining. As the Project Area is located within the Yellabinna Regional Reserve, which is managed by the Yumbarra Co-management Board, under Section 43A (2) of the NPW Act, the MLP application needs to be approved by the Minister for Environment and Water as well as the Minister for Energy and Mining.

The Mining Act provides a two staged approvals process, both stages of which need to be approved prior to mining commencing in South Australia:

- The first stage of this process is the MLP (this document) which is written to support the proponents ML application under sections 35 and 53 of the Mining Act. If approved, this results in the granting of the ML.
- The second stage of this process involves preparing a Program for Environment Protection and Rehabilitation (PEPR) which is submitted to DEM once a ML is granted. Once the PEPR has been approved mining can commence on site.

Figure 2-1 outlines the two-stage assessment process under the Mining Act.

2.1.1 Regulatory guidelines

This MLP has been prepared to meet the specific requirements set out in the relevant Atacama Project Mining Lease Application Terms of Reference (referred hereafter as TOR Atacama) – *Mineral mine lease/licence applications – Notice under Section 36 of the* Mining Act) and guidelines (The Minerals Regulatory Guideline MG2a - *Preparation of a mining application for metallic and industrial minerals* (referred hereafter as MG2a)). The content required in this MLP, as outlined in TOR Atacama and MG2a, is as follows:

- basic information on the proposed mine
- declaration of accuracy requirement
- description of the existing environment
- description of proposed mining operations
- consultation
- management of environmental impacts
- reasonable prospect of access to land
- description of contributions to the economy
- reserves or resources (or both).

DEM will assess this MLP, in collaboration with relevant government agencies, and make a recommendation to the Minister. This decision will be based on the proposed level of impact and whether this impact is deemed acceptable, considering the economic and social benefits, and management via the proposed control measures.

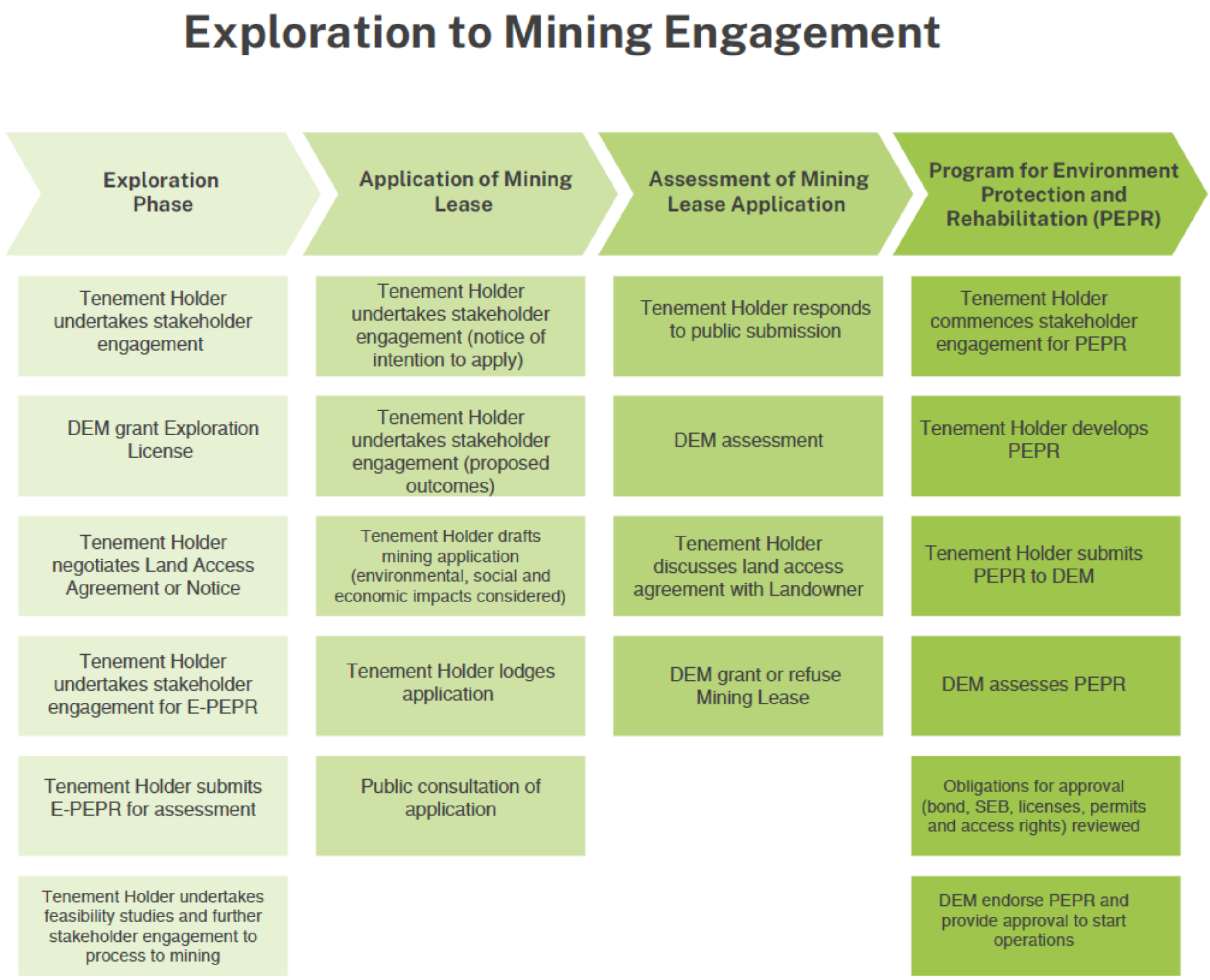


Figure 2-1 Mining Act assessment process (adapted from DEM, 2020)

2.2 Environment Protection and Biodiversity Conservation Act 1999 (Cth)

The EPBC Act is the Federal government's principal environmental legislation in place for the protection and management of Matters of National and Environmental Significance (MNES). The EPBC Act is administered by the Department of Climate Change, Energy and Environment and Water (DCCEEW).

The Project was referred to DCCEEW on 16 June 2022 [ref EPBC 2022/09289] for its potential impact to threatened species and to provide information relating to the storage of naturally occurring radioactive material (NORMs) which is present within the heavy mineral concentrate (HMC) to be produced. On 9 November 2022, the Project was determined to be a Controlled Action under Section 75 of the EBPC Act. The relevant Matter (the controlling provision) is threatened species and communities (Section 18 and 18A of the

EPBC Act). DCCEEW identified that the Project may have, or is likely to result in a significant impact to the following MNES species:

- Malleefowl (*Leipoa ocellata*)
- Sandhill Dunnart (*Sminthopsis psammophila*)
- Ooldea Guinea-flower (*Hibbertia crispula*).

The significance of potential impacts from the Project on MNES concerning relevant EPBC Act guidance is addressed separately in this MLP in Section 8.

DEM is assessing the MLP as an Accredited Assessment on behalf of the Commonwealth under Section 87 of the EPBC Act. This assessment provides for a single environmental assessment process conducted by the State, with DCCEEW providing comment on the MLP during the public comment period and reviewing the Response to Submissions. At the completion of the assessment, the DEM Report is provided to DCCEEW, assessing the likely impacts of the Project on MNES.

The Commonwealth Minister for the Environment will make an approval decision. On approval, a Decision Notice will be issued, including implementation conditions to be applied to the Project.

2.3 Environment Protection Act 1993 (SA)

The EP Act is administered by The South Australian Environment Protection Authority (EPA). The purpose of the EP Act is to protect the state's environment (land, air and water) and allow risk-based regulation of pollution, waste, noise and radiation. Under Section 25 of the EP Act, general environmental duty is established, requiring that an activity that pollutes, or might pollute the environment must not be undertaken unless all reasonable and practicable measures to minimise harm are implemented.

Where the proposed mining operation involves activities listed in Schedule 1 of the EP Act (e.g., mineral processing), an authorisation in the form of a works approval is required from the EPA and a licence must be obtained before these activities may commence. Section 35 also requires that a works approval is authorised in relation to construction or alteration of a building or structure to be used for a prescribed activity of environmental significance. Section 36 of the EP Act establishes the requirement for license, where a prescribed activity of environmental significance must not be undertaken without obtaining an environmental license.

2.4 Radiation Protection and Control Act 2021 (SA)

The RPC Act will repeal (in early 2023) the *Radiation Protection and Control Act 1982*, these acts established the control of activities related to radioactive substances and radiation apparatus, and for protecting the environment and the health and safety of people against the harmful effects of radiation, and for other purposes. This Project will require a Radiation Management Plan (RMP) to be approved by the EPA under the RPC Act before construction commences due to the NORM within the mineral sands. The RMP is also required under the Code of Practice for Radiation Protection and Radioactive Waste Management in Mining and Mineral Processing 2005 (Mining Code) (ARPANSA, 2005).

The RMP provides the measures to control the exposure of employees, members of the public from radiation associated with the mining operation. The RMP is developed to provide for the proper management of radioactive waste arising from the mining operation.

This Project will require a RMP to be approved by the EPA under the RPC Act as part of the submission of the PEPR due to the NORMs within the mineral sands.

2.5 Native Vegetation Act 1991 (SA)

The NV Act is a key piece of legislation for the management of native vegetation on both private and public land in South Australia. It promotes the conservation, management and regeneration of native vegetation and seeks to ensure personal and public safety. A Significant Environmental Benefit (SEB) for any vegetation clearance under the NV Act must be provided to offset the clearance and ensure an environmental gain over and above the impacts of the approved clearance (DEWNR, 2017). The SEB may be established via a number of different options, including monetary contribution to the Native Vegetation Fund (NVF), management of native vegetation for conservation purposes, direct revegetation and/ or on-ground works.

The approach to providing an SEB in relation to the proposed clearance for the Atacama Project is provided in Section 4.9.

2.6 Other legislation

Several other South Australian and Commonwealth legislations are also applicable to mining operations and have been considered for the proposed actions as part of the Atacama Project through the assessment and management of impacts discussed in Sections 7 and 8. Incorporating demonstrated awareness and compliance with requirements from other relevant legislation is important for a cohesive assessment and supports the development of the PEPR. Other relevant legislation includes:

- *Aboriginal Heritage Act 1988* (SA)
- *Australian Radiation Protection and Nuclear Safety Act 1998* (Cth)
- *Civil Aviation Act 1988* (Cth)
- *Climate Change and Greenhouse Emissions Reduction Act 2007* (SA)
- *Controlled Substances Act 1984* (SA)
- *Dangerous Substances Act 1979* (SA)
- *Electricity Act 1996* (SA)
- *Explosives Act 1936* (SA)
- *Fire and Emergency Services Act 2005* (SA)
- *Landscapes South Australia Act 2019* (SA) (Landscape SA Act)
- *Mines and Works Inspection Act 1920* (SA)
- *National Greenhouse and Energy Reporting Act 2007* (Cth)
- *National Parks and Wildlife Act 1972* (SA) (NPW Act)
- *Native Title Act 1993* (Cth)
- *Public Health Act 2011* (SA)
- *Road Traffic Act 1961* (SA)
- *Work Health and Safety Act 2012* (SA).

Iluka will comply with all relevant State and Commonwealth legislation and regulations applicable to the Project.

3 DESCRIPTION OF THE EXISTING ENVIRONMENT

This chapter provides an overview of the existing environment and regional setting relevant to the development and operation of the proposed ML.

The information contained within this chapter has been described sufficiently to provide an environmental and social impact assessment (detailed in Section 7) undertaken in accordance with the requirements of the TOR Atacama.

The following terms are used within this section and as such defined here:

Project Area: The area in which the Project will occur and the boundary of which has been used to study the environmental baseline (see Figure 1-1 for boundary).

3.1 Topography and landscape

The Interim Biogeographical Regionalisation for Australia (IBRA) classifies landscapes across Australia into bioregions based upon common climate, geology, landform, and biodiversity information. These bioregions are then further refined into subregions. The Atacama Project Area is located within the Great Victoria Desert IBRA bioregion, and in the Yellabinna IBRA subregion (Figure 3-1). The Nullarbor and Yalata subregions are also located within close proximity to the Atacama Project Area.

The Yellabinna subregion, approximately 48,300 km^2 in size, predominantly comprises parallel dune systems, within the Great Victoria Desert IBRA. The dunefields are predominantly northwest – southeast direction covering an erosional plain (Figure 3-2). This is broken up by low outcrops of granite, inselbergs or tors formed of volcanics.

The Project Area is located on the western fringe of the Yellabinna Dunefield within two broad physiographic areas that is, a dunal system on a higher terrace to the north and a lower terrace associated with an ancient coastline.

CDM Smith (2022a) describe the Project Area landscape as having a gradational change from north to south within the landscapes with parallel steep sided dunes in the north grading to dunes with broader swales and change of vegetation, which then grades to the gentle slopes and plains associated with bluebush and saltbush. The level swale depressions are likely to represents an older relict landscape, possibly a paleo-channel, that has been buried by the parallel dune system.

The parallel dunes are generally hundreds of metres long and up to 20 m high with the distance between parallel crests approximately 250 m to 500 m (Alluvium, 2014). The linear dunes typically consist of terminal catchments (i.e., small, isolated catchments that are typically delineated by dunes) bounded by a dune crest to the north and south, and low, rounded, ridgelines that are perpendicular to the dunes. Almost all catchments end in a terminal pan.

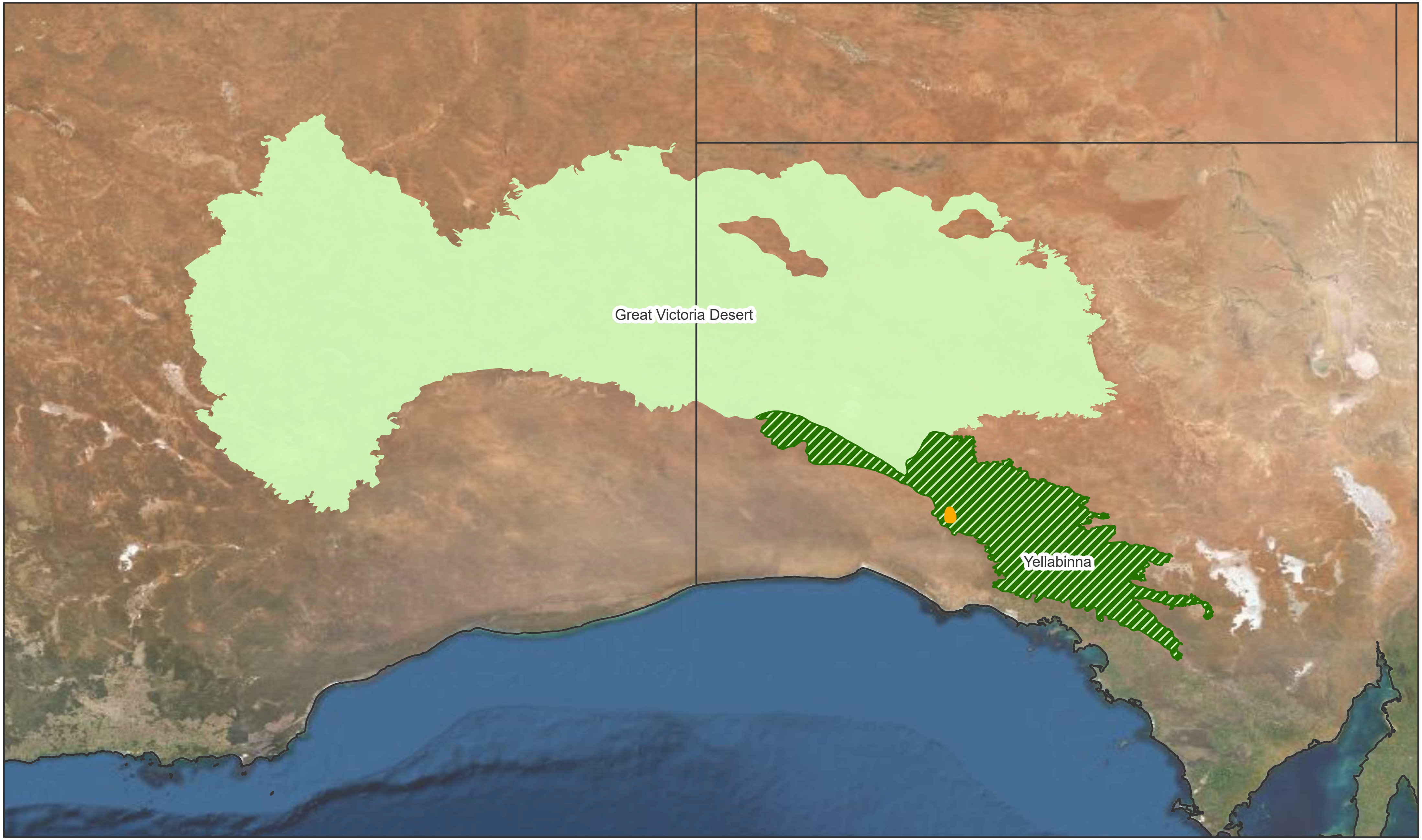


Figure 3-1: IBRA regions

The morphology of this landscape is dominated by aeolian (wind) processes, with fluvial (water) processes playing a relatively minimal role on the landscape primarily influencing the terminal plans of the area (Alluvium, 2014). Alluvium notes that in several places in the Project Area, the dune crest ends have sunk over time enabling the troughs (dune swales) to connect, effectively joining two formerly parallel catchments.

Figure 3-2 Typical linear sand dunes in the Atacama region

In the southwestern corner of the Project Area the dune system transitions into an interdunal landscape. The topography here is markedly different to that topography surrounding the Atacama deposits and reflects the dendritic network found throughout the J-A catchments. In contrast to the remaining Atacama Project Area, fluvial processes dominate here while aeolian processes have a minor influence.

3.2 Climate

The Project Area is located within the Eucla Basin, an arid region, having a mean annual precipitation of less than 250 mm (Godske, et al., 1957). The closest Bureau of Meteorology (BoM) weather stations to Atacama are Maralinga and Tarcoola Aero, with a private weather station located on the adjacent J-A site (Table 3-1). The average temperature conditions for the three weather stations are summarised in Table 3-2. Evaporation rates are not recorded these weather stations and therefore are not included in this MLP.

The Köppen Classification Scheme (BoM 1990) indicates that the Project is located within a grassland region (Figure 3-3) and is classified as hot and persistently dry (Figure 3-4).

Table 3-1 BoM weather station details

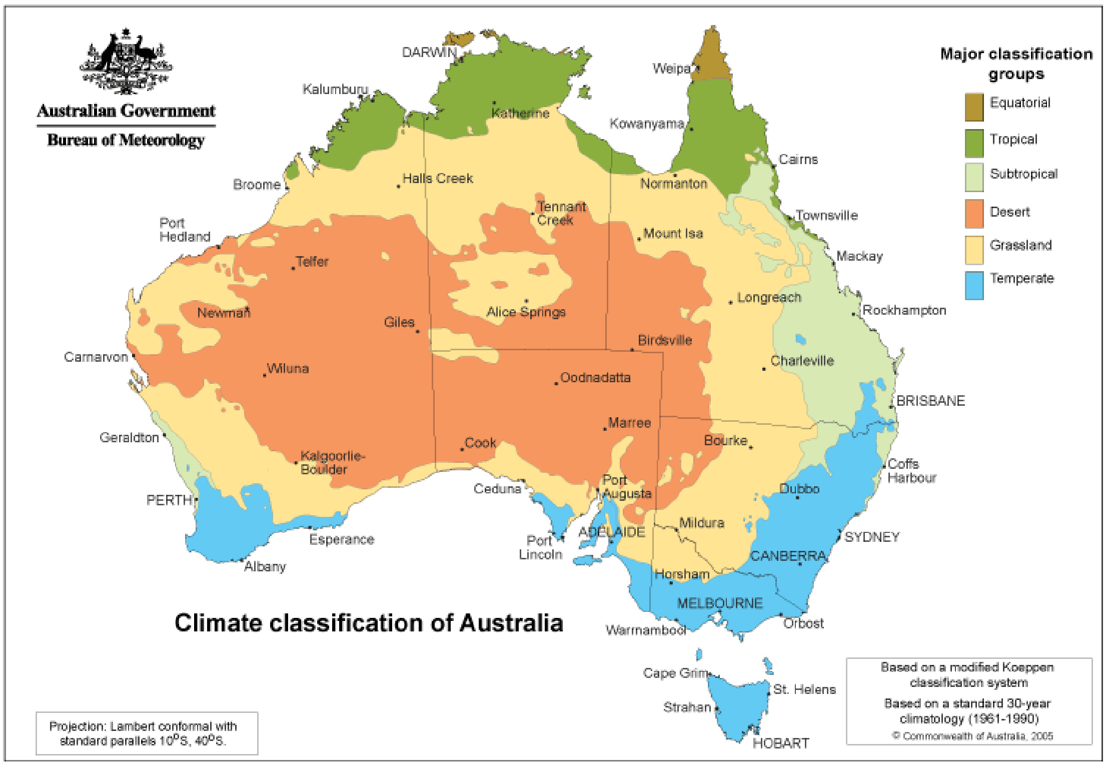
Station	Site number	Latitude	Longitude	Approximate location to Atacama	Length of rainfall record	Measured parameters
Maralinga	018114	-30.1591	131.5790	100 km north-west	1955 to current	Temperature, rainfall, daily elements, humidity, wind speed
Tarcoola Aero	016098	-30.7051	134.5786	220 km east	1997 to current	Temperature, rainfall, daily elements, humidity, wind speed
J-A	SA ILUKAAWS Iluka AWS @ Ceduna (Iluka Jacinth)	-30.8874	132.2001	10km south-west	2020 to current	Temperature, rainfall, barometric pressure, solar radiation, humidity, wind speed & direction

Source: BOM 2022a; BOM 2022b

Table 3-2 Temperature statistics for nearest weather stations

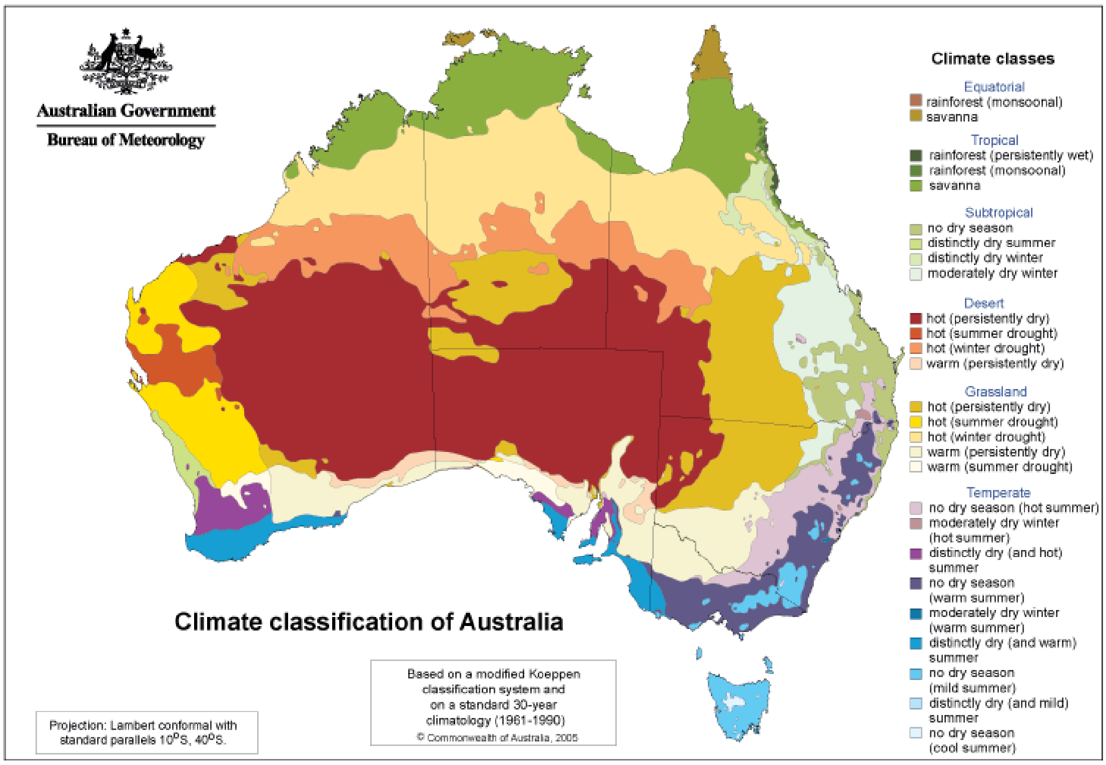
Temperature (°C)	Maralinga	Tarcoola Aero	J-A Site
Mean maximum temperature	25.4	27.7	29.8
Highest temperature	44.7	49.1	45.0
Mean minimum temperature	11.8	12.1	10.6
Lowest temperature	-0.7	-3.8	1.2
Mean number of days >30°C	91.5	134.5	-
Mean number of days >35°C	38.6	71.5	-
Mean number of days >40°C	8.5	24.4	-
Mean number of days <2°C	2.6	23.7	-
Mean number of days <0°C	0.4	7.4	-

Source: BOM 2022a; BOM 2022b



Source: BOM 1990

Figure 3-3 Köppen major climate classifications of Australia



Source: BOM 1990

Figure 3-4 All Köppen climate classifications of Australia

Figure 3-5, Figure 3-6 and Figure 3-7 show the precipitation recorded at each BoM weather station (2022a, 2022b). The data indicates that temperature ranges from the J-A site are similar to Tarcoola, though slightly more variable than at Maralinga. Tarcoola's winter precipitation is slightly lower than experienced at Maralinga, however both stations display a greater variation to the J-A site when compared to the temperature correlation.

Due to the Project Area being located within an arid region the humidity is expected to be low, consistent with observations at Maralinga and Tarcoola (Table 3-3). The J-A weather station shows an average relative humidity of 54% and a maximum wind speed of 91.4km/h.

Table 3-3 BoM wind and humidity for Maralinga and Tarcoola Aero weather stations

Statistics	Maralinga	Tarcoola Aero
9 am conditions		
Relative humidity (%)	57	53
Wind speed (km/h)	16.1	17
3 pm conditions		
Relative humidity (%)	32	29
Wind speed (km/h)	16.7	18.8

Source: BOM 2022a; BOM 2022b

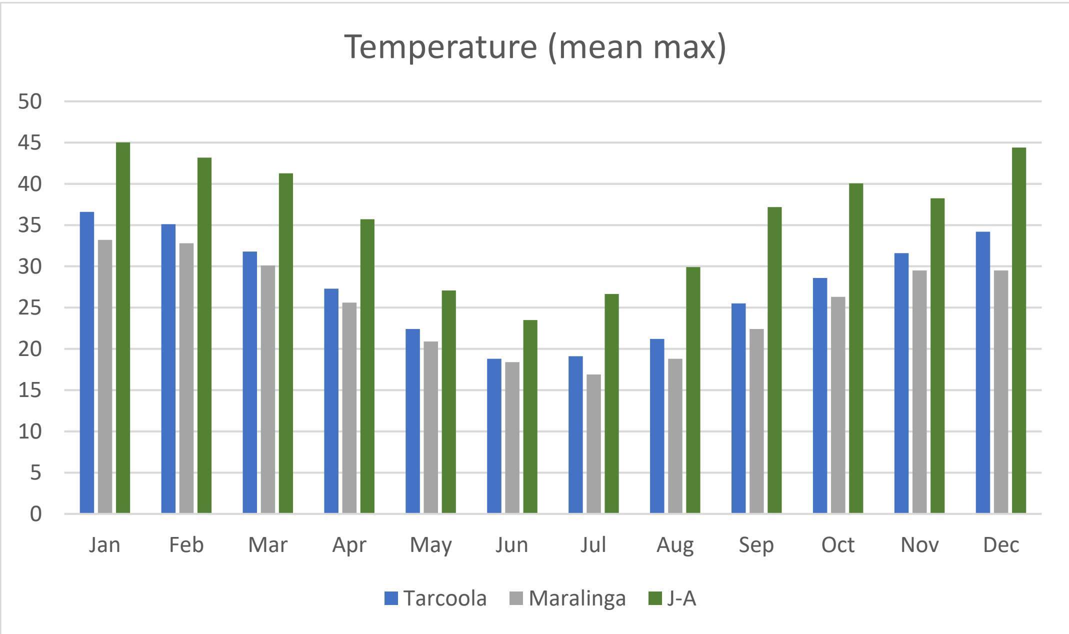


Figure 3-5 Nearby weather station mean maximum temperature

Source: BOM 2022a, BOM 2022b

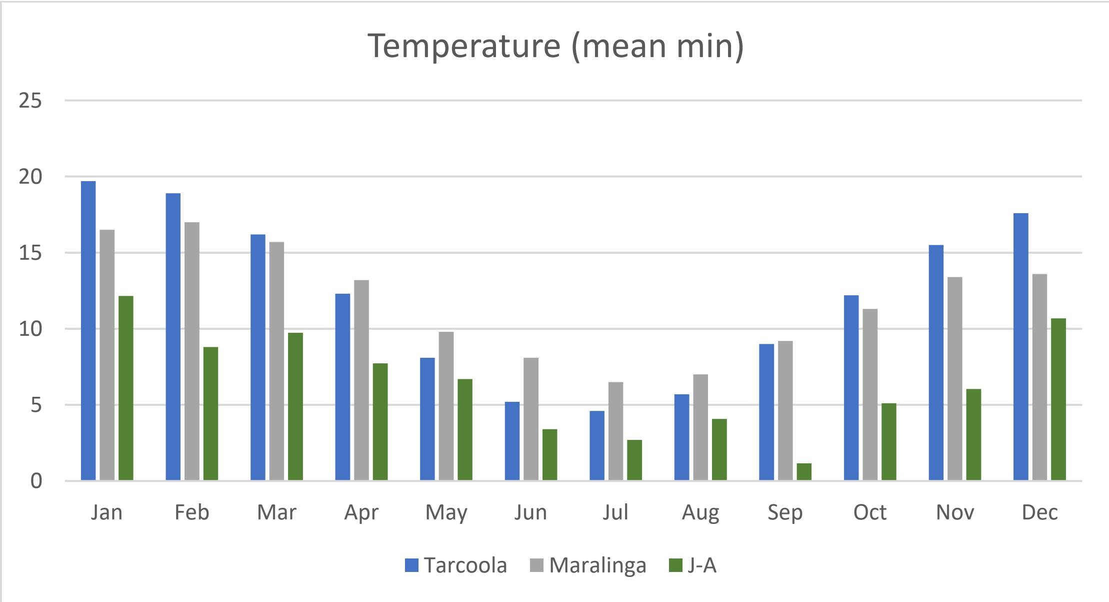


Figure 3-6 Nearby weather station mean minimum temperature.
Source: BOM 2022a, BOM 2022b

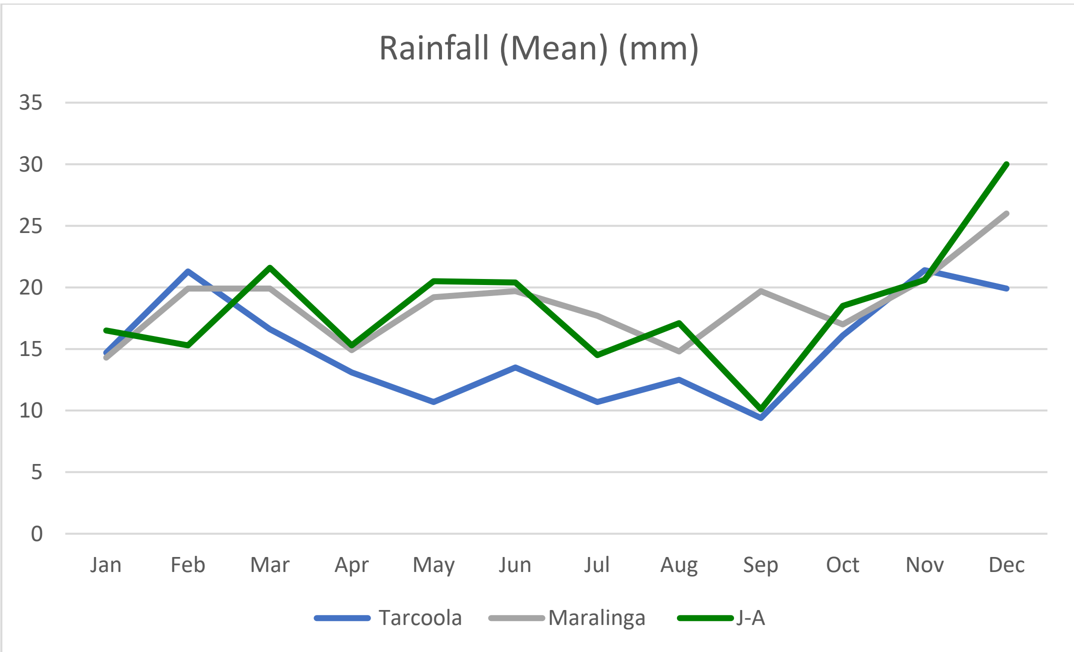


Figure 3-7 JA Nearby weather station mean rainfall Source: BOM 2022a, BOM 2022b

Mean temperatures for all sites are similar, with extremes ranging from -3.8 °C to 49.1 °C. Tarcoola experiences greater variability and a greater number of high temperature (>30 °C) days than Maralinga. Observations from the J-A station are considered more reflective of those at Tarcoola. The observed conditions at J-A are considered to be the best reflection of the conditions within the Project Area with Tarcoola being the next best indication.

Figure 3-8 to Figure 3-11 show the wind direction and speed at Maralinga and Tarcoola weather stations. The morning winds (9 am) at Maralinga has a strong wind direction to the north-east, however Tarcoola does not have a strong dominant wind direction. Afternoon winds (3 pm) tend to be more variable for both stations. .

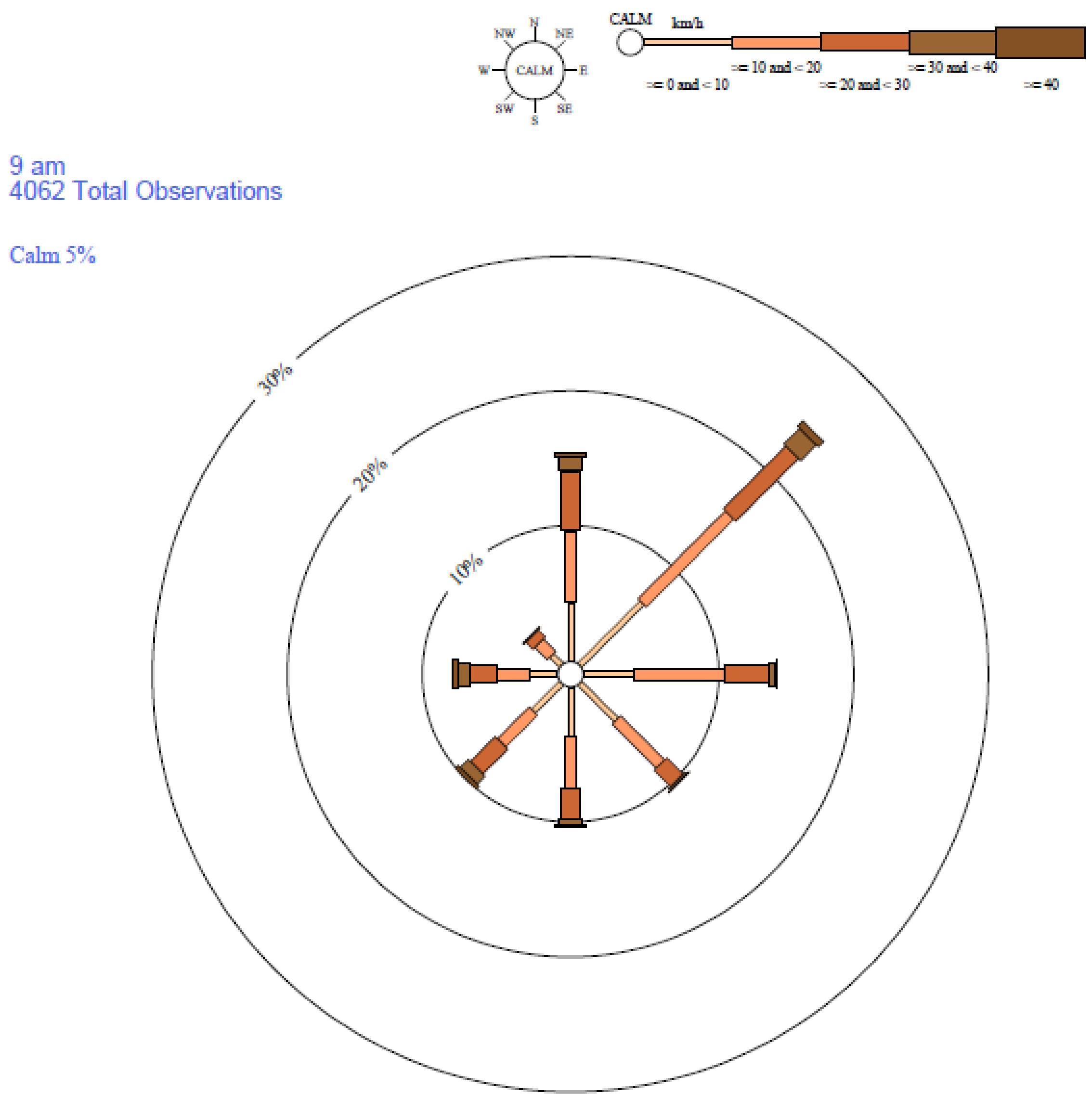


Figure 3-8 Morning (9 am) wind directions observed at Maralinga weather station (9 May 1955 to 19 December 1967) (BOM, 2022a)

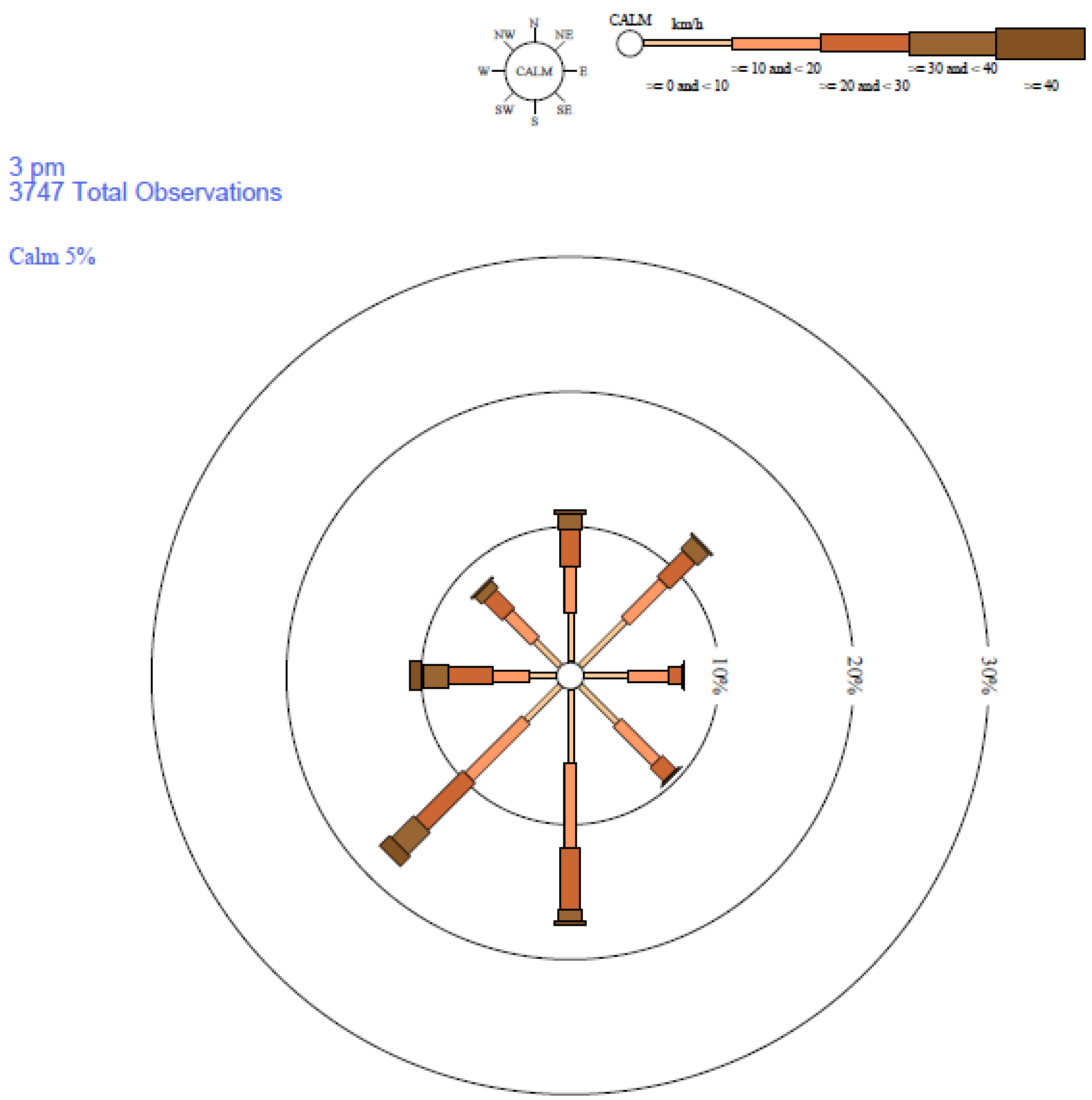


Figure 3-9 Afternoon (3 pm) wind directions observed at Maralinga weather station (9 May 1955 to 19 Dec 1967) (BOM, 2022a)

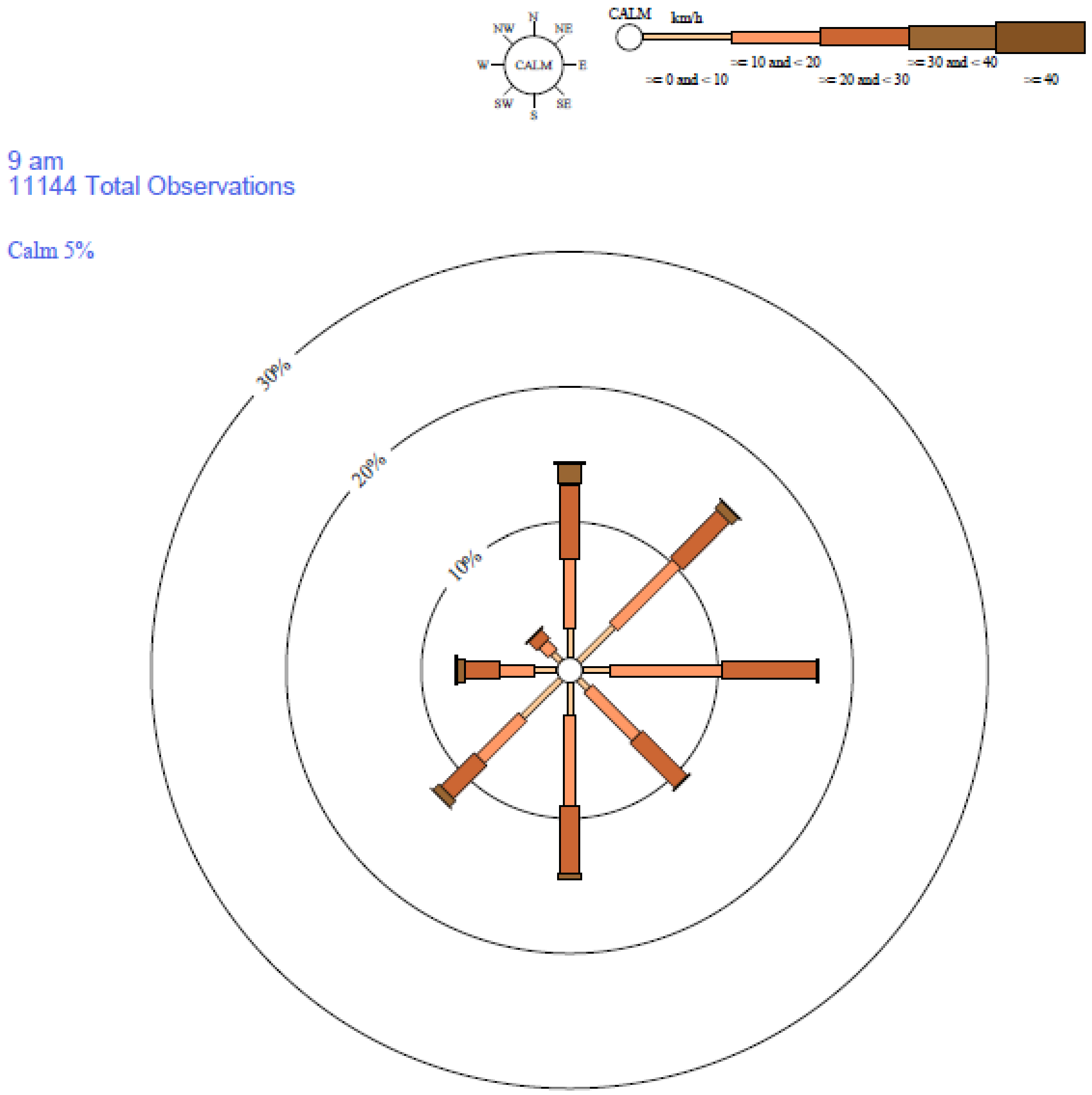


Figure 3-10 Morning (9 am) wind directions observed at Tarcoola Aero weather station (1 Oct 1997 to 11 Aug 2021) (BOM, 2022a)

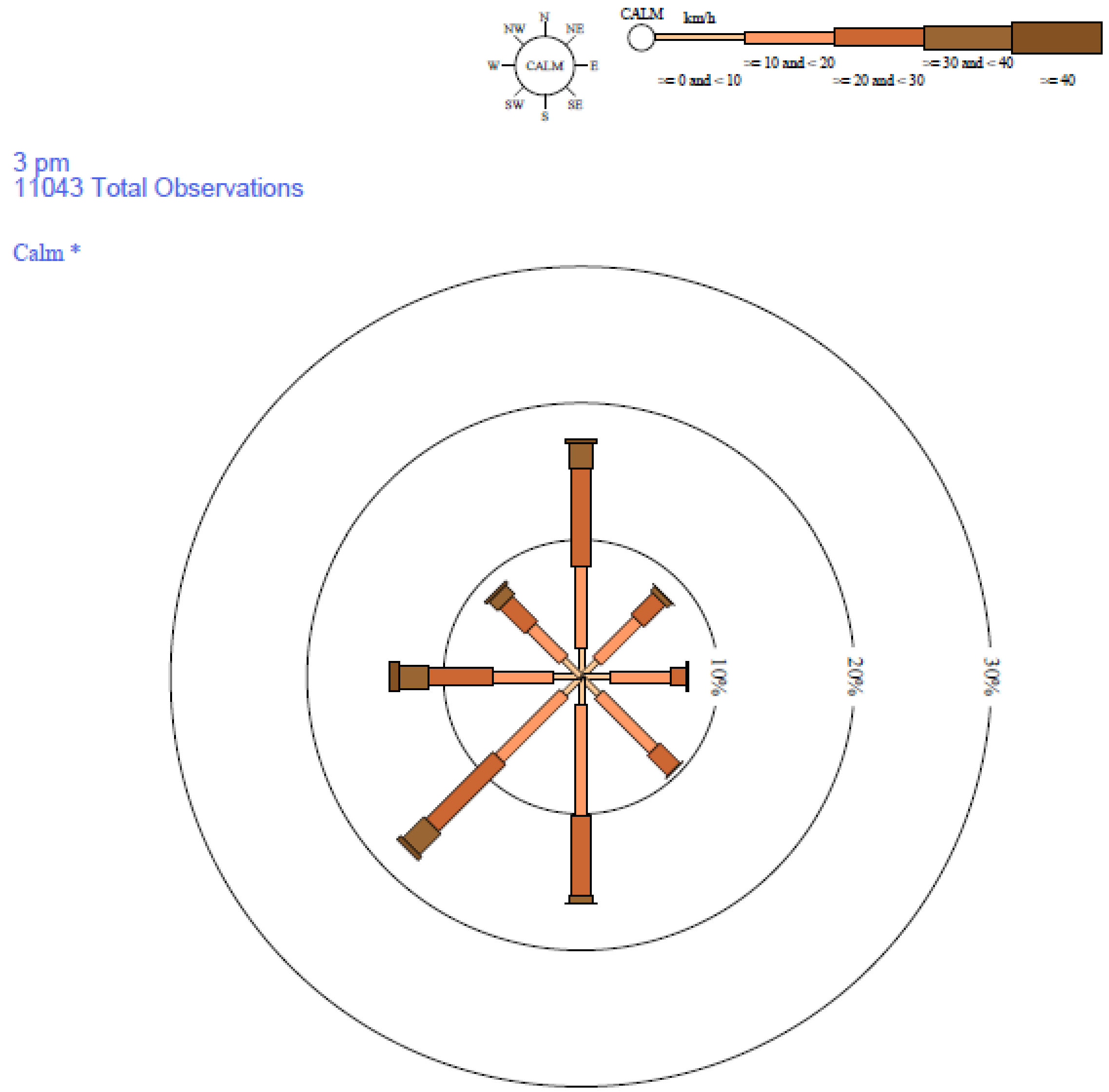


Figure 3-11 Afternoon (3 pm) wind directions observed at Tarcoola Aero weather station (1 Oct 1997 to 11 Aug 2021) (BOM, 2022a)

3.3 Soils

An overview of soils is described within this section. For a more detailed discussion on baseline information please refer to Appendix B1 *Baseline Soils Assessment, Atacama Project for Iluka Resources Limited* (CDM Smith, 2022a)

A baseline soil survey has been undertaken for the Project Area by CDM Smith (2022a) to analyse and characterise the topsoil and subsurface soils within the Atacama Project Area (refer Figure 3-12 for Project Area boundary).

Five soil landscapes have been identified by CDM Smith (2022a) within the Project Area:

- Unit 1 – parallel dunes with narrow spinifex swales
- Unit 2 – parallel dunes with narrow and broad bluebush swales
- Unit 3 – gently undulating rises
- Unit 4 – gently undulating plains to level plains
- Unit 5 – level swale depressions.

The distribution of these systems is shown in Figure 3-12.

Surface soil texture on the dunes is sand or loamy sand and grades to sandy loam, light sandy clay loam, sandy clay loam and loam on the swales.

CDM Smith (2022a) describe the soil profile and soil materials in order of increasing depth as follows:

- Dune A horizons– up to 80 cm in depth consisting of brown, or yellow-brown topsoil of sand and loamy sand with the potential presence of fine-earth carbonate concentrations.
- Spinifex swale A horizons– between 10 and 30 cm depth consisting of brown, or yellow brown topsoil of sandy loam, light sandy clay loam, sandy clay loam or clay loam with varying fine-earth carbonate concentrations. Topsoil over soil carbonate layers. These materials should be preserved for rehabilitation.
- Bluebush swale A horizons– between 10 and 30 cm consisting of brown, yellow brown sandy clay loam or clay loam with varying fine-earth carbonate concentrations and surface calcrete fragments at some locations.
- Soil carbonate horizon– between 25 and 40 cm depth consisting of brown, yellow brown or light grey topsoil of sandy loam to clay loam with very high fine-earth concentrations.
- Pedogenic clay horizon– between 500 and 600 cm in depth consisting of red sandy clay, light clay or light medium clay with no fine-earth carbonate or course fragments. These materials form a discontinuous, horizontal clay lens and the soil material above and below this clay lens is red sandy loam to clay loam.
- Pidinga loam consisting of yellow, yellow-brown, pale grey and grey sandy clay loam to clay loam with no fine-earth carbonate found 1400 cm below surface. Silcrete may occur at one or more depths and is used as a marker to the heavy mineral ore body.

- Pidinga sand consisting of grey and dark grey sands, fine sands and loamy sands above and within the heavy mineral ore body found 1700 cm below surface. Yellow, yellow-brown and pale grey bands of sand and loamy sand maybe present, but soil colour is more consistently grey compared to Pidinga loams.

In terms of soil material properties, there are subtle differences between topsoils with dune topsoils being the lightest (most coarse) and Spinifex topsoils slightly heavier (finer) than Bluebush topsoils. There is a general trend of increasing clay content in the subsoils, peaking in the pedogenic clays, and then becoming lighter with increasing depth through the overburden sequence. Pedogenic clays and pidinga loams are dispersive, as evident in aggregate testing and high levels of exchangeable sodium, making them prone to soil erosion.

Soil nutrient status is low and the ability of topsoils to store and retain nutrients is also low, with the organic matter held in the topsoil likely playing a key role in supporting the nutritional needs of the existing vegetation cover. Salinities are low to moderate and are highest in the carbonate and pedogenic clays. Topsoils and the underlying carbonate layers are alkaline, with carbonate layers exhibiting a particularly high pH making them unsuitable for seed germination directly. Deeper soil materials are more acidic.

There was no evidence of acid sulphate soils (ASS) in the topsoil and subsoil (CDM Smith, 2022a). For information on ASS at depth within the lithology please refer to Section 3.6 (Geochemistry).

A baseline soil survey of J-A (through which the southern corridor of the Atacama Project Area passes) reported that surface soils were similar across the Ambrosia area and are classified as Calcarosols with the upper 1.5 m consisting of a gradational increase in texture from sandy loam in the topsoil to clay loam in the subsoil. Soil texture was found to follow a characteristic profile with depth of increasing clay content from the surface to the pedogenic clays and then decreasing through the Pidinga Formation and into the Aeolian sand (SKM, 2014). Water retention curves reveal that the soil materials have a high-water storage capacity to support vegetation.

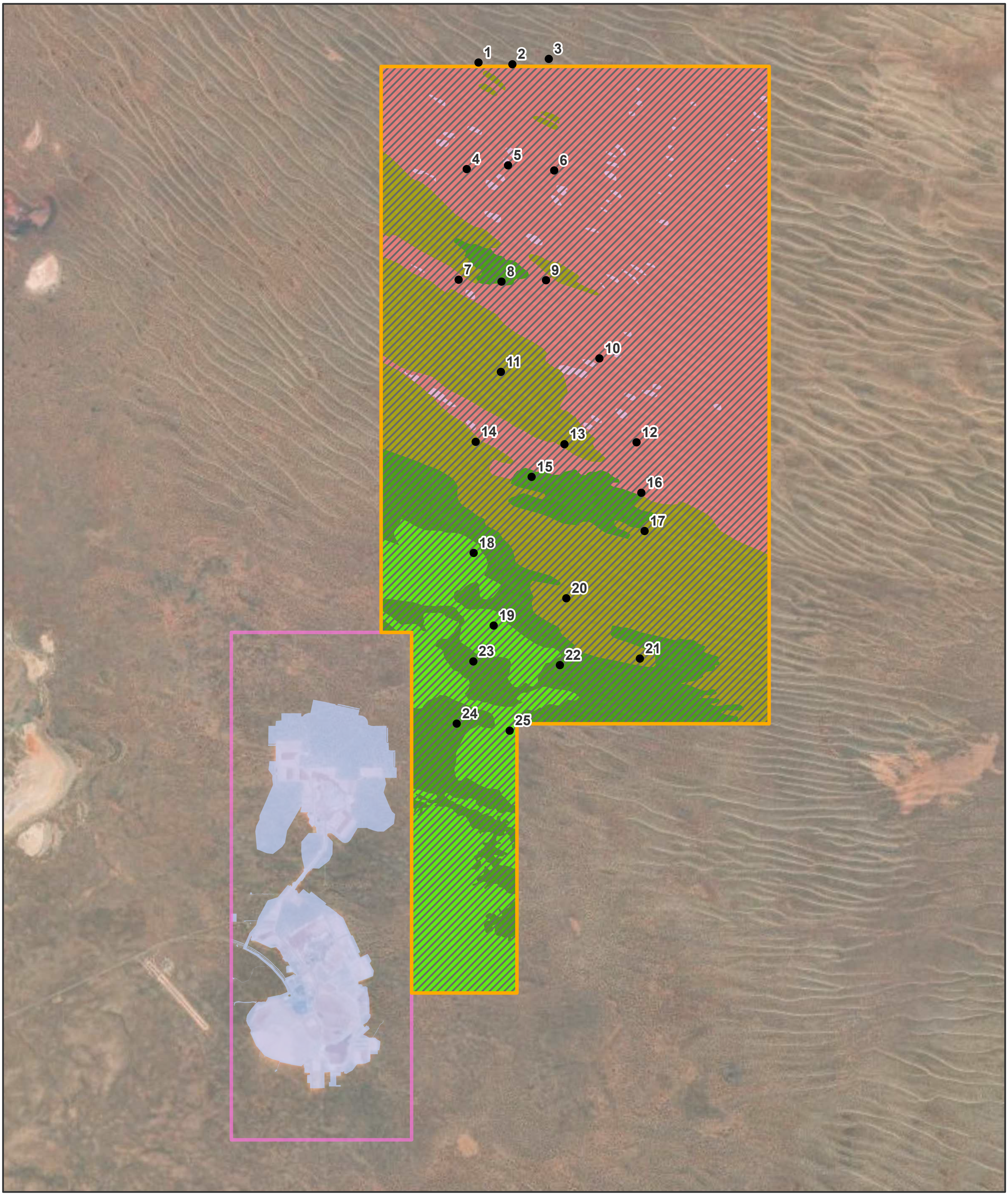


Figure 3-12 Soil units in the Atacama area

- Project area
- ML 6315
- ML 6315 Disturbance Footprint
- Sampling site

Inferred from vegetation mapping

Soil landscape units

- U1: Parallel dunes with narrow spinifex swales
- U2: Parallel dunes with bluebush swales
- U3: Gently undulating rises
- U4: Gently undulating plains to level plains
- U5: Level swale depressions

0 2 4
Kilometres

Datum/Projection:
GDA 1994 MGA Zone 53

Project: 20409-SH/OK Date: 2/8/2023

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3.4 Geology

An overview of geology is described within this section. For a more detailed discussion please refer to Appendix B2 *Atacama Project Groundwater and Geochemical Baseline Report (*EMM, 2022a*)*.

Descriptions of the regional, local deposit geology, stratigraphy and mineralisation for the Project Area are provided in this section.

3.4.1 Regional geology

The Atacama deposit occurs in Tertiary age sediments and sedimentary rocks of the Eucla Basin. The Eucla Basin includes sediments deposited in marine and terrestrial settings in the south-western part of South Australia (Benbow et al. 1995).

The regional geology of south-western South Australia including the Eucla Basin is shown in Figure. Local stratigraphy is shown in Figure 3-14.

The Eucla Basin in underlain by Archaean to Mesoproterozoic rocks of the Gawler Craton and Coompana Block which comprise much of the granitic basement. This is overlain by late Proterozoic to early Palaeozoic sediments which form the Officer Basin in the northern region. The southern coastal region is overlain by Permian sediments referred to as the Denman Basin. To the west of the Project, is the Early to Late Cretaceous Bight Basin which is comprised of coarse sandstone and shale of the Loongana and Madura Formation (EMM, 2022a).

The Eucla Basin is the largest onshore Cainozoic basin in the world and contains palaeodrainage with headwaters in the Musgrave Block and the Gawler Craton. The tertiary sequence being defined as the Middle to Late Eocene sediments of the Burdunga Subgroup, the Middle Eocene to Middle Miocene marine limestone of the Eucla Group and the Early Miocene to Early Pliocene terrigenous sediments of the Immarna Group (EMM, 2022).

From oldest to youngest, the Pidinga Formation, Hampton Sandstone and Ooldea Sands make up the Burdunga Subgroup of the Immarna Group which represents a dominant stratigraphic sequence locally to both the J-A mine and the Atacama Project Area. The heavy mineral (HM) sands, targeted by Iluka, are hosted within the Ooldea Sands.

Undifferentiated Quaternary aeolian sediments overlie the tertiary sequences making up the Eucla Basin in the far north to the south-east, with the Bridgewater Formation found along the far north-west coast of the Eyre Peninsula.

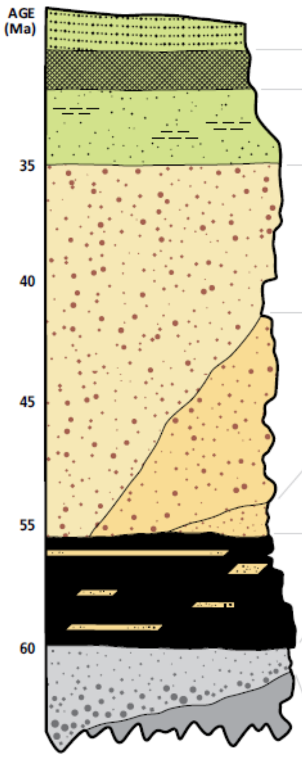
Figure 3-13 Regional geology

3.4.2 Local geology

Based on a literature review and drilling programs in the region, the following key geological units are present (from oldest to youngest) locally as outlined in Table 3-4 and Figure 3-14.

Table 3-4 Local geology (Source: EMM, 2022a)

Age	Group/sub-group	Unit	Lithology
Archaean to mid-Proterozoic	-	Gawler Craton	The basement is made up of granite and gneiss rocks. Commonly overlain by highly weathered saprolite – a white clay or off-white silt. The saprolite layer may be tens of metres thick with the interface between saprolite and basement rock usually occurring between 100-150 m below ground.
Middle to late Eocene	Burdunga Subgroup	Pidinga Formation	Interbedded, well-sorted, fine to coarse-grained carbonaceous sand and silt with minor lignite. Flood zone clays and lignite, fluvial/estuarine channel sands, gravelly (carbonaceous) coarse sands.
		Hampton Sandstone	Sand, generally quartz-rich, clayey at base, glauconitic and fossiliferous.
		Ooldea Sands	Fine to medium grained marine sand, with coarse sands at surf zones. Orange/red, becoming yellow to orange with depth. Heavy mineral content. Generally, 20-30 m thick.
Miocene to Pliocene	Immarna Group	Garford Formation	Mudstone, carbonate, stromatolitic, oncolytic and oolitic, gastropods, minor sandstone horizons. Upward change from argillaceous to carbonate mudstone. Lacustrine.
Quaternary	-	Aeolian sands and loam	Clayey sands (5-15 m thick) overlain by a more clayey horizon (5-12 m thick) as a result of pedogenic processes. A yellow to orange colour is produced by the variable distribution of iron oxides throughout the unit.



LITHOLOGY	INFERRED STRATIGRAPHIC UNIT	COLOUR	DESCRIPTION	DEPOSITIONAL ENVIRONMENT
Aeolian sands	Wintrena Formation	Tan, light brown, light brown-red	Fine-medium sand, moderately sorted, subrounded-angular, moderate sphericity	Aeolian/alluvial
Calcrete		White, light to dark grey, mottled yellow orange-light brown	Hard, pedogenic	
Loam/sandy clay		Yellow-orange to red-orange, red-brown	Sandy clay: fine, poorly sorted, subangular-angular, high sphericity Silty sand: fine-moderate, poorly sorted, subangular, moderate-high sphericity	
Sand	Ooldea Sands	Yellow-orange, tan, rust, red-orange, light brown-orange, brown, light brown, light yellow, grey, olive Mottled red/blue/yellow, red-blue, violet blue when HM present Trace minor brown banding	Sand: fine, moderate-very well sorted, rounded-subangular, high sphericity Silty sand: fine, well sorted, rounded-subrounded, high sphericity Sections of fine, poorly sorted, angular sand observed Interspersed cemented sand horizons, up to 3 m thick, containing fine, well-sorted sand, high sphericity Trace cement nodules observed HM observed	Marine
Carbonaceous sand	Pidinga Formation	Violet, blue violet, brown, light yellow-orange, tan, mottled red violet/blue violet/yellow, light brown	Sand: fine-medium, moderate to well-sorted, subrounded-subangular, moderate-high sphericity Sections of coarse, poorly sorted, angular sand observed Trace iron cement observed Interspersed cemented sand horizons	Fluvial/estuarine
Sandstone	Hampton Sandstone	Orange/violet	Hard, fractured. Open fractures, moderately to intensely fractured (recovered in mostly 0.1–0.2 m lengths), mostly 0° (horizontal) fractures, trace fractures between 20-45° Interbedded sandy clay: mottled light grey/light yellow-orange	Marine
Lignite	Pidinga Formation	Black, brown-black, dark brown	Lignite: Competent, moderately soft rock[1] Sandy lignite: light brown/light yellow-grey very fine to medium sand, poorly sorted, subangular-subrounded, moderate-high sphericity Clayey lignite and areas of interbedded clay and lignite observed	Lagoonal
Saprolite	Gawler Craton	Mottled grey with white/tan, light grey to pale light blue, yellow-green	Sandy clay at the top of the layer, increasing quartz content with depth. Hard bands/quartz veins present throughout Trace hornblende present Iron staining present on some quartz Some zones containing vugs Sericite and chlorite present towards the bottom of the layer Transition from clay to highly weathered rock with evidence of fracturing at the bottom of the layer	n/a
Bedrock	Gawler Craton	White and dark blue, blue-grey	Highly weathered gneiss: soft[2], some iron staining. Slightly fractured (0.3 to 1.0 m lengths recovered), half 0° (horizontal) fractures, half approximately 45° Gneiss/granite: Extremely hard rock[3], very slightly fractured (>1 m lengths recovered) to slightly fractured (0.3 to 1.0 m lengths recovered), shallow fractures (0–30°). Iron staining and sericite observed on fracture surfaces Potential pyrite observed	n/a

Notes:
[1] *Moderately soft rock is defined as: "Shallow indentations (1 to 3 mm) can be made by firm blows with point of a geologic pick. Can be peeled with pocket knife with difficulty." (EMM 2018)*
[2] *Soft rock is defined as: "Hand-held specimen crumbles under firm blows with point of geologic pick." (EMM 2018)*
[3] *Extremely hard rock is defined as "Intact specimen can only be chipped, not broken, by repeated, heavy blows of a geologic hammer." (EMM 2018)*

EMM creating opportunities

Atacama stratigraphic key
Iluka Resources
Atacama Groundwater and Geochemical Baseline

Figure 3-14 Local Stratigraphy (Source: EMM 2022a)

3.5 Hydrogeology

An overview of hydrogeology is described within this section. For a more detailed discussion please refer to Appendix B2 *Atacama Project Groundwater and Geochemical Baseline Report (*EMM, 2022a*)*.

Descriptions of the regional and local hydrogeology, groundwater dependent ecosystems (GDEs), the conceptual groundwater model and geochemistry for the Project Area are provided in this section.

3.5.1 Regional hydrogeology

The Project's regional hydrogeological understanding is developed from groundwater drilling programs, groundwater monitoring surveys, and numerical groundwater modelling undertaken across Iluka assets. Sites include Iluka's exploration projects (Sonoran and Typhoon), Iluka's J-A Mine site; and from studies commissioned by Iluka specifically for this Project. , The following provides a summary of the findings.

Groundwater moves slowly south-west from the Project Area, towards the J-A Mine site. Pre-mining groundwater levels at the J-A mine are inferred to have ranged between 90 m AHD and 100 m AHD (EMM, 2020a; refer Figure 3-17). Current groundwater levels are elevated due to seepage of tailings creating a mound beneath the mine site, raising levels to between 100 m AHD and 130 m AHD. Locally, the groundwater mound influences flow, however, the general groundwater flow direction remains south-west.

Groundwater continues flowing south-west towards playa lake evaporative discharge zones such as Lake Ifould, where groundwater levels are recorded to approximately 70 mAHD. Groundwater does not express at surface, continuing to flow south-west towards the J-A water supply palaeochannel, where water levels are approximately 20 m AHD.

The palaeochannels of the Nullarbor Plain are secondary groundwater flow systems within the regional area and are understood to be hydraulically distinct due to basement highs along the foot of the Ooldea Range. Groundwater within the palaeochannel, located in the western portion of the region, flows south-west with some westerly flow. This conceptualisation aligns with the State-wide 1:2,000,000 paleo-drainage and Cainozoic coastal barriers mapping by the Geological Survey of South Australia (EMM, 2022a) (Figure 3-15) which details that paleo-drainage originates further to the north-east beyond the Barton Ranges.

Three main hydrostratigraphic units (HSUs) are defined in the regional area and are based on each unit's permeability and porosity estimates. In order of depth from the land surface, the HSUs are Unit 1) Cenozoic sediments, which are mostly unsaturated yet permeable; Unit 2) Saprolite / weathered basement, which is clayey and of very low permeability and; Unit 3) Fresh basement, which is very impermeable aside from fracture networks which can host localised groundwater systems. Groundwater is found to occur only within the Gawler Craton basement rock.

As a result of low rainfall across the area (refer Section 3.2), groundwater recharge to the fractured rock is estimated to be less than 1 mm/year. Water quality, measured as total dissolved solids (TDS), from the fractured rock is poor, ranging between 21,900 to 36,000 mg/L. The beneficial use for groundwater is therefore not suitable for stock or potable use, which is limited to waters less than 10,000 mg/L TDS.

Figure 3-15 Regional geophysical magnetic survey, inferred faults and palaeodrainage (Source: EMM, 2022a)

3.5.2 Local hydrogeology

Groundwater level data have been sourced from three newly installed bores in the Project Area (ATMW01, ATMW02 and ATMW03) (Figure 3-16), and from groundwater monitoring surveys undertaken within the Eucla Basin at other Iluka Projects.

Groundwater levels measured from the newly installed Atacama bores range between 91.7 to 93.4 mAHD, validating the south-west groundwater flow direction towards playa lakes (70 mAHD), and the J-A water supply palaeochannel (20 mAHD) shown in Figure 3-17.

Measured groundwater level contours from June 2021 are shown in Figure 3-18 that are based on all groundwater monitoring bore data from J-A and Atacama. The latest groundwater levels available for the nearby Sonoran and Typhoon deposits (November 2019) have also been included in Figure 3-18 as the water table is not expected to significantly change over time in these areas and the data aids context in terms of regional groundwater levels.

It is important to note that mining has occurred at Jacinth since 2009, and seepage from the disposal of wet tailings in tailings storage facilities (TSF) has led to the development of groundwater mounds. The mound associated with the off-path TSF reached more than 40 m above pre-mining water table elevations, though it has fallen closer to 20 m currently. This mound has caused large perturbations in groundwater flow directions compared to the inferred pre-mining levels at some locations, with groundwater inferred to flow northward towards Ambrosia before returning to the regional east-west gradient.

There is an interpreted fault to the south of the Atacama deposit that runs along the eastern boundary of the adjacent J-A Mine. East of the fault, the groundwater system is interpreted to be isolated from the effects of tailings induced mounding, due to the fault potentially acting as barrier to groundwater flow and compartmentalising the groundwater system. The mound is expected to extend west and is predicted to reach Lake Ifould.

3.5.3 Recharge processes

Groundwater recharge from rainfall is expected to be low, due to low annual rainfall and high potential for evapotranspiration.

Topographic low points, Lake Ifould and Lake Tallacootra, may act as temporary recharge sources following high rainfall events, however as noted in EMM (2022a) the pre-mining groundwater contours do not appear to show significant zones of high recharge in these locations.

3.5.4 Discharge processes

Regionally, there are no permanent surface water features, however, there are a number of salinas in regions of low topography such as Lake Ifould and Lake Tallacootra. Dependent on the depth to groundwater, these salinas may act as groundwater discharge zones via capillary rise of groundwater, and subsequent evapotranspiration due to the observation of high salt content at the surface.

The groundwater levels suggest that the prevailing palaeochannel drainage causes groundwater flow to occur in a south-west to westerly flow direction. Further to the west of the current Eucla Basin deposits, this flow direction heads southward along the prevailing palaeochannel drainage lines, whereby groundwater is assumed to be discharged offshore to the ocean. This represents the largest regional discharge mechanism of the Eucla Basin hydrogeological system.

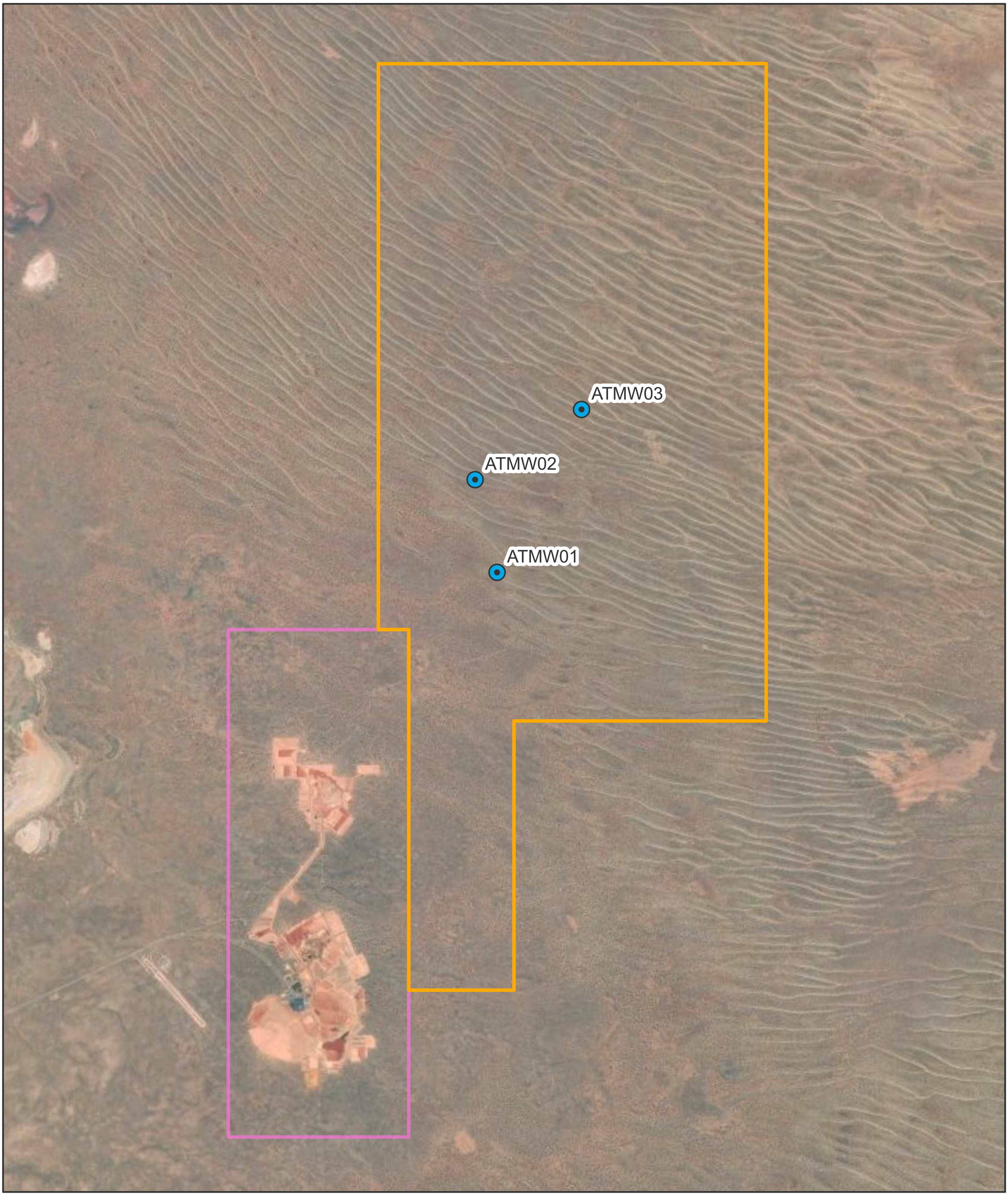


Figure 3-16 Monitoring bore locations

Project Area
ML 6315
Monitoring well locations

0 2 4
Kilometres

Datum/Projection:
GDA 1994 MGA Zone 53

Project: 20409-SH/OK Date: 2/8/2023

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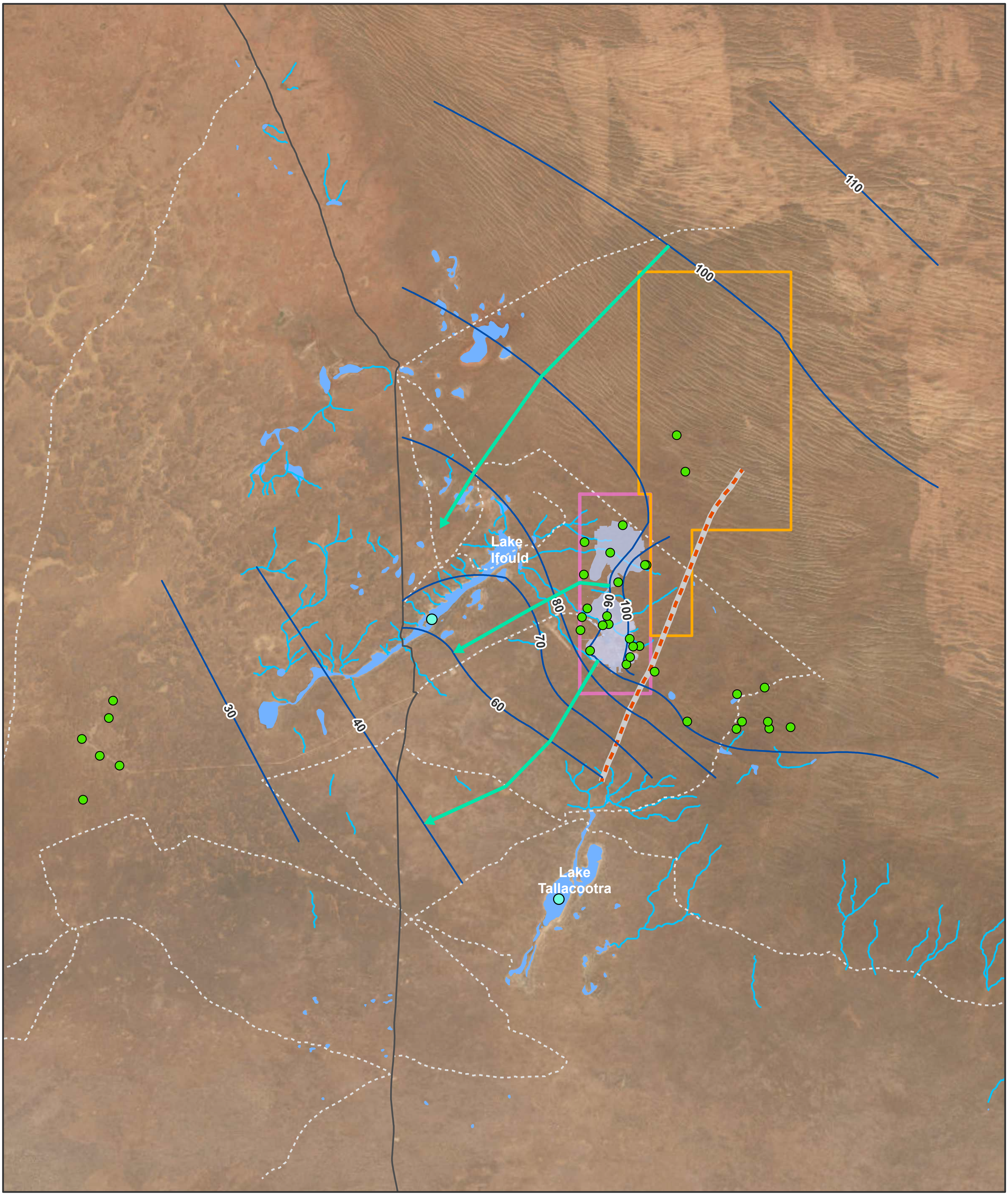

Figure 3-17 Conceptual pre-mining groundwater level contours

- Project Area
- ML 6315
- ML 6315 Disturbance Footprint
- Watercourse/drinage line
- Waterbody
- Local road
- Vehicular track
- Groundwater elevation (pre-mining)
- Inferred groundwater elevation
- 10m Inferred groundwater Contours (mAHD)
- Inferred groundwater flow direction
- Inferred fault

0 5 10
Kilometres

Datum/Projection:
GDA 1994 MGA Zone 53

Project: 20409-SH/OK Date: 2/8/2023

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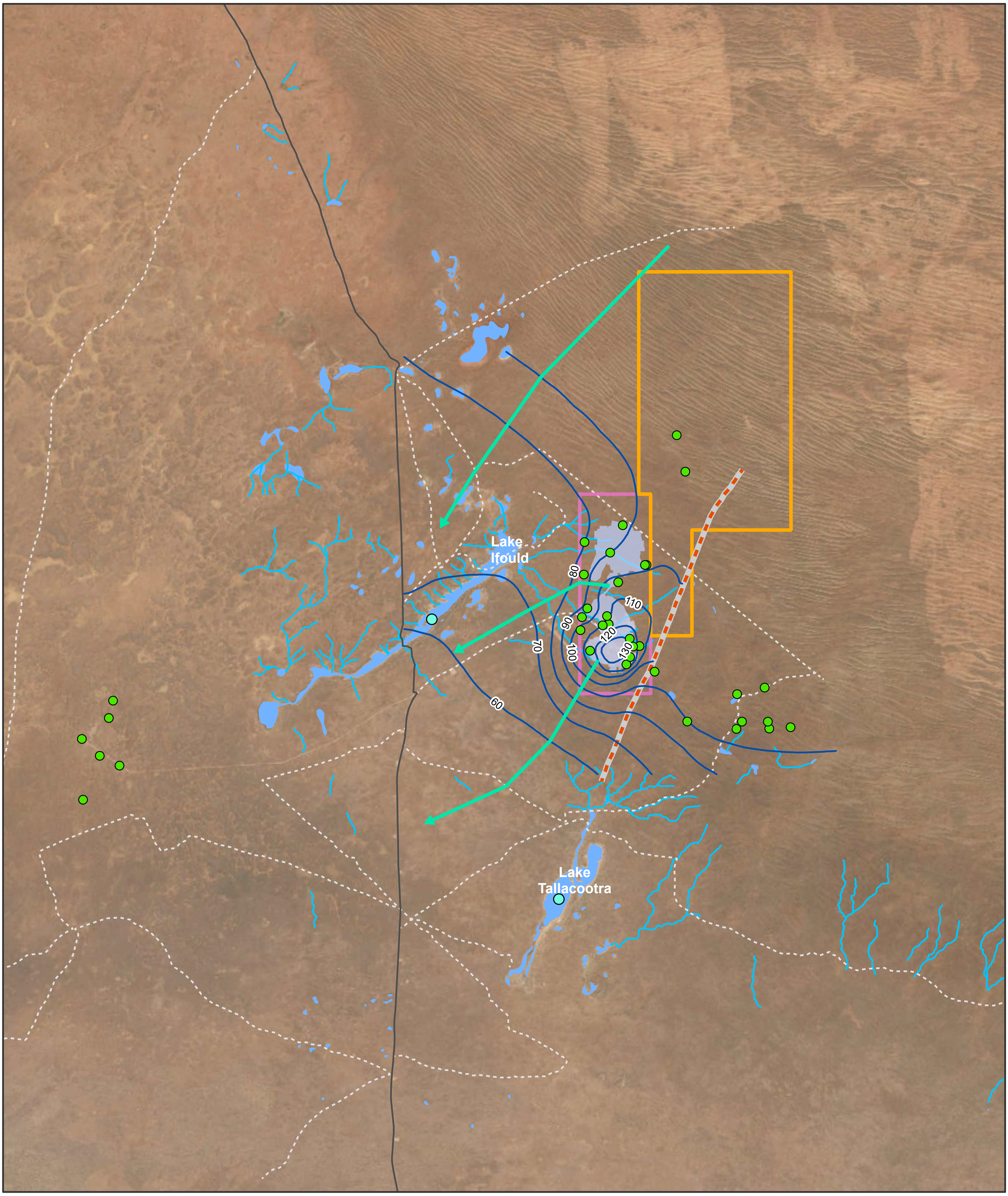

Figure 3-18 Measured groundwater level contours (June 2021)

3.5.5 Groundwater dependent ecosystems

The BoM GDE Atlas was used to identify the potential locations for Groundwater Dependent Ecosystems (GDE) in the vicinity of the Project Area which is outlined in Figure 3-19. The GDE Atlas does not specify ecosystem value, condition, sensitivity, threat or risk. It does however show areas where groundwater interactions may occur. The following has been summarised from the review of the GDE Atlas:

- There are no aquatic GDEs located within close proximity of the Project Area. The closest aquatic GDE is an unnamed low potential GDE approximately 7 km south of the Project Area
- Terrestrial GDEs (i.e., those that rely on the sub-surface presence of groundwater) are identified in the Project Area. These include Eucalyptus Mallee forest and Mallee woodland rated as low and high potential GDEs. However, considering the shallowest groundwater encountered in the Project Area is 75 m BGL, it is considered that the terrestrial species are more likely to rely on episodic rainfall and soil moisture rather than groundwater.

Subterranean GDEs (i.e., stygofauna) have not been analysed in proximity to the Project Area. It was considered by EMM (2022a) that there was a low likelihood of stygofauna presence in the Project Area due to the depth of the fractured rock aquifer and the highly saline nature of the groundwater environment. The closest existing stygofauna assessment near the Project Area was undertaken approximately 400 km away in Streaky Bay.

3.5.6 Environmental values (groundwater)

The Project is within the Alinytjara Wilurara Landscape Region, which is a non-prescribed groundwater resource.

The environmental values of groundwaters, as specified in the *Environment Protection (Water Quality) Policy 2015*, are presented in Table 3-5. Background EC concentrations from the Project have ranged from 36,000 to 38,100 µS/cm EC; approximately 23,488 to 24,384 mg/L TDS. Due to this high TDS concentration, the groundwater as Atacama is considered to have no environmental value.

Table 3-5 Environmental values of groundwater as specified in the Environment Protection Policy 2015

Background groundwater TDS (mg/L)	Drinking water for human consumption	Primary industries – irrigation and general water uses	Primary industries – livestock drinking water	Primary industries – aquaculture and human consumption of aquatic foods
<1,200 mg/L	X	X	X	X
≥1,200 mg/L and <3,000 mg/L		X	X	X
≥3,000 mg/L and <13,000 mg/L			X	X

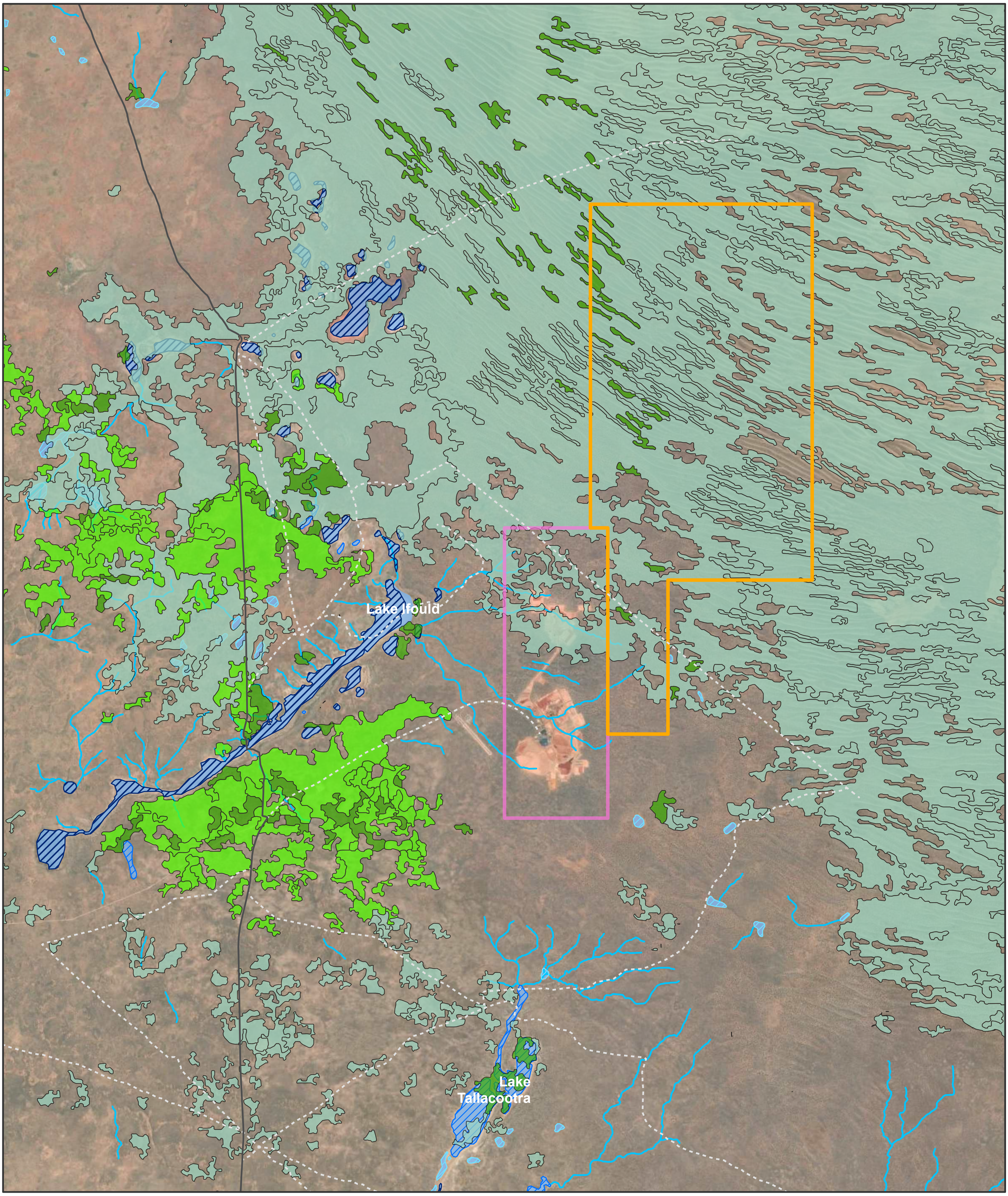

Figure 3-19 GDEs in the vicinity of the Project

3.5.7 Groundwater chemistry

Groundwater samples were collected at three groundwater monitoring bores installed at Atacama (ATMW01, ATMW02 and ATMW03) and tested for field chemistry (pH and temperature), major ions, nutrients and dissolved metals. The results of analysis are presented in Table 3-6, and compared against the extensive existing data set from the J-A regional groundwater monitoring bores, which were considered, by EMM, to be located far enough away from the J-A operations as to constitute baseline conditions (EMM, 2022a).

Table 3-6 Initial groundwater chemistry sampling results (October and December 2019)

Analyte	Unit	ATMW01	ATMW02	ATMW03	J-A – Regional[3]
Field temperature1	°C	22.1	20.6	23.6	-
Field pH1	-	6.71	6.79	6.64	4.8
Laboratory pH	-	6.13	6.18	7.79	-
Electrical conductivity	µS/cm	38,100	36,700	38,000	61,360
Total alkalinity as CaCO3	mg/L	35	54	230	74.5
Sulfate as SO4	mg/L	2,360	2,200	2,250	3,600
Chloride – dissolved	mg/L	13,400	12,800	13,200	24,000
Chloride:sulfate ratio	-	5.7	5.8	5.9	6.7
Calcium – dissolved	mg/L	585	334	431	744
Magnesium – dissolved	mg/L	882	888	822	1,850
Sodium – dissolved	mg/L	7,430	7,610	7,120	11,450
Potassium – dissolved	mg/L	202	324	249	276
Nitrate + Nitrite as N	mg/L	<0.01	<0.01	<0.01	1.2
Ammonia as N	mg/L	12	3.94	0.92	0.7
Total Kjeldahl nitrogen	mg/L	12.6	6.8	2.1	-
Dissolved metals					
Aluminium	mg/L	<0.01	<0.01	<0.01	23.2
Arsenic	mg/L	<0.001	<0.001	<0.001	0.004
Boron	mg/L	3.53	3.95	3.71	7.8
Barium	mg/L	0.048	0.107	0.172	0.064

[3] This includes MB06D, MB07, MB08D, MBN10, Canberra, MBN07, MBN01D, MBN01S, MBN11 and MB11D.

Analyte	Unit	ATMW01	ATMW02	ATMW03	J-A – Regional[3]
Beryllium	mg/L	<0.001	<0.001	<0.001	0.005
Cadmium	mg/L	<0.0001	<0.0001	<0.0001	0.001
Cobalt	mg/L	<0.001	<0.001	0.004	0.097
Chromium	mg/L	<0.001	<0.001	<0.001	0.012
Copper	mg/L	<0.001	<0.001	<0.001	0.070
Iron	mg/L	66.3	6.93	<0.05	7.0
Manganese	mg/L	4.54	5.36	0.26	5.2
Nickel	mg/L	0.003	0.009	0.077	0.205
Lead	mg/L	<0.001	<0.001	<0.001	0.003
Selenium	mg/L	<0.01	<0.01	<0.01	0.008
Vanadium	mg/L	<0.01	<0.01	<0.01	0.006
Zinc	mg/L	0.022	0.024	<0.005	0.363
Mercury	mg/L	<0.0001	<0.0001	<0.0001	<0.0001

Notes: 1. Field pH and field temperature values were measured on 10 December 2019 with groundwater collected via HydraSleeves

2. JA – regional values are the average values of samples collected from bores in regional areas (further from the J-A mine workings) in October 2019 (9 sites)

Samples from ATMW01, ATMW02 and ATMW03 at the Project site were analysed for radionuclides. The results are presented in Table 3-7 with Atacama Project data compared to the J-A regional bores[4], as well as bores at nearby Iluka Projects Sonoran and Typhoon (both in the Eucla Basin – Figure 3-20).

The results were found to generally be below the limit of detection for radionuclides, except for potassium-40, radium-226 and radium-228. Potassium-40 and Radium-226 measurements in the Atacama bores were found to be similar to those measured at J-A, Sonoran and Typhoon. The highest radium-226 activity of 0.3 Becquerels per litre (Bq/L) was measured in ATMW01, which is below the 5 Bq/L ANZECC (2000) guideline value. Radium-228 measurements in ATMW02 and ATMW03 are lower than those from J-A and Sonoran, and below the guideline value of 2 Bq/L. ATMW01 has an unusually high radium-228 activity of 4.61 Bq/L, which is higher than all the other sites and the guideline value.

[4] Noting regional bores are defined here as those identified by EMM as being relevant for regional data to define baseline water quality.

Table 3-7 Radionuclide results (December 2019)

Analyte	Unit	Atacama ATMW01	Atacama ATMW02	Atacama ATMW03	J-A average	Sonoran average	Typhoon average	Guideline
Actinium-227	Bq/L	<0.34	<0.20	<0.20	-	-	-	-
Lead-210	Bq/L	<10	<10	<10	-	<4.3	<2.8	-
Potassium-40	Bq/L	5.0	7.9	6.5	-	<6.2	<5.1	-
Protactinium-231	Bq/L	<2	<1	<1	-	-	-	-
Radium-223	Bq/L	<0.66	<0.23	<0.23	-	-	-	-
Radium-226	Bq/L	0.3	<0.2	<0.2	0.3	<1.8	<0.27	5
Radium-228	Bq/L	4.61	0.81	0.39	2.8	<1.1	<0.68	2
Thorium-227	Bq/L	<0.37	<0.20	<0.20	-	-	-	-
Thorium-228	Bq/L	<0.40	<0.20	<0.20	-	<31	<22	-
Thorium-230	Bq/L	<11	<10	<10	-	<23	<16	-
Thorium-234	Bq/L	<2.0	<2.0	<2.0	-	<2.8	<2.3	-
Uranium-235	Bq/L	<0.20	<0.20	<0.20	-	<1.2	<0.9	-

Note: 1. J-A average (regional), Sonoran average and Typhoon average columns represent the average radionuclide levels measured at the J-A mine (regional bores only) and Sonoran satellite deposit respectively, using all available data

2. Radium-228 measurements at Sonoran and Typhoon were obtained via measurement of 228-Ac and assuming equilibrium conditions

3. Guidelines values from ANZECC (2000) for livestock and irrigation water

Further baseline chemistry monitoring and sampling occurred in in September 2020, October 2020, June 2021 and November 2021[5]. Rainfall impeded access in November 2021, with only ATMW01 sampled. The latest data set for all bores (June 2021) is summarised in Table 3-8 and Table 3-9.

Since the initial sampling in 2019 the following changes and/ or observations are noted:

- field pH measurements have increased from 6.7 to an average of 8.3
- EC measurements have decreased by 3,000-5,000 µS/cm
- Total alkalinity in ATMW01 and ATMW02 has increased by 130 mg/L and 193 mg/L respectively
- dissolved iron and manganese concentrations have significantly decreased

[5] Further monitoring has occurred in May and October 2022 however this occurred after the finalization of EMM's baseline report and is not included here. Any further data collected since November 2021 will be included within the PEPR.

- radionuclide levels are generally below the limit of reporting and are otherwise lower than the measurements in 2019.

Table 3-8 Groundwater chemistry results (June 2021)

Analyte	Unit	Atacama ATMW01	Atacama ATMW02	Atacama ATMW03	J-A – Regional
Field temperature[1]	°C	21.5	24	20.3	20.6
Field pH[1]	-	8.3	8.0	8.6	4.8
Electrical conductivity	µS/cm	34,200	33,500	33,100	56,500
Total alkalinity as $CaCO_3$	mg/L	165	247	232	33
Sulfate as SO_4	mg/L	2,400	2,400	2,700	3,980
Chloride – dissolved	mg/L	12,900	14,200	12,500	21,800
Chloride:sulfate ratio	-	5.38	5.92	4.63	5.48
Calcium – dissolved	mg/L	790	450	660	887
Magnesium – dissolved	mg/L	540	650	200	1,830
Sodium – dissolved	mg/L	8,200	7,800	7,900	11,950
Potassium – dissolved	mg/L	160	260	200	278
Dissolved metals					
Aluminium	mg/L	<0.05	<0.05	<0.05	12.4
Cadmium	mg/L	<0.0005	<0.0005	<0.0005	0.002
Copper	mg/L	<0.005	<0.005	<0.005	0.05
Iron	mg/L	0.079	0.17	0.054	4.5
Manganese	mg/L	0.26	0.96	0.046	6.5
Nickel	mg/L	<0.001	<0.001	<0.001	0.3

1. Note: JA -regional values of samples collected from bores in regional areas (further from J-A mine workings) in June 2021

Table 3-9 Radionuclide results (September 2020)

Analyte	Unit	Atacama ATMW01	Atacama ATMW02	Atacama ATMW03	J-A average	Sonoran average	Typhoon average	Guideline
Actinium-227	Bq/L	<0.40	<0.40	<0.40	-	-	-	-
Lead-210	Bq/L	<10	<10	<10	-	<4.3	<2.8	-
Potassium-40	Bq/L	<2.0	7.8	6.9	-	<6.2	<5.1	-
Protactinium-231	Bq/L	<1	<1	<1	-	-	-	-
Radium-223	Bq/L	<0.40	<0.47	<0.43	-	-	-	-
Radium-226	Bq/L	<0.20	<0.21	0.21	0.57	<1.8	<0.27	5
Radium-228	Bq/L	0.26	0.33	<0.33	0.66	<1.1	<0.68	2
Thorium-227	Bq/L	<0.40	<0.40	<0.40	-	-	-	-

Analyte	Unit	Atacama ATMW01	Atacama ATMW02	Atacama ATMW03	J-A average	Sonoran average	Typhoon average	Guideline
Thorium-228	Bq/L	<0.20	0.91	<0.20	0.032	<31	<22	-
Thorium-230	Bq/L	<10	<10	<10	-	<23	<16	-
Thorium-234	Bq/L	<2.0	<2.0	<2.0	-	<2.8	<2.3	-
Uranium-235	Bq/L	<0.20	<0.20	<0.20	-	<1.2	<0.9	-

Note: 1. J-A average (regional), Sonoran average and Typhoon average columns represent the average radionuclide levels measured at the J-A mine (reginal bores only) and the Sonoran and Typhoon satellite deposit respectively, using all available data

2. Ra-228 measurements at Sonoran and Typhoon were obtained via measurement of 228-Ac and assuming equilibrium conditions

3. Guidelines values from ANZECC (2000) for livestock and irrigation water

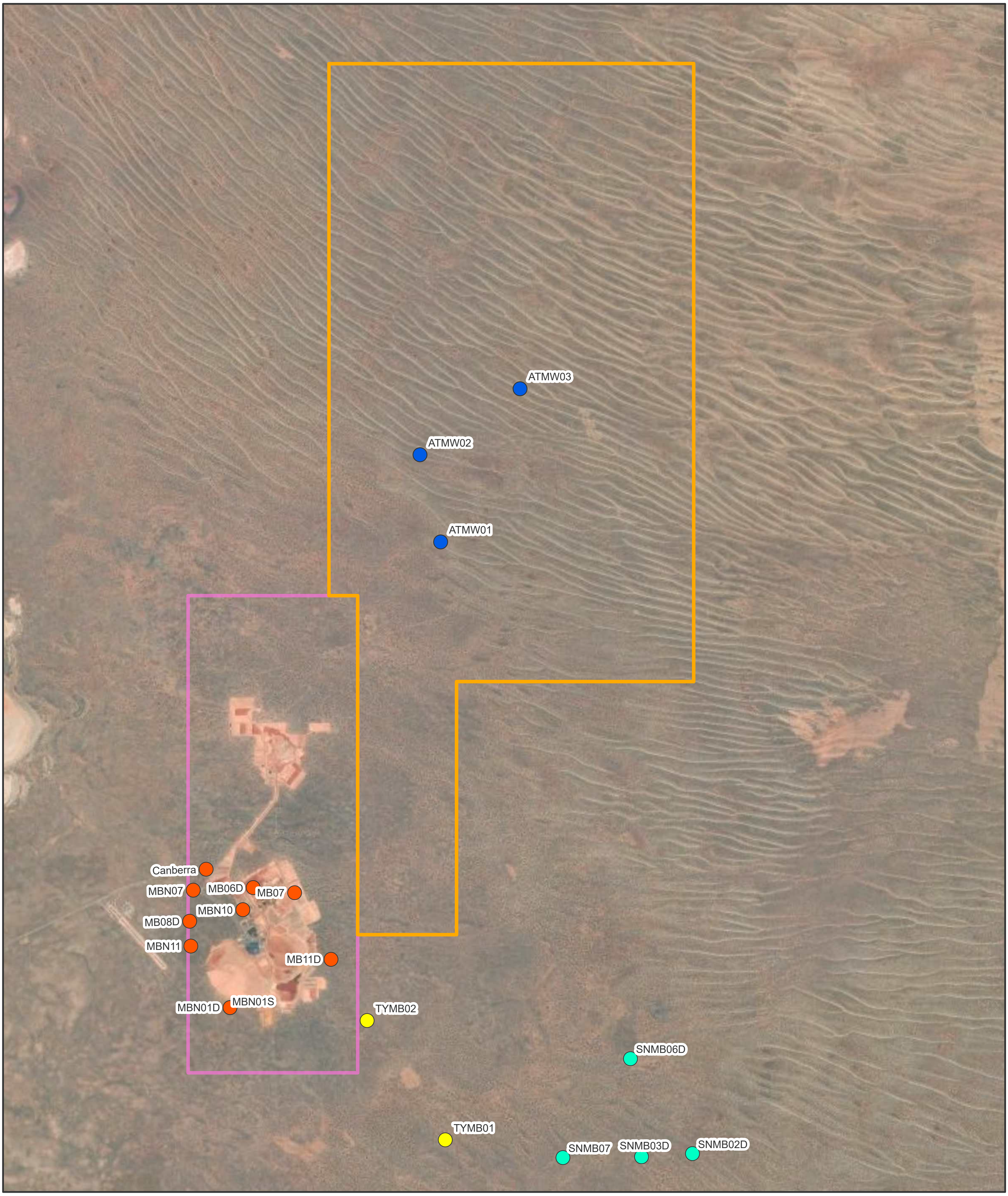

Figure 3-20 Regional groundwater chemistry monitoring locations

Project area
ML 6315

Atacama groundwater wells
Typhoon groundwater wells
Sonoran groundwater wells
J-A (regional) groundwater wells

0 2 4
Kilometres

Datum/Projection:
GDA 1994 MGA Zone 53

Project: 20409-SH/OK Date: 2/8/2023

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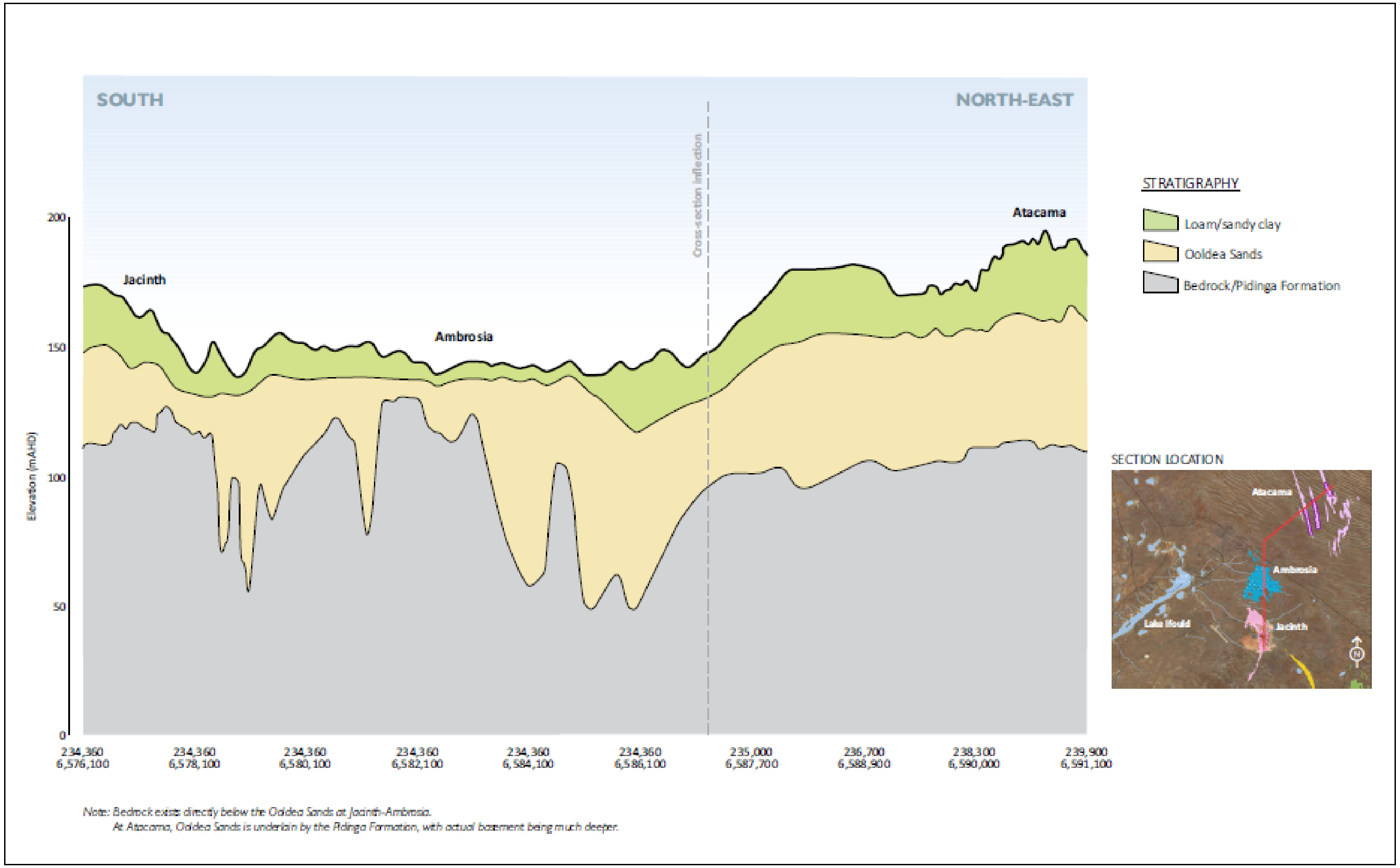
3.5.8 Conceptual hydrogeochemical model

A conceptual hydrogeochemical model has been created for the Project by EMM (2022a). Table 3-10 below provides a summary of the hydrogeological framework, groundwater recharge and discharge, flow directions, hydrochemistry and geochemistry. The hydrogeological conceptual model is represented visually in Figure 3-21 and Figure 3-22.

Table 3-10 Summary of conceptual hydrogeochemical model (EMM, 2022)

Feature	Summary of knowledge
Hydrogeological framework	• The Eucla Basin is comprised of Cainozoic sediments of terrestrial and marine origin. • The Burdunga Subgroup, which the Ooldea Sands is a part of and hosts the heavy mineral ore bodies, is one of several groups in the Eucla Basin, and occurs across the study area. • The Eucla Basin is underlain by Archaean to Mesoproterozoic rocks of the Gawler Craton. • Faulting has the potential to disrupt regional groundwater flow. • Four hydrostratigraphic units have been identified: loam, sands, lignite and basement.
Aquifer properties	Horizontal hydraulic conductivity (Kh): • Loam: 1.2 to 4.2 m/d, mean 2.0 m/d. • Sands: 0.1 to 14.0 m/d, mean 6.9 m/d. • Weathered basement: 0.2 to 1.2 m/d, mean 0.6 m/d. • Hydraulic 'slug' testing: 5 x 10-4 to 2 x 10-2 m/d, mean 7.5 x 10-3 m/d across the weathered basement. Specific yield (Sy). • Loam: 18% to 45%, mean 32%. • Sands: 18% to 44%, mean 34%. • Weathered basement: 17% to 40%, mean 30%.
Groundwater level and flow	• Regional groundwater flow occurs generally south-west with some westerly flow. • The pre-mining water table elevation in the Project Area sits either in the basement or sands depending on weathering and the top elevation of the Gawler Craton. • Depth to groundwater is approximately 95 and 106 mAHD (greater than 60 m below ground level (mBGL)). • The hydraulic head gradient away from the mine site is around 0.1 to 0.2. • A fault to the east and south of J-A appears to reduce propagation of groundwater flow, causing potential compartmentalisation of the groundwater system.
Recharge mechanisms	• Diffuse recharge from rainfall is expected to be low, estimated at less than 1 mm/year in the current groundwater flow model (EMM 2019). • Ephemeral recharge may occur from Lake Ifould and Lake Tallacootra following events of high rainfall. These recharge events are expected to be at relatively low rates considering play lakes typically form groundwater discharge zones. • Enhanced recharge from tailings seepage has been identified at Jacinth and will occur at other future tailings cells.



Conceptual hyudrostratigraphic cross section through Jacinth, Ambrosia, and Atacama
Iluka Resources
Atacama Groundwater and Geochemical Baseline

Figure 3-21 Conceptual Hydrostratigraphic cross section (South to North-East) (Source: EMM, 2022a)

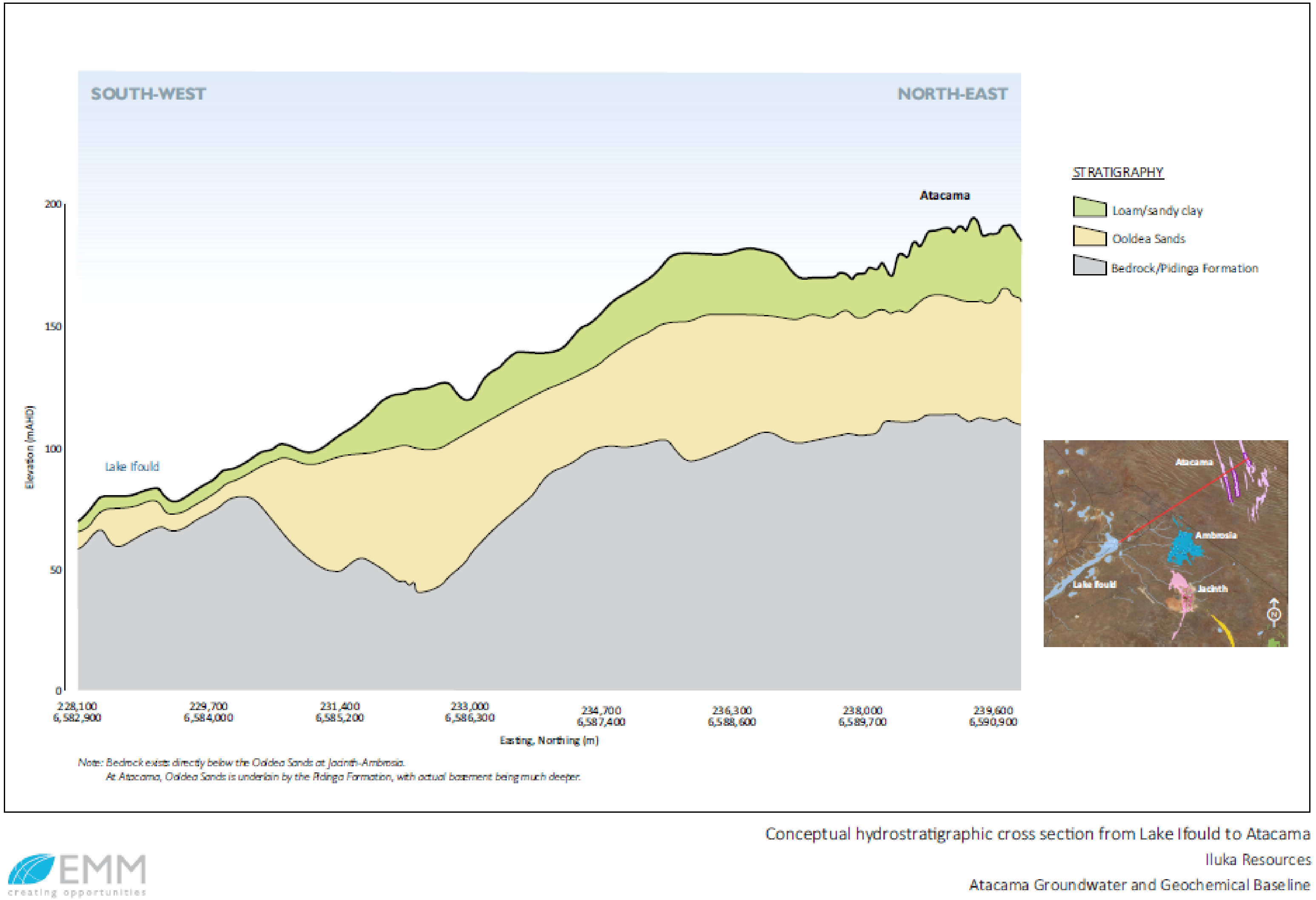


Figure 3-22 Conceptual Hydrostratigraphic cross section (South-West to North-East) (Source: EMM, 2022a)

3.6 Geochemistry

An overview of geochemistry is described within this section. For a more detailed discussion please refer to Appendix B1 *Baseline Soils Assessment, Atacama Project for Iluka Resources Limited (*CDM Smith, 2022a*)*, Appendix B2 *Atacama Project Groundwater and Geochemical Baseline Report (*EMM, 2022a*)* and Appendix B4 *Sediment sampling and analysis for Atacama Development Project (*CDM Smith, 2022b*)*

Descriptions of the acid base accounting and ASS potential for lithology sampled within boreholes ATMW01, ATMW02 and ATMW03 (locations shown in Figure 3-16) for the Project Area are provided in this section.

3.6.1 Acid base accounting

The acid base account estimates the potential for a material to produce acid and neutralise acid. This is undertaken by calculating both the maximum potential acidity (MPA) and acid neutralisation capacity (ANC) of the sample. The difference between these two values is the net acid production potential (NAPP), which is expressed in units of kg H_2SO_4 (sulfuric acid) per tonne of material (EMM, 2022a).

The MPA is commonly conservatively estimated using the total sulfur content of a sample (Department of Industry, Innovation, and Science [DoIIS] 2016), assuming it is only present as pyrite. The ANC is calculated through back-titration after adding a known quantity of acid to the sample. A negative NAPP suggests that a sample may have sufficient neutralising capacity to prevent acid generation, while a positive value suggests the sample may be acid-generating (EMM, 2022a).

While MPA is commonly calculated using the total sulfur content as a conservative measure, the samples collected from Atacama have been analysed using chromium reducible sulfur content. The chromium reducible sulfur method measures the non-sulfate inorganic sulfur content, which provides a more accurate representation of the oxidisable sulfur in samples. This method was developed to avoid oxidising organic sulfur, which may be present in the lignite (EMM, 2022a).

Another indicator of potential AMD impacts is the ratio of ANC and MPA values. A higher ratio suggests greater acid neutralisation capacity in comparison to the potential acidity, and therefore is considered 'safer' for the prevention of acid generation. An ANC/MPA ratio of three or more signifies that the sample is likely to remain at an approximately neutral pH and should not cause acidic drainage (EMM, 2022a).

The net acid generation test (NAG) is a simple indicator of potential AMD complications. This test is performed by adding hydrogen peroxide to a sample to rapidly oxidise sulfide minerals, causing both acid-generating and acid-neutralising reactions to occur. The net amount of acid released from the sample is then determined by titration. A pH value after the NAG test (NAG pH) of less than 4.5 is an indicator that the sample is acid generating (EMM, 2022a).

Figure 3-23 presents the NAG pH and NAPP values from core samples at Atacama and Figure 3-24 shows the NAG pH values and the ANC/ MPA ratios. Results suggest that only the lignite layer is potentially acid forming (PAF). Table 3-11 summarises the depth, lithology and acid generation classification for each sample.

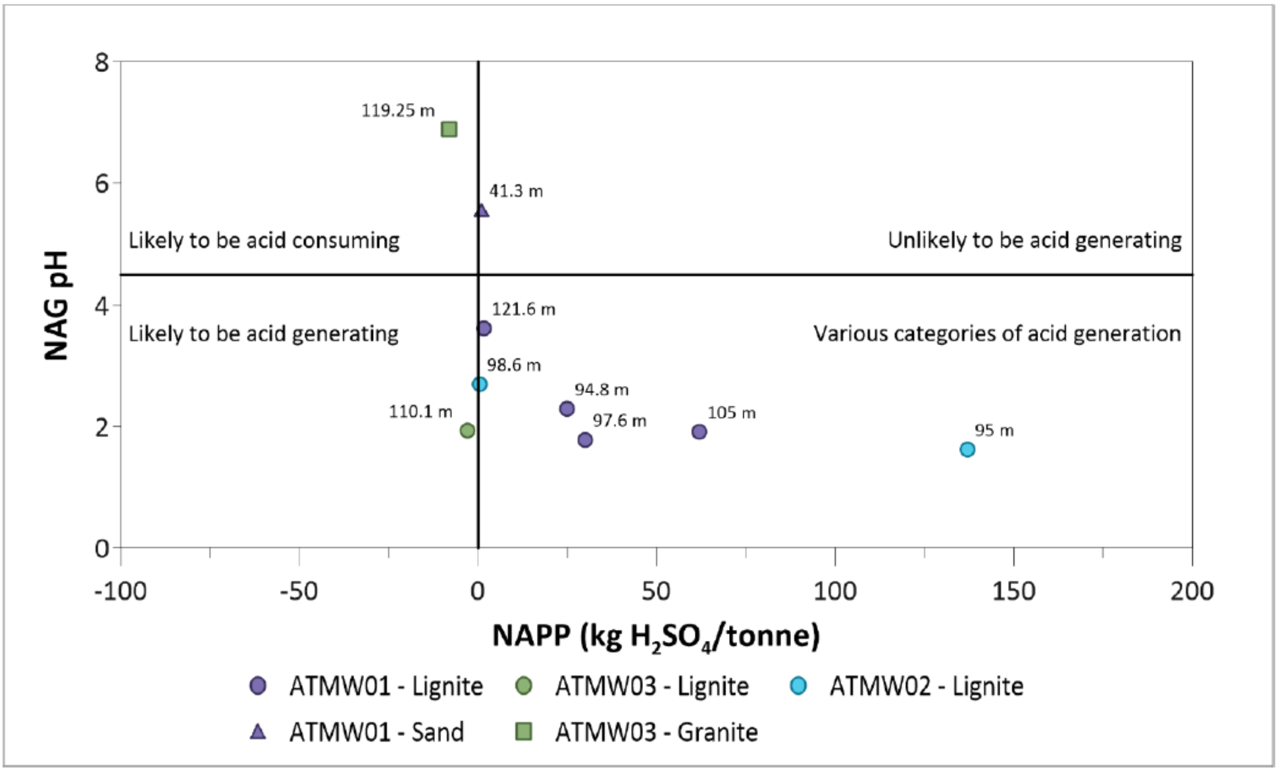


Figure 3-23 NAG pH and NAPP values for samples

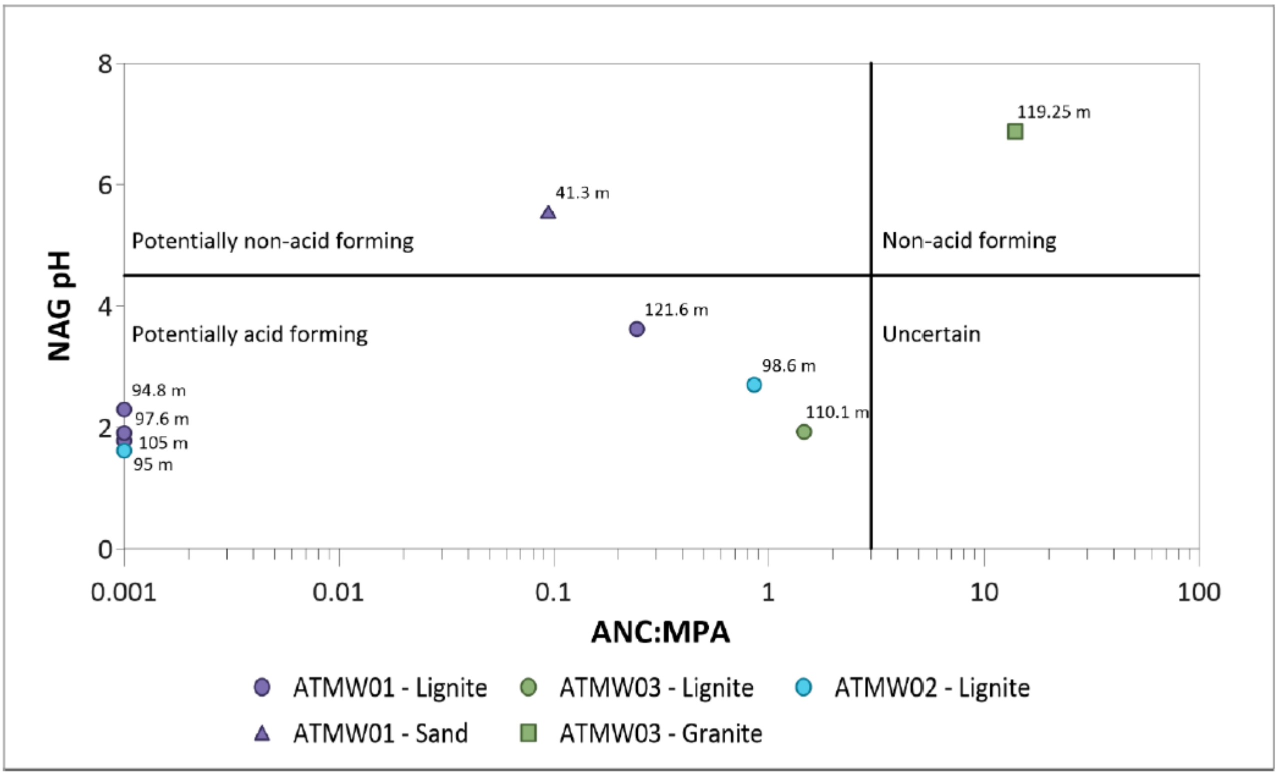


Figure 3-24 NAG pH and ANC:MPA ratio for samples

Table 3-11 Acid formation classification from Atacama rock samples (EMM, 2022a)

Borehole ID	Sample depth (mBGL)	Lithology	Classification
ATMW01	41.3	Cemented sand	Potentially non-acid forming
ATMW01	94.8	Lignite	Potentially acid forming
ATMW01	97.6	Lignite	Potentially acid forming
ATMW01	105	Lignite	Potentially acid forming
ATMW01	121.6	Lignite	Potentially acid forming
ATMW02	95	Lignite	Potentially acid forming
ATMW02	98.6	Lignite	Potentially acid forming
ATWM03	110.1	Lignite	Potentially acid forming
ATMW03	119.25	Granite	Non-acid forming

3.6.2 Acid sulfate soils

Acid Sulfate Soils (ASS) are those which have been affected by the oxidation of reduced inorganic sulfur (RIS), or those which could be affected by the oxidation of RIS contained within them (EMM, 2022a). Soils which have already undergone oxidation of RIS are termed actual acid sulfate soils (AASS), while those which contain RIS which has yet to be oxidised are called potential acid sulphate soils (PASS) (EMM, 2022a).

Table 3-12 indicates the classification for ASS parameters which has been used to identify if rock sample results in Table 3-13 from ATMW01 to 03 are actual ASS, PASS or an acid soil which has pH of <5. The following was found:

- The lignite and saprolite layers (below the orebody) in all three boreholes are PASS.
- The lignite in ATMW01 from 94.8 m to 97.6 mBGL are AASS.
- The aeolian sands, calcrete and loam in all three boreholes are not classified as ASS.
- The marine sands, sandstone and carbonaceous sand are not classified as ASS with the following exceptions:
    - The marine sands sampled in ATMW02 from 35.5 m BGL may be AASS.
    - The sandstone, carbonaceous sand and some of the marine sands overlaying a lignite layer in ATMW03 are classified as AASS.

The three samples submitted for analysis show a variation in the depth of the ASS. PASS is present below the ore body in all three samples. Samples ATMW02 and ATMW03 show the presence of AASS within the Marine Sands lithology (this is absent in ATWM01), which is the unit containing the ore body. Noting that the presence of AASS was generally observed in the last sample within the Marine sands as it transitioned into the next unit.

Table 3-12 Acid forming classification for Atacama rock samples (EMM, 2022a)

Parameter	PASS	AASS	Acid Soil
pHF	>4, commonly 7-9	<4	<5

Parameter	PASS	AASS	Acid Soil
pHFOX	<3	<3	Variable
ΔpH	>1	Variable	Variable
H2O2 reaction	Strong	Variable	Variable
SCR (% mass)	>0.01	Variable	<0.01

Table 3-13 Atacama rock sample results (EMM, 2022)

Sample location	Sample depth (mBGL)	Lithology	pHF	pHFOX	ΔpH	H2O2 reaction	SCR (% mass)	Classification
ATMW01	0.5	Aeolian sand	7.05	6.89	0.16	Weak	0.006	-
	2	Loam	8.31	6.8	1.51	Weak	0.008	-
	3.5	Loam	7.8	3.74	4.06	Weak	<0.005	-
	9.5	Loam	5	3.89	1.11	Weak	<0.005	-
	20.1	Marine sand	9.52	6.71	2.81	Weak	<0.005	-
	27.05	Marine sand	8.91	6.99	1.92	Weak	<0.005	-
	41.3	Marine sand	7.62	5.46	2.16	Weak	<0.005	-
	45.5	Marine sand	8.28	5.87	2.41	Weak	<0.005	-
	56.3	Marine sand	7.21	4.42	2.79	Weak	<0.005	-
	83.7	Carbonaceous sand	9.29	6.84	2.45	Weak	<0.005	-
	94.8	Lignite	3.17	0.47	2.7	Strong	0.7900	AASS
	97.6	Lignite	3.41	0.76	2.65	Strong	0.9660	AASS
	105	Lignite	4.21	1.16	3.05	Strong	1.9810	PASS
	121.6	Lignite	4.52	1.16	3.36	Weak	0.0713	PASS
	127.7	Saprolite	5.08	1.99	3.09	Strong	0.1380	PASS
	129.8	Saprolite	5.77	1.87	3.9	Strong	1.5250	PASS
	131.9	Saprolite	6.26	2.08	4.18	Weak	0.1820	PASS
	133	Saprolite	5.69	4.81	0.88	Strong	0.0540	PASS
	135	Saprolite	5.99	5.19	0.8	Strong	0.0310	PASS
ATMW02	1	Aeolian sand	8.1	7.65	0.45	Moderate	0.009	-
	2.2	Calcrete	8.85	7.41	1.44	Weak	<0.005	-
	6	Marine sand	5.5	4.07	1.43	Weak	<0.005	-
	16	Marine sand	9.52	6.24	3.28	Weak	<0.005	-
	35.5	Marine sand	3.91	3.47	0.44	Weak	<0.005	AASS

Sample location	Sample depth (mBGL)	Lithology	pHF	pHFOX	ΔpH	H2O2 reaction	SCR (% mass)	Classification
	41.5	Marine sand	3.42	2.72	0.7	Weak	<0.005	AASS
	43.3	Marine sand	3.74	3.1	0.64	Weak	<0.005	AASS
	95	Lignite	4.97	1.27	3.7	Strong	4.384	PASS
	98.6	Lignite	4.15	1.29	2.86	Strong	0.095	PASS
	105	Saprolite	4.8	1.34	3.46	Strong	1.57	PASS
	112.35	Saprolite	4.54	1.69	2.85	Strong	0.244	PASS
	116	Saprolite	6.21	3.77	2.44	Strong	0.017	PASS
ATMW03	0.5	Aeolian sand	7.48	6.01	1.47	Weak	<0.005	-
	3.7	Loam	5.23	4.4	0.93	Weak	<0.005	-
	5.7	Marine sand	4.15	3.39	0.76	Weak	<0.005	-
	13.5	Marine sand	5.27	6.62	-1.35	Weak	<0.005	-
	20.1	Marine sand	4.17	3.89	0.28	Weak	<0.005	-
	36.3	Marine sand	4.86	3.33	1.53	Weak	<0.005	-
	47.7	Marine sand	3.61	2.22	1.39	Weak	<0.005	AASS
	54.4	Carbonaceous sand	4.01	3.18	0.83	Weak	<0.005	AASS
	81.5	Sandstone	6.02	3.99	2.03	Weak	-	-
	88.75	Sandstone	3.35	2.9	0.45	Weak	<0.005	AASS
	110	Lignite	5.07	0.49	4.58	Strong	0.23	PASS
	114.25	Saprolite	6.07	2.07	4	Strong	0.332	PASS

3.7 Geohazards

The South Australian Resources Information Gateway (SARIG) identifies that the closest earthquake to occur near the Project Area was approximately 44.44 km to the south which was recorded on 25 September 1988 and had a magnitude of 3.8 (DEM, 2022a). No other earthquakes have been recorded within the local area and resultantly, the Project Area is not considered to be structurally unstable due to seismic activity. Figure 3-25 displays the earthquakes recorded in the region from 1840 to 2017.

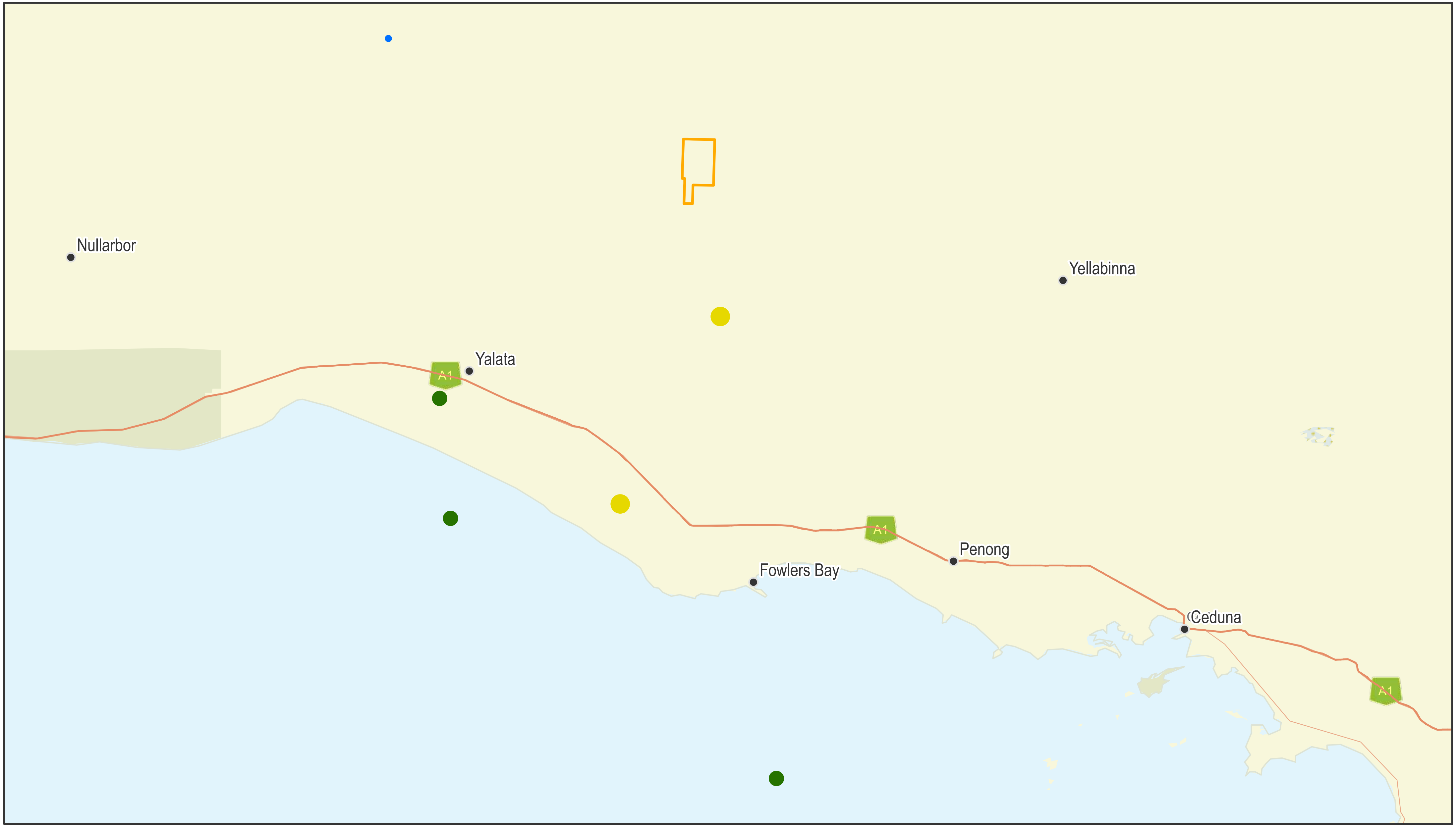


Figure 3-25: Earthquakes recorded in SA

Project Area

Magnitude

- Less than 1
- 2.00 - 2.99
- 3.00 - 3.99

0 30 60

Kilometres

Datum/Projection:
GCS GDA 1994
Project: 20409-OK Date: 15/09/2022

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3.8 Hydrology

An overview of hydrology is described within this section. For a more detailed discussion please refer to Appendix C1 *Atacama Surface Water Assessment (EMM, 2022b)* and Appendix B3 *Atacama Development Project: Atacama Surface Water Study (*Alluvium, 2014*)*.

The Project Area lies in the Eucla Basin where the Nullarbor Plain meets the Yellabinna Dunefield, and within ephemeral tributaries of the Lake Ifould catchment.

The Project Area is not:

- within a prescribed area under the Landscape SA Act, or
- within a water protection area under the River Murray Act 2003, or
- located within the Murray Darling Basin.

Rainfall in the area is infrequent and irregular both spatially and temporally across the broader region. Rainfall records from Tarcoola Aero (230 km northeast from study site) show an annual rainfall of 200-300mm (EMM, 2022) (Section 3.2). The annual evaporation exceeds monthly rainfall rates for all months (EMM, 2022).

There are no large watercourses within the Project Area. Instead, drainage occurs along dune swales into terminal pans, with no defined watercourses present throughout much of the area. Small, incised gullies have formed in the base of some dune swales through which the spine track (exploration access) has been cut. These gullies have formed in response to the hydrologic impacts caused by development and maintenance of the track.

The northern section of the Project Area lies to the northeast of the J-A catchment (EMM, 2022). The southern section of the Project Area lies in the upper J-A catchment (Figure 3-26). The J-A catchment drains west towards various unnamed salt pans and Lake Ifould (EMM, 2022). These upland watercourses form part of a dendritic network but are largely undefined in these upper reaches. Several defined reaches of Jacinth North Creek and Ambrosia South Creek lie within the south-western portion of the Project Area. Ephemeral stream channel form is generally controlled by high magnitude, low frequency floods and is modified at a slow rate by smaller flow events. Stream flow is ephemeral and only occurs in response to rainfall. Sediment movement through the watercourses typically occurs episodically in response to runoff generated by intense rainfall of short duration.

Stream flow is ephemeral and only occurs in response to rainfall. Streams do not receive groundwater discharges (EMM, 2022). There is limited gauged flow data available in the Project Area. Stream flow has occurred five times since mining operations commenced at the nearby J-A mine, in 2008, 2014, 2016 and twice in 2021. Smaller, intermittent flow events were also reported in 2009 and 2011. The troughs between the Atacama dunes act as undefined watercourses following rainfall events (Alluvium, 2014). Terminal pans are subject to aggregation when receiving fine sediments during episodic inflows (Alluvium, 2014). Losses and decreasing flow in the downstream direction encourages deposition and storage of sediment within the terminal pan system (Alluvium, 2014).

Alluvium (2014) note that anecdotal reports indicate that rainfall at J-A is localised, and small events (less than 10 mm) may not generate sufficient runoff for the watercourses to flow. Furthermore, flow in one part of a catchment often does not reach further downstream. Alluvium completed an assessment of hydrology using the River Styles® framework based on high resolution aerial imagery, field inspection and use of helicopter and four-wheel drive vehicle. The distribution of mapped features according to the River Style® framework is shown in Figure 3-27**.** The dune swale is overwhelmingly the most common River Style® in the Atacama region. This reflects proximity to the Yellabinna Dunefield and dominance of aeolian processes as a landscape control (Alluvium, 2014).

Pans are an important feature across the landscape. The terminal pans in the Project Area are generally smaller and more elongated than those found to the south. This reflects the smaller and elongated catchments created by the linear dunes in the dune field.

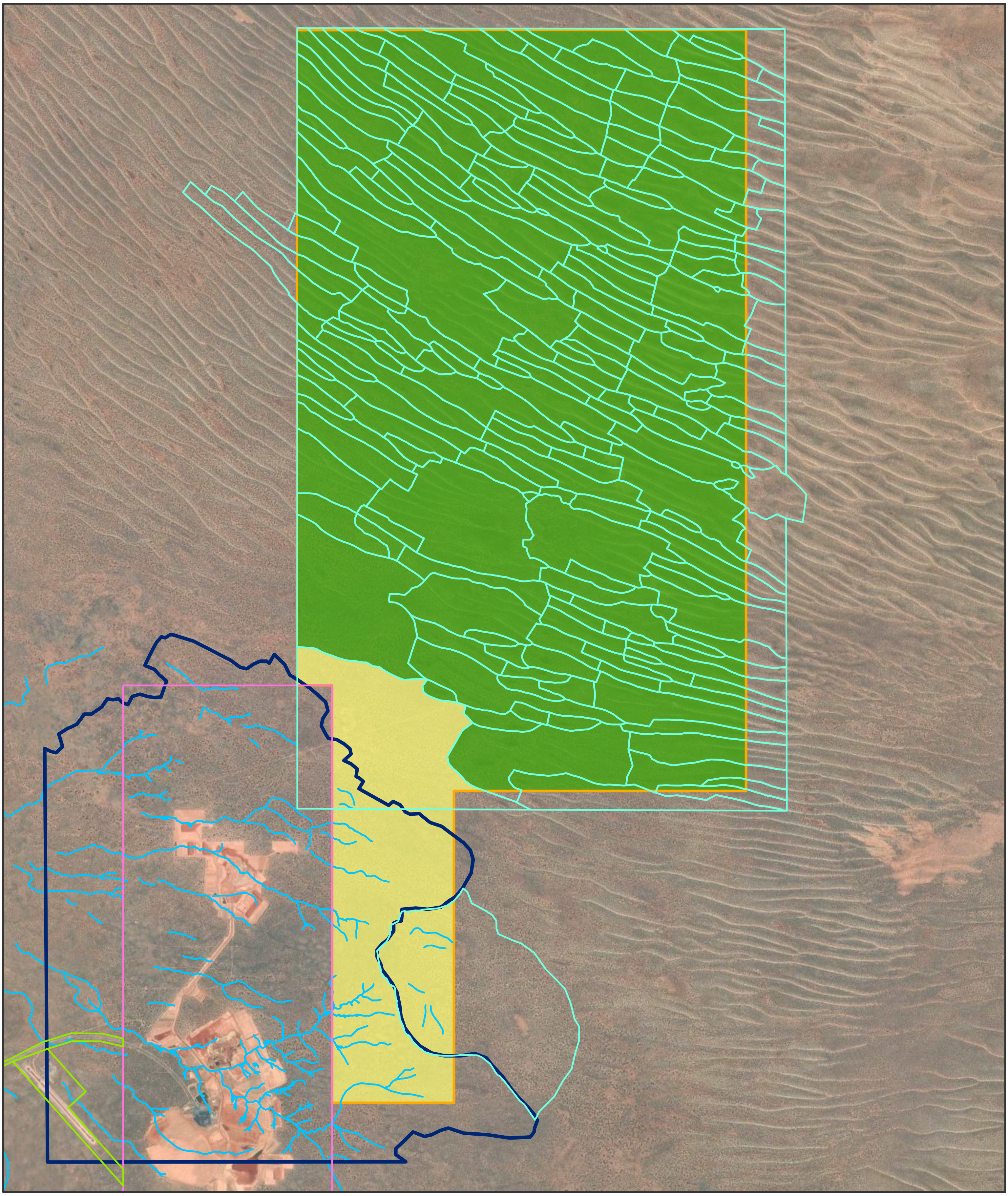

Figure 3-26 Surface Water

Project Area

J-A tenements

ML

EML

MPL

Watercourse

J-A Catchment

Catchment boundary (Alluvium 2014)

Landscape region

Atacama region - Dunefield

Southern corridor - Interdunal

0 2 4

Kilometres

Datum/Projection:
GDA 1994 MGA Zone 53

Project: 20409-OK Date: 2/8/2023

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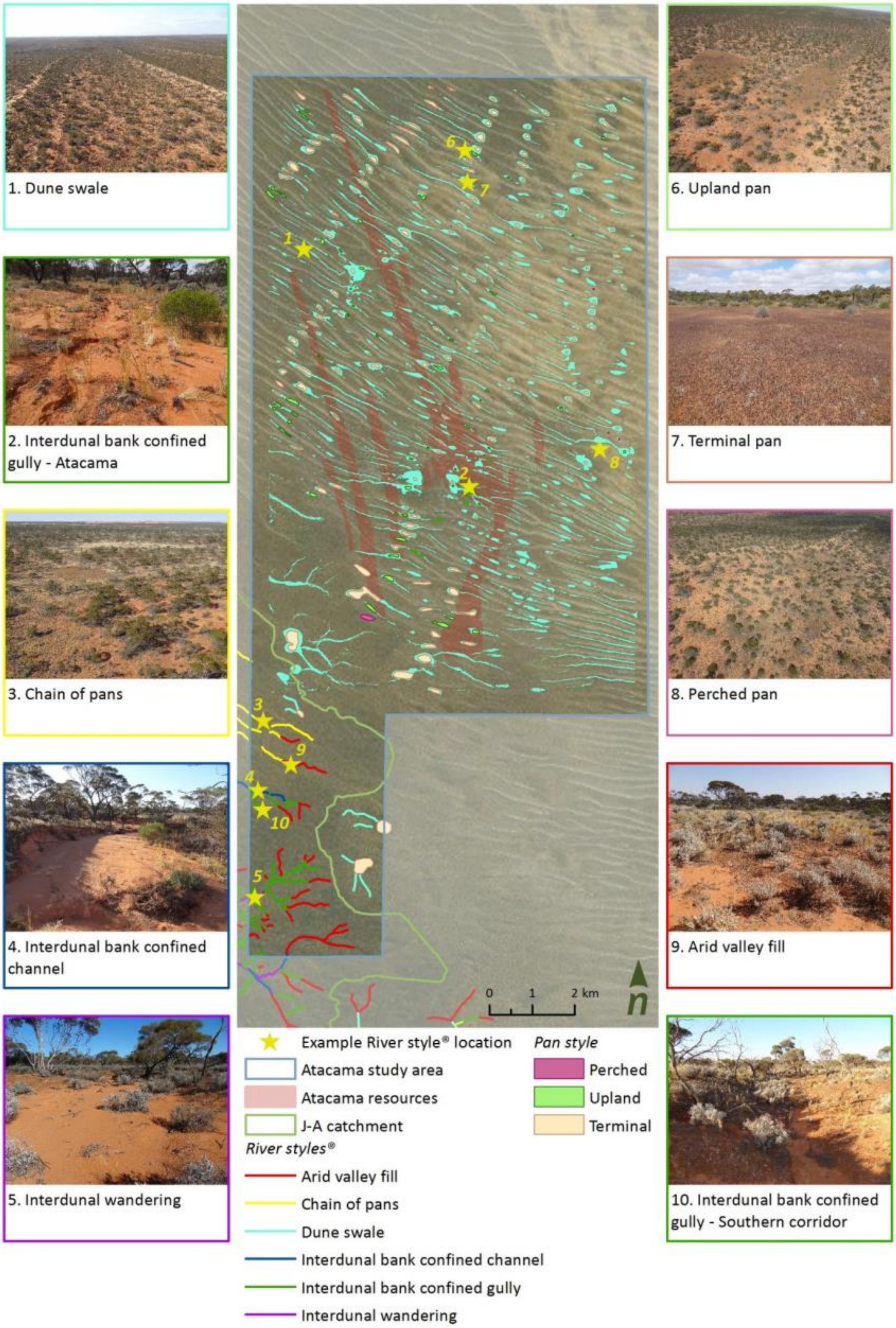

Figure 3-27 Map of surface water features with examples from the Atacama Project Area (Source: Alluvium, 2014)

Alluvium (2014) conducted hydrodynamic modelling of water depth and delineation of catchments at 1,000-year ARI storm event which showed that watercourses in the vicinity of the Atacama resource deposits are in separate catchments, demonstrating that surface water runoff is highly localised. The modelling results indicate that there is no runoff during the 2-year ARI as the soil absorbs all rainfall. Runoff occurs during the 5-year ARI and starts to accumulate in individual pans. Flood water depths increase in larger rainfall events to the maximum of up to 3 m during the 1 in 100-year ARI event (i.e., 82.51 mm of rain over 1 hour produces a flood depth of up to 3 m) in the pans within and in the vicinity of the Atacama deposits.

Maximum water depth distribution for 10- and 20-year ARI rainfall events are shown in Figure 3-28, indicating that accumulation of water is restricted to terminal pan areas.

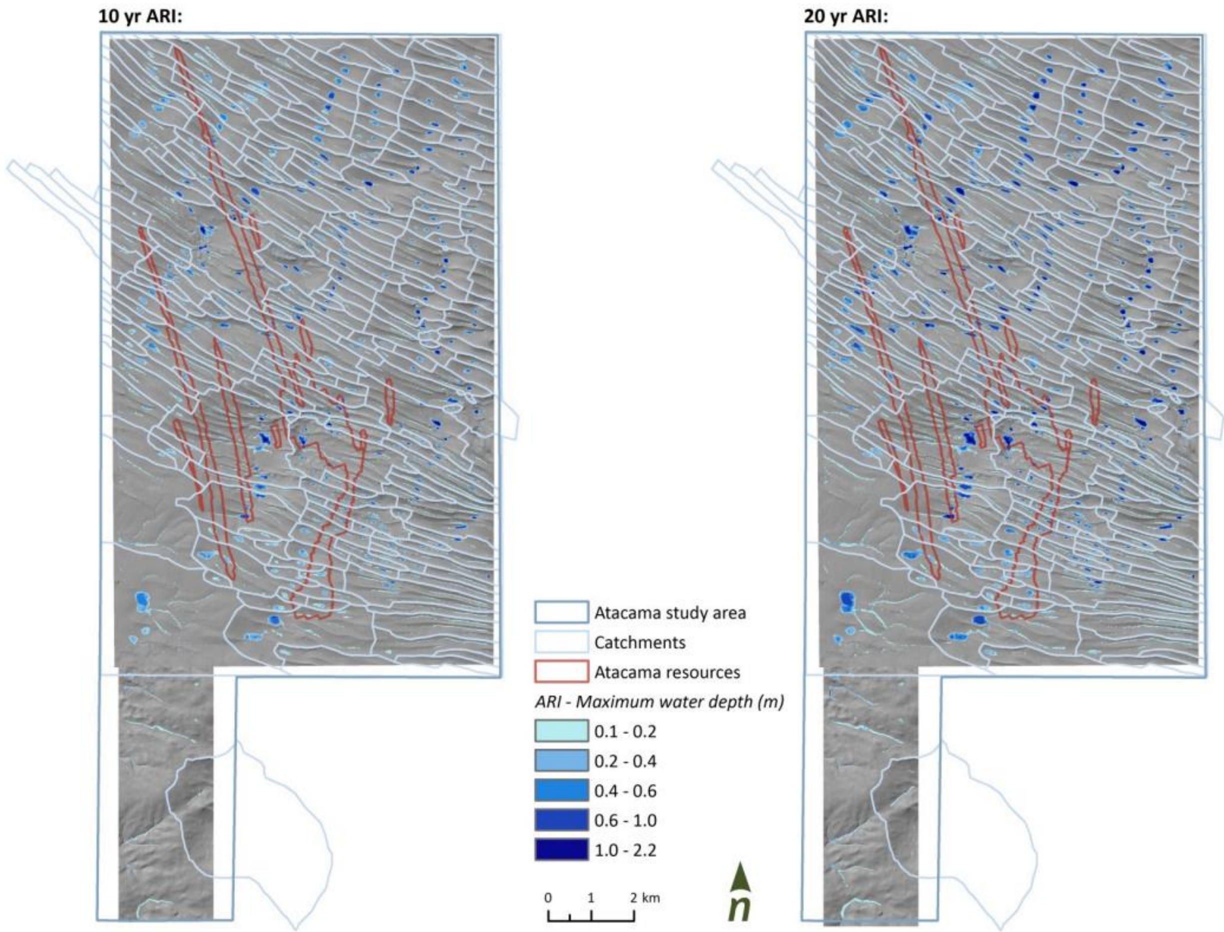

Figure 3-28 Maximum water depth distribution for 10- and 20-year ARI rainfall events (Source: Alluvium, 2014)

3.8.1 Surface water quality

An overview of surface water quality is described within this section. For a more detailed discussion on baseline information please refer to Appendix B4 *Sediment sampling and analysis for Atacama Development Project* (CDM Smith, 2022b).

As discussed above, the arid climate and sandy permeable soils within the Project Area result in rare surface water flows with few obvious drainage features evident. Any flows that do occur are typically in response to large infrequent rainfall events and are hard to predict. Water quality sampling could not be undertaken due to the ephemeral nature of the waterways in this area. In order to understand surface water quality, the TOR 006 allows for sediment sampling to act as a proxy for water quality data. Sediment sampling is considered a suitable proxy as fine sediment is typically transported as a suspended load by any waterflow occurring in the streams and then redeposited along the swale floor during decreasing flow (Alluvium, 2014). Three site visits were undertaken in 2019 and 2022 to collect sediment in identified drainage lines, upstream and downstream of the Project Area (CDM Smith, 2022b). No surface water was present at these times.

Typically, sediment data is collected upstream and downstream of the Project Area, however, the surface catchments within the Project Area are typically small unconnected catchments and do not extend beyond the Project Area boundaries.

A sediment sampling program was designed to collect baseline sediment data from as many identified catchments as possible within the Project Area. Forty-two (42) locations were selected for sampling, with locations shown in Figure 3-29. In some locations, sampling was constrained by accessibility and track locations. Sampling occurred in three rounds occurring in September 2019, October 2019 and April/ May 2022 (CDM Smith, 2022b).

Twenty (20) soil samples were submitted for laboratory analysis. The results of the sediment sampling showed the sediment deposits were shallow (less than 2-3cm thick) and dry. Table 3-14 shows the analysis undertaken, with selected results of the analysis presented in Table 3-15 and Table 3-16. CDM Smith only showed aluminium and iron as they have the highest measured concentrations in comparison to other measured metals. Other metal analysis are provided in Appendix B4. The analysis performed meets the QA/QC requirements for the sampling to be considered valid. Further details of the sampling and methods used are detailed in Appendix B4.

Three surface water samples were collected near the J-A site by EMM (2022) between 2016-2021. One sample, SW1 is upstream of J-A Mine, SW3 downstream of J-A Mine and SWM16 within the J-A Mine, downstream of SW1 (EMM, 2022). Full details regarding the surface water sampling are included in Appendix C1.

Table 3-14 Chemical analysis undertaken on each sample (Source: CDM Smith, 2022b)

Sample Number	Drainage	Sediment analysis	–Leachate analysis
Sed 7	Obvious drainage	• Particle sizing with hydrometer plus soil particle	• pH (PCT) • Major cations (calcium, magnesium, sodium, potassium)
Sed 8	Obvious drainage		

Sample Number	Drainage	Sediment analysis	–Leachate analysis
Sed 101	No obvious drainage line	• Individual natural radionuclides by High Resolution Gamma Spectrometry (Tranche 1)	• Water leachate Inductively Coupled Plasma Mass Spectrometry (ICP-MS) metals • ASLP leachate • Electrical Conductivity (EC) plus Total Dissolved Solids (TDS) • Major anions (chloride, sulfate, alkalinity)
Sed 107	Erosion gully, 50cm deep, active		
Sed 110	No obvious drainage		
Sed 115	No obvious drainage		
Sed 116	No obvious drainage		
Sed 118	No obvious drainage		
Sed 119	Shallow drainage line around type 4 mounds		
Sed 120	No obvious drainage		
V1 (dup Sed 101)	No obvious drainage		
A1	No obvious drainage	• Particle sizing with hydrometer plus soil particle	• pH (PCT) • Major cations (calcium, magnesium, sodium, potassium) • Water leachate Inductively Coupled Plasma Mass Spectrometry (ICP-MS) metals • ASLP leachate • Electrical Conductivity (EC) plus Total Dissolved Solids (TDS) • Major anions (chloride, sulfate, alkalinity) • Individual natural radionuclides by High Resolution Gamma Spectrometry.
A2	No obvious drainage		
A3	Minor drainage line, 5cm deep		
A4	No obvious drainage		
A5	Minor drainage lines and signs of run off		
A6	Drainage line, 5cm deep		
A7	Obvious drainage line, 30cm deep		
QA1A	Duplicate of A7		
B1	No obvious drainage		
B2	No obvious drainage		
B3	No obvious drainage		

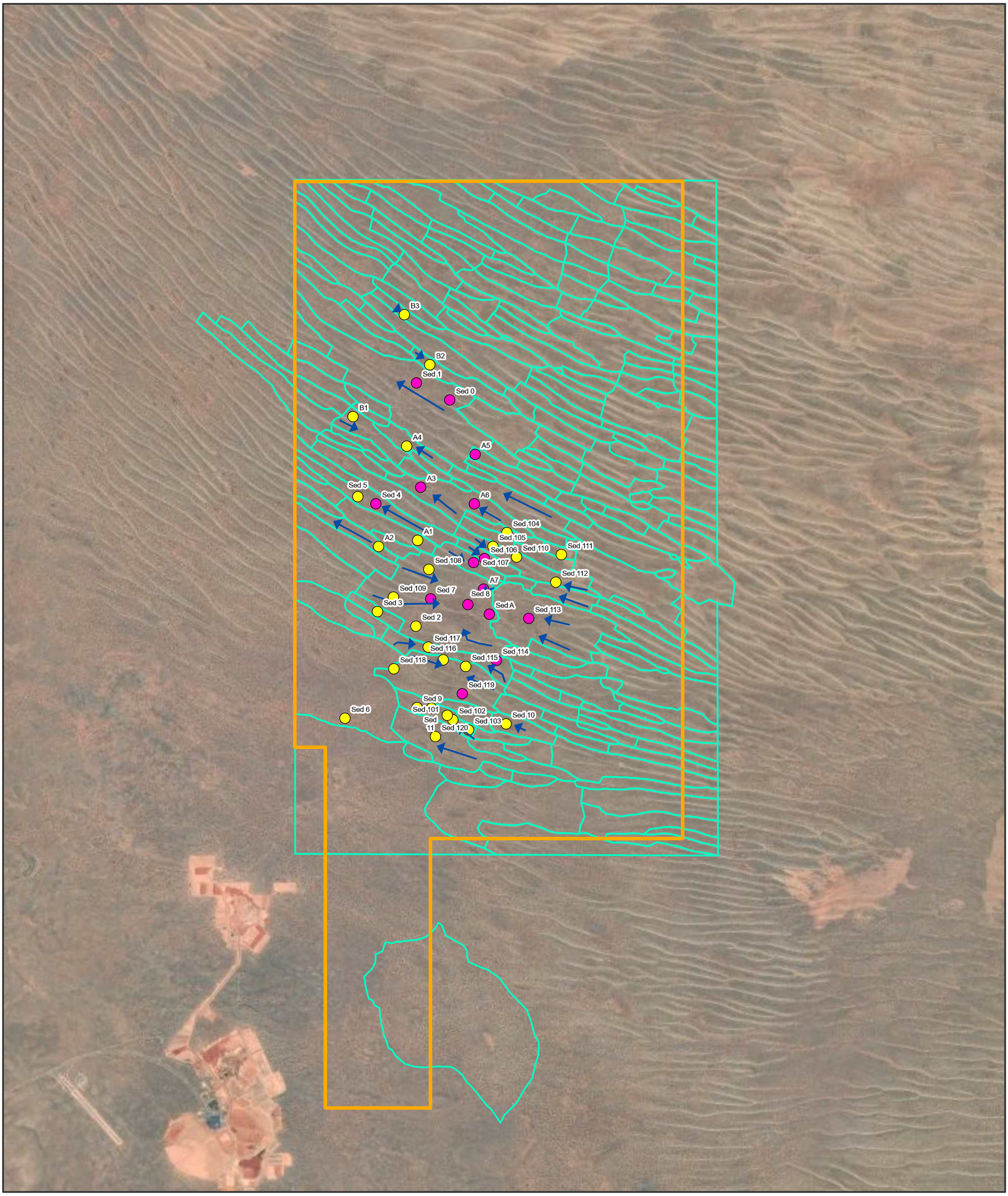

Figure 3-29 Sediment sample locations

Project Area

Catchment boundary (Alluvium 2014)

Flow direction

Sediment sampling sites

No obvious drainage

Obvious drainage

0 2 4

Kilometres

Datum/Projection:
GDA 1994 MGA Zone 53

Project: 20409-SH/OK Date: 2/8/2023

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Table 3-15 Chemical analysis on leachate (Source: CDM Smith, 2022b)

Site ID	Vegetation	Landform	Drainage comment	pH	EC (uS/cm)	TDS (mg/L)	Alkalinity (mg/L) as CaCO3				Water leachable major cations (mg/L)				Water leachable metals (mg/L)	
							OH	CO3	HCO3	Total	Ca	Mg	Na	K	Al	Fe
Sed 7	Eucalyptus	Gently undulating plains	Obvious drainage	8.27	54	35	<1	<1	31	31	9	2	5	1	5.89	1.76
Sed 8	Myall, bluebush	Gently undulating plains	Obvious drainage	7.63	57	37	<1	<1	44	44	4	2	8	2	4.96	1.78
Sed 101	Myall, bluebush	Swale 300 m wide	No obvious drainage	8.63	78	51	<1	6	40	46	15	2	7	2	3.95	1.30
Sed 107	Eucalyptus, spinifex	Swale 100 m wide	Erosion gully, 50 cm deep, active	8.65	54	35	<1	8	35	42	14	2	4	<1	3.03	1.14
Sed 110	Eucalyptus, Myall	Swale 25 m wide	No obvious drainage	8.65	38	25	<1	4	22	26	3	1	8	2	4.74	1.75

Site ID	Vegetation	Landform	Drainage comment	pH	EC (uS/cm)	TDS (mg/L)	Alkalinity (mg/L) as CaCO3				Water leachable major cations (mg/L)				Water leachable metals (mg/L)	
							OH	CO3	HCO3	Total	Ca	Mg	Na	K	Al	Fe
Sed 115	Eucalyptus, Myall, saltbush	Swale 100 m wide	No obvious drainage	8.43	55	36	<1	3	27	30	8	1	5	1	4.10	1.38
Sed 116	Eucalyptus, saltbush, spinifex	Swale 150 m wide	No obvious drainage	8.70	64	42	<1	6	56	61	12	1	6	<1	3.71	1.35
Sed 118	Myall, bluebush, saltbush, Quandong	Gently undulating plains	No obvious drainage	8.74	68	44	<1	6	38	44	18	3	8	2	4.11	1.25
Sed 119	Myall, Eucalyptus	Swale 250 m wide	Shallow drainage line around type 4 mounds	8.69	60	39	<1	5	30	36	12	2	5	1	5.81	1.91
Sed 120	Myall, saltbush	Swale flat and broad, 400 m wide	No obvious drainage	8.60	87	56	<1	5	47	52	16	2	7	2	4.46	1.49

Site ID	Vegetation	Landform	Drainage comment	pH	EC (uS/cm)	TDS (mg/L)	Alkalinity (mg/L) as CaCO3				Water leachable major cations (mg/L)				Water leachable metals (mg/L)	
							OH	CO3	HCO3	Total	Ca	Mg	Na	K	Al	Fe
V1 (dup of Sed 101)	Myall, bluebush	Swale 300 m wide	No obvious drainage	8.76	87	56	<1	8	44	52	16	2	7	2	4.97	1.62
A1	Eucalyptus, Myall	Swale 100m wide	No obvious drainage	8.69	54	35	<1	<1	31	31	3	<1	3	<1	1.76	1.25
A2	Eucalyptus, Myall	Swale 150m wide	No obvious drainage	8.73	33	21	<1	<1	13	13	<1	<1	4	<1	3.57	3.22
A3	Myall, bluebush	Swale 200m wide	Minor drainage line, 5cm deep	8.09	46	30	<1	<1	19	19	<1	<1	6	<1	5.94	5.52
A4	Myall, bluebush	Swale 200m wide	No obvious drainage	9.04	51	33	<1	7	22	29	3	<1	4	<1	1.89	1.50

Site ID	Vegetation	Landform	Drainage comment	pH	EC (uS/cm)	TDS (mg/L)	Alkalinity (mg/L) as CaCO3				Water leachable major cations (mg/L)				Water leachable metals (mg/L)	
							OH	CO3	HCO3	Total	Ca	Mg	Na	K	Al	Fe
A5	Eucalyptus, Myall	Swale 100m wide	Minor drainage lines and signs of run off	8.87	29	19	<1	<1	10	10	<1	<1	4	<1	6.42	7.33
A6	Myall, bluebush	Swale 200m wide	Drainage line, 5cm deep	8.96	64	42	<1	9	29	37	4	<1	4	<1	2.82	2.35
A7	Myall, bluebush	Gently undulating plains	Obvious drainage line, 30cm deep	9.17	55	36	<1	9	21	30	2	<1	4	<1	3.66	2.63
QA1A	Myall, bluebush	Gently undulating plains	Obvious drainage line, 30cm deep	9.13	58	38	<1	9	23	32	2	<1	5	<1	5.06	3.69
B1	Myall, bluebush	Swale 200m wide	No obvious drainage	5.37	4	3	<1	<1	5	5	<1	<1	7	<1	21.7	15.6

Site ID	Vegetation	Landform	Drainage comment	pH	EC (uS/cm)	TDS (mg/L)	Alkalinity (mg/L) as CaCO3				Water leachable major cations (mg/L)				Water leachable metals (mg/L)	
							OH	CO3	HCO3	Total	Ca	Mg	Na	K	Al	Fe
B2	Eucalyptus, Myall	Swale 150m wide	No obvious drainage	3.1	6	4	<1	<1	<1	<1	5	<1	4	<1	16.6	9.79
B3	Eucalyptus, Myall	Swale 100m wide	No obvious drainage	2.81	1	1	<1	<1	<1	<1	2	<1	7	<1	23.2	16.4

Table 3-16 Summary of natural radionuclides (Source: CDM Smith, 2022b)

Site ID	Uranium 238 (Bq/kg Dry Weight)	Thorium 234 (Bq/kg Dry Weight)	Thorium 230 (Bq/kg Dry Weight)	Radium 226 (Bq/kg Dry Weight)	Lead 210 (Bq/kg Dry Weight)	Uranium 235 (Bq/kg Dry Weight)	Protactinium 231 (Bq/kg Dry Weight)	Actinium 227 (Bq/kg Dry Weight)	Thorium 227 (Bq/kg Dry Weight)	Radium 223 (Bq/kg Dry Weight)	Radium 228 (Bq/kg Dry Weight)	Thorium 228 (Bq/kg Dry Weight)	Potassium 40 (Bq/kg Dry Weight)
Sed 7	<11	<11	<76	5.2	74	<1	<16	<3.1	<3.1	<4.0	10.8	10.3	58
Sed 8	11	11	<105	14.7	94	<2	<22	<4.4	<4.4	<5.3	34.1	34.2	265
Sed 101	<10	<10	<95	11.8	<50	<2	<20	<4	<3.9	<4.7	25.4	21.7	205
Sed 107	<10	<10	<66	5.8	<50	<1	<15	<4	<3	<4.1	9.1	8.1	38
Sed 110	<12	<12	<80	8.6	<50	<1	<17	<3.3	<3.3	<3.8	14.6	14.8	76
Sed 115	<10	<10	<80	8.1	<50	<1	<17	<3.5	<3.5	<4	16.2	14.5	95
Sed 116	13	13	<85	12.8	<50	<1	<17	<3.5	<3.5	<4.3	20.6	19.8	114

Site ID	Uranium 238 (Bq/kg Dry Weight)	Thorium 234 (Bq/kg Dry Weight)	Thorium 230 (Bq/kg Dry Weight)	Radium 226 (Bq/kg Dry Weight)	Lead 210 (Bq/kg Dry Weight)	Uranium 235 (Bq/kg Dry Weight)	Protactinium 231 (Bq/kg Dry Weight)	Actinium 227 (Bq/kg Dry Weight)	Thorium 227 (Bq/kg Dry Weight)	Radium 223 (Bq/kg Dry Weight)	Radium 228 (Bq/kg Dry Weight)	Thorium 228 (Bq/kg Dry Weight)	Potassium 40 (Bq/kg Dry Weight)
Sed 118	<10	<10	<85	8.5	<50	<1	<17	<3.4	<3.4	<3.4	16.4	15.2	119
Sed 119	<15	<15	<80	707	<50	<1	<17	<3.1	<3.1	<3.1	12.8	12.7	66
Sed 120	<15	<15	<105	19.2	<50	<1	<20	<4	<4	<4	29.8	28.9	275
V1 (dup Sed 101)	<15	<15	<95	17.5	<50	<1.0	<20.0	<4.0	<4.0	<7.2	25.1	25.4	223
Bq/L (Leachate)													
A1		<2	<10	<0.2	<10	<0.2	<1	<0.2	<0.2	<0.2	<0.2	<0.2	<2
A2		<2	<10	<0.2	<10	<0.2	<1	<0.2	<0.2	<0.2	<0.2	<0.2	<2
A3		<2	<10	<0.2	<10	<0.2	<1	<0.2	<0.2	<0.2	<0.2	<0.2	<2
A4		<2	<10	<0.2	<10	<0.2	<1	<0.2	<0.2	<0.2	<0.2	<0.2	<2
A5		<2	<10	<0.2	<10	<0.2	<1	<0.2	<0.2	<0.2	<0.2	<0.2	<2
A6		<2	<10	<0.2	<10	<0.2	<1	<0.25	<0.2	<0.25	<0.2	<0.28	<2
A7		<2	<10	<0.2	<10	<0.2	<1	<0.2	<0.2	<0.2	<0.2	<0.2	<2
QA1A		<2	<10	<0.2	<10	<0.2	<1	<0.24	<0.21	<0.24	<0.2	<0.2	<2
B1		<2	<10	<0.2	<10	<0.2	<1	<0.2	<0.2	<0.2	<0.2	<0.2	<2
B2		<2	<10	<0.2	<10	<0.2	<1	<0.2	<0.2	<0.2	<0.2	<0.2	<2
B3		<2	<10	<0.2	<10	<0.2	<1	<0.2	<0.2	<0.2	<0.2	<0.2	<2

3.8.2 Surface water dependent ecosystems

Vegetation community patterns within the Project Area are largely dictated by soil type and substrate material, with other drivers such as rainfall, runoff, fire and other disturbance factors (such as camels) also influencing vegetation community dynamics. Field observations suggest that within the Project Area, the interdune swales are consistently comprised of Myall woodlands, with vegetation communities driven primarily by soil depth, and transitional communities present as responses to the last flood event.

Vegetation communities present within flood zones are not reliant on flows or flooding because these events occur at such infrequent intervals; they do not sustain ephemeral communities. The period in which these areas stay inundated may also drive communities as a response to tolerance of extended wetting rather than reliance.

While fauna may use surface water when present, none are expected to be reliant on surface water habitat (Alluvium, 2014).

Other than ecological receptors no other receptors such as human third parties are known to use the ephemeral resources within the Project Area.

3.9 Vegetation, weeds and plant pathogens

An overview of the native vegetation and flora within the Project Area is described within this Section. For a more detailed discussion on baseline information please refer to Appendices B5 *Atacama Baseline Flora and Fauna Assessment – 2014* (EBS, 2015), B6 *Baseline Environmental Investigations Atacama Project* (EBS, 2019a) and B8 *Atacama Threatened Species Assessment Spring 2021* (ELA, 2022a).

Several vegetation field assessments have been undertaken in and around the Project Area. These include:

- Atacama baseline flora and fauna assessment – 2014 (EBS, 2015a)
- Baseline environmental investigations Atacama Project (EBS, 2019a)
- Atacama threatened species assessment (ELA, 2022a).

Initial assessments were undertaken to establish any potential ecological constraints in the Project Area (EBS, 2015). This assessment (EBS, 2015a) involved detailed field assessments for both flora and fauna species, completed by EBS (2019a) which assessed gaps in 2014 survey work and proposed targeted surveys for Ooldea Guinea-flower. A further targeted threatened species survey was undertaken during spring 2021 (ELA, 2022a) to provide an in-depth assessment of the likely presence of and potential for impact to Ooldea Guinea-flower, Malleefowl and Sandhill Dunnart (fauna species discussed later in Section 3.10). The Project has been determined to be a Controlled Action for these three species for more information on this please refer to Section 8.

All field surveys were undertaken during spring periods when many flora species flower, enabling species identification.

3.9.1 Regional vegetation

The Atacama Project Area is located within the Great Victoria Desert IBRA bioregion (Figure 3-1). The Great Victoria Desert bioregion (418,750 km^2) is located in the southern rangelands of Western Australia (WA; 52% of bioregion area), stretching into the western half of South Australia (SA) and is characterised by dunefields with playa lakes and lunettes. Vegetation is predominantly marble gum, mulga and yarldarlba over spinifex grassland. Most of the bioregion is unallocated crown land, conservation reserves and Aboriginal land and has very low pastoral value and little land development/ land clearance has occurred. More than 15% of the Great Victoria Desert bioregion is protected in reserves.

The Project Area is located within the Yellabinna IBRA subregion (Figure 3-1), which consists of dunes and inter-dune swales which represent a south-eastern extension of the Great Victoria Desert dune fields. The Yellabinna subregion is a broadly undulating landscape and is characterised by open Mallee woodland generally atop low dunal rises and Myall woodland within the shallow troughs, interspersed with open low shrublands.

Towards the eastern edge of the Project Area, low open woodland dominated by Western Myall (*Acacia papyrocarpa*) occurs, with an understorey similar to the vegetation of the Nullarbor Plain. This woodland grades into the Mallee woodlands of the Yellabinna dunefield, with the Western Myall woodlands replaced by Mallee in the eastern part of the Project Area.

To the west of the Project Area the transition to the Nullarbor subregion occurs. The Nullarbor subregion is dominated by the Nullarbor Plain, a generally treeless karst plain with chenopod low shrubland vegetation. Occasional depressions on the plain have deeper soils and support taller vegetation. The low shrubland vegetation is dominated by bluebush species, particularly Pearl Bluebrush (*Maireana sedifolia)*. The Western Myall woodlands are the least common of these communities in this area and represent a transition between the Mallee woodlands of the Yellabinna dunefield and the low shrublands of the Nullarbor Plain.

South of the Project Area, the limestone of the Nullarbor Plain ends and soils comprising red brown sandy and clayey-sand Callabonna clays are apparent. Further south towards Colona (within the Yalata Aboriginal Reserve), silts and fine-grained sandy wind-blown (Aeolian) deposits, often rich in quartz and calcareous in nature, dominate the area. The broadly undulating landscape is characterised by open Mallee woodland generally atop low dunal rises and Myall woodland within the shallow troughs, interspersed with open low shrublands. (EDS, 2019a)

3.9.2 Vegetation associations and habitat

Approximately 99% of the Yellabinna subregion has been mapped as remnant native vegetation, with 55% of this area under conservation (EBS 2019a). Only a small proportion (8%) of the Great Victoria Desert bioregion is grazed, mainly where WA pastoral leases abut the western margin of the bioregion. Yellabinna Regional Reserve overlays the Nullarbor Regional Reserve on its western boundary. The Yumbarra Conservation Park and Pureba Conservation Park are adjacent to the Yellabinna Regional Reserve on its southern boundary. These areas combined cover 3 million hectares (ha) of predominantly Mallee vegetation that is largely undisturbed from human activity and indirect impacts from human activity including weed infestation (DEWNR, 2013).

Ecological field surveys have mapped nine vegetation associations (VA) present within the Project Area (Figure 3-30). These communities are dominated by Mallee associations, especially in the north, with the association *Eucalyptus yumbarrana* (Yumbarra Mallee) Mixed Mallee the most widely occurring closely followed by Western Myall Open Woodland (Table 3-17). *Acacia*, *Alectryon* and *Casuarina* Woodlands, and *Senna* and *chenopod* Shrubland associations were present in the south of the Project Area.

The VAs within the Project Area are representative of the vegetation in the broader subregion. No VA showed elevated diversity of flora species. None of the VAs observed are listed as Threatened Ecological Communities (TEC) under the EPBC Act, or State threatened ecological communities under the Provisional list of threatened ecosystems of South Australia (EBS 2019a).

The VAs are presented visually in Figure 3-30 for both the Project Area and J-A ML (noting that only three of the VAs (2, 6 and 8) are present in the J-A ML, which has also been displayed for context).

Table 3-17 Vegetation associations recorded in the Project Area

VA number	Description
1	*Eucalyptus* spp. / *Hakea francisiana* (Bottlebrush Hakea) / *Grevillea stenobotrya* (Rattle-pod Grevillea) Tall Open Shrubland
2	*Acacia papyrocarpa* (Western Myall) Open Woodland +/- *Cratystylis conocephala* (Daisy Bluebush) and *Maireana sedifolia* (Bluebush)
3	*Eucalyptus oleosa* ssp. Mixed Mallee over Triodia spp.
4	*Eucalyptus yumbarrana* (Yumbarra Mallee) Mixed Mallee
5	*Alectryon oleifolius* (Bullock Bush) Shrubland
6	*Atriplex vesicaria* (Bladder Saltbush) Low Open Shrubland
7	*Casuarina pauper* (Black Oak) +/- *Acacia papyrocarpa* (Western Myall) Woodland
8	*Eucalyptus oleosa* spp. (Red Mallee) / *Acacia papyrocarpa* (Western Myall) +/- *Myoporum platycarpum* (False Sandalwood) Open Woodland
9	*Senna* spp. Open Shrubland

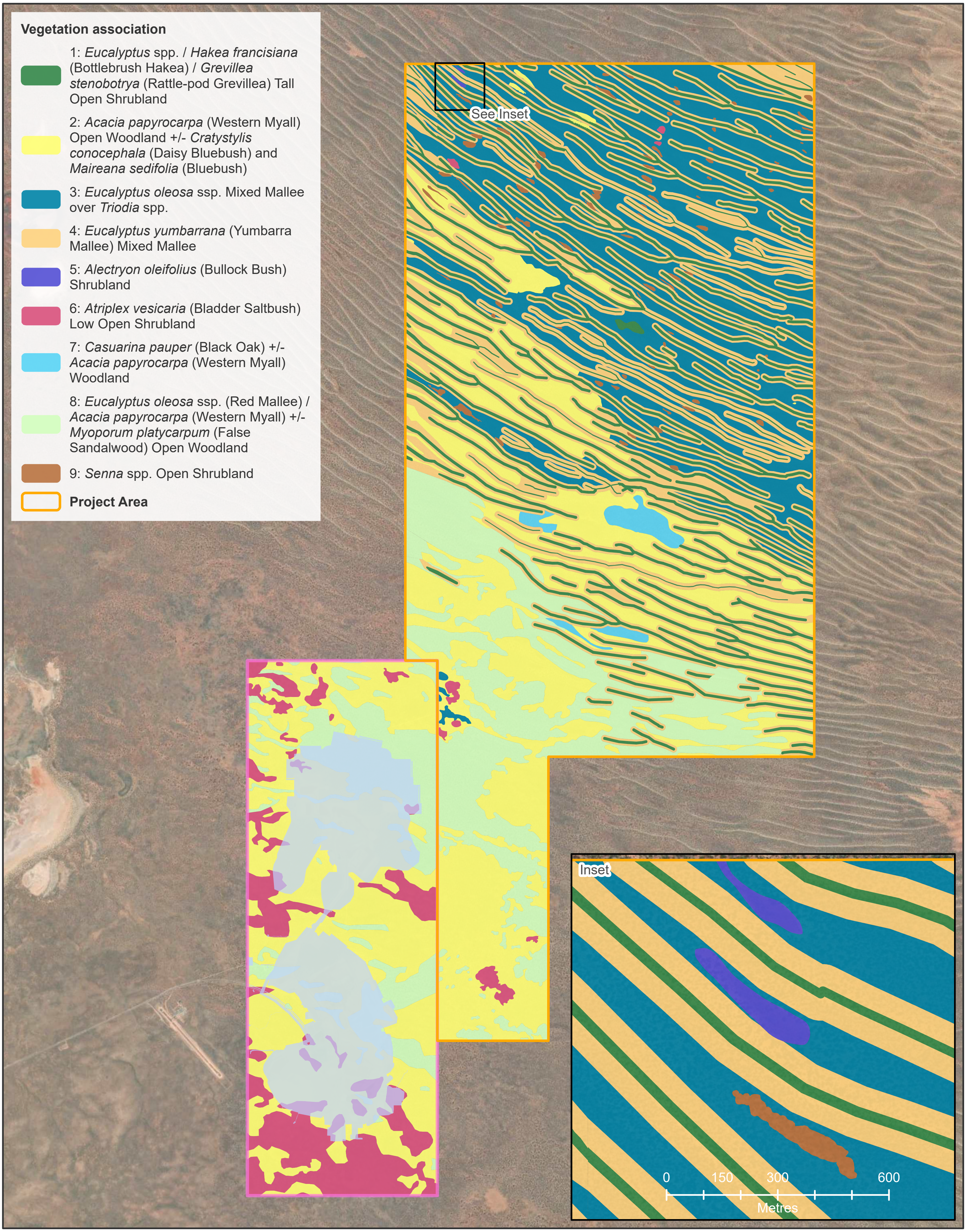

Figure 3-30 Native vegetation associations

3.9.3 Flora species

A total of 174 native flora species were recorded within the Project Area across three surveys (EBS 2015a, ELA, 2022a). The most widespread species observed include Buckbush (*Salsola australis*), Silver Mulla (*Ptilotus obovatus*), Bladder Saltbush (*Atriplex vesicaria*), Desert Senna (*Senna artemisioides ssp. artemisioides x ssp. coriacea*) and Native Apricot (*Pittosporum angustifolium*), each of which were recorded in at least seven of the nine recorded VA's.

Three weed species were also recorded in very low densities throughout the Project Area. Rosy dock (*Acetosa vesicaria*) was present in areas of run off collection such as ephemeral drainage lines, swales and the edges of some vehicle tracks. Wild turnip (*Brassica tournefortii*) occurred on a range of landforms but predominantly on sandy sites. Ward's weed (*Carrichtera annua*) was the least common all weed species and was found in small, dense patches surrounding dead trees in areas subject to runoff. Buffel grass (*Cenchrus ciliaris*) while known to be present in the wider region, has not been observed within the Project Area.

There was no evidence of plant pathogens during field investigations. The Project Area is not located in a high-risk *Phytophthora cinnamomi* (root-rot fungus) or Mundulla Yellows area due to the low annual rainfall and minimal human disturbance.

Table 3-18 Total flora list

Scientific name	Common name	Conservation status	
		EPBC	NPW
Acacia acanthoclada ssp. acanthoclada	Harrow Wattle		
Acacia ligulata	Umbrella Bush		
Acacia nyssophylla	Spine Bush		
Acacia oswaldii	Umbrella Wattle		
Acacia papyrocarpa	Western Myall		
Acacia rigens	Nealie		
Acetosa vesicaria	Rosy Dock*		
Adriana tomentosa var. hookeri	Mallee Bitter-bush		
Alectryon oleifolius ssp. canescens	Bullock Bush		
Alyogyne pinoniana var. pinoniana	Sand Hibiscus		
Amphipogon caricinus var. caricinus	Long Grey-beard Grass		
Amyema quandang var. quandang	Grey Mistletoe		
Aristida contorta	Curly Wire-grass		
Atriplex vesicaria	Bladder Saltbush		
Austrostipa acrociliata	Graceful Spear-grass		
Austrostipa elegantissima	Feather Spear-grass		
Austrostipa nitida	Balcarra Spear-grass		

Scientific name	Common name	Conservation status	
		EPBC	NPW
Austrostipa platychaeta	Flat-awn Spear-grass		
Austrostipa sp.	Spear-grass		
Beyeria opaca	Dark Turpentine Bush		
Billardiera cymosa ssp.			
Boronia coerulescens ssp. coerulescens	Blue Boronia		
Bossiaea walkeri	Cactus Pea		
Brachyscome sp.	Native Daisy		
Brassica tournefortii	Wild Turnip*		
Calandrinia sp.	Purslane/Parakeelya		
Callitris verrucosa	Scrub Cypress Pine		
Calotis hispidula	Hairy Burr-daisy		
Calotis lappulacea	Yellow Burr-daisy		R
Calotis sp.	Burr-daisy		
Calytrix sp.	Fringe-myrtle		
Carrichtera annua	Ward's Weed*		
Cephalipterum drummondii	Pompom Head		
Chenopodium curvispicatum	Cottony Goosefoot		
Chrysocephalum apiculatum	Common Everlasting		
Codonocarpus cotinifolius	Desert Poplar		
Coopernookia strophiolata	Sticky Coopernookia		
Crassula sp.	Crassula/Stonecrop		
Cratystylis conocephala	Bluebush Daisy		
Cynanchum floribundum	Desert Cynanchum		
Dampiera dysantha	Shrubby Dampiera		
Dampiera lanceolata var. lanceolata	Grooved Dampiera		
Daviesia ulicifolia ssp.			
Dianella revoluta var. divaricata	Broad-leaf Flax-lily		
Dicrastylis beveridgei var. lanata	Woolly Sand-sage		
Dicrastylis lewellinii	Purple Sand-sage		
Dicrastylis verticillata	Whorled Sand-sage		
Dillwynia uncinata	Silky Parrot-pea		

Scientific name	Common name	Conservation status	
		EPBC	NPW
Dodonaea stenozyga	Desert Hop-bush		
Dodonaea viscosa ssp. angustissima	Narrow-leaf Hop-bush		
Enchylaena tomentosa var.	Ruby Saltbush		
Eremophila alternifolia	Narrow-leaf Emubush		
Eremophila crassifolia	Thick-leaf Emubush		
Eremophila gibsonii	Gibson's Emubush		
Eremophila glabra ssp.	Tar Bush		
Eremophila macdonnellii	Macdonnell's Emubush		
Eremophila maculata ssp.	Spotted Emubush		
Eremophila paisleyi ssp. paisleyi			
Eremophila latrobei ssp.	Crimson Emubush		
Eremophila scoparia	Broom Emubush		
Eriochiton sclerolaenoides	Woolly-fruit Bluebush		
Eriochlamys behrii	Woolly Mantle		
Eucalyptus brachycalyx	Gilja		
Eucalyptus capitanea	Desert Ridge-fruited Mallee		
Eucalyptus oleosa ssp. oleosa	Red Mallee		
Eucalyptus pimpiniana	Pimpin Mallee		
Eucalyptus yumbarrana	Yumbarra Mallee		
Euphorbia drummondii			
Euphorbia tannensis ssp. eremophila	Desert Spurge		
Exocarpos sparteus	Slender Cherry		
Frankenia serpyllifolia	Thyme Sea-heath		
Geijera linearifolia	Sheep bush		
Glischrocaryon behrii	Golden Pennants		
Gnephosis tenuissima	Dwarf Golden-tip		
Goodenia glauca	Pale Goodenia		
Goodenia havilandii	Hill Goodenia		
Goodenia varia	Sticky Goodenia		
Gratwickia monochaeta			R
Gramineae sp.	Grass Family		

Scientific name	Common name	Conservation status	
		EPBC	NPW
Grammosolen truncatus	Shrubby Ray-flower		
Grevillea huegelii	Comb Grevillea		
Grevillea juncifolia ssp. juncifolia	Honeysuckle Grevillea		
Grevillea stenobotrya	Rattle-pod Grevillea		
Gyrostemon thesioides	Broom Wheel-fruit		
Hakea francisiana	Bottlebrush Hakea		
Halgania andromedifolia	Scented Blue-flower		
Haloragis gossei	Gosse's Raspwort		
Lepidium phlebopetalum	Veined Peppercress		
Lepidium sp.	Peppercress		
Leptospermum coriaceum	Dune Tea-tree		
Logania nuda	Leafless Logania		
Lomandra collina	Sand Mat-rush		
Lomandra leucocephala ssp. robusta	Woolly Mat-rush		
Lycium australe	Australian Boxthorn		
Maireana erioclada	Rosy Bluebush		
Maireana georgei	Satiny Bluebush		
Maireana pentatropis	Erect Mallee Bluebush		
Maireana radiata	Radiate Bluebush		
Maireana sedifolia	Bluebush		
Maireana trichoptera	Hairy-fruit Bluebush		
Maireana turbinata	Top-fruit Bluebush		
Maireana villosa	Silky Bluebush		
Melaleuca eleuterostachya	Hummock Honey-myrtle		
Melaleuca leiocarpa	Pungent Honey-myrtle		R
Minuria cunninghamii	Bush Minuria		
Minuria leptophylla	Minnie Daisy		
Myoporum montanum	Native Myrtle		
Myoporum platycarpum ssp.	False Sandalwood		
Newcastelia bracteosa			
Nicotiana velutina	Velvet Tobacco		

Scientific name	Common name	Conservation status	
		EPBC	NPW
Olearia calcarea	Crinkle-leaf Daisy-bush		
Olearia exiguifolia	Lobed-leaf Daisy-bush		
Olearia lepidophylla	Clubmoss Daisy-bush		
Olearia muelleri	Mueller's Daisy-bush		
Olearia pimeleoides	Pimelea Daisy-bush		
Podolepis capillaris	Wiry Podolepis		
Pimelea microcephala ssp.	Shrubby Riceflower		
Pimelea trichostachya	Spiked Riceflower		
Pittosporum angustifolium	Native Apricot		
Prostanthera striatiflora	Striated Mintbush		
Ptilotus incanus/obovatus	Silver Mulla Mulla		
Ptilotus nobilis ssp. nobilis	Yellow-tails		
Ptilotus polystachyus	Long-tails		
Rhagodia candolleana ssp.	Sea-berry Saltbush		
Rhagodia candolleana ssp. argentea	Silver Sea-berry Saltbush		
Rhagodia crassifolia	Fleshy Saltbush		
Rhagodia preissii ssp. preissii	Mallee Saltbush		
Rhagodia spinescens	Spiny Saltbush		
Rhagodia ulicina	Intricate Saltbush		
Rhodanthe floribunda	White Everlasting		
Salsola australis	Buckbush		
Santalum acuminatum	Quandong		
Santalum spicatum	Sandalwood		V
Scaevola depauperata	Skeleton Fanflower		
Scaevola humilis	Inland Fanflower		
Scaevola spinescens	Spiny Fanflower		
Schoenus subaphyllus	Desert Bog-rush		
Sclerolaena diacantha	Grey Bindyi		
Sclerolaena obliquicuspis	Oblique-spined Bindyi		
Sclerolaena parviflora	Small-flower Bindyi		
Sclerolaena patenticuspis	Spear-fruit Bindyi		

Scientific name	Common name	Conservation status	
		EPBC	NPW
Sclerolaena sp.	Bindyi		
Senecio gregorii	Fleshy Groundsel		
Senna artemisioides ssp. artemisioides x ssp. coriacea	Desert Senna		
Senna artemisioides ssp. X coriacea	Broad-leaf Desert Senna		
Senna artemisioides ssp. petiolaris			
Senna cardiosperma ssp. gawlerensis	Gawler Ranges Senna		
Senna phyllodinea			
Senna pleurocarpa var. pleurocarpa	Stripe-pod Senna		
Sida fibulifera	Pin Sida		
Sida petrophila	Rock Sida		
Sida sp.	Sida		
Sida trichopoda	High Sida		
Solanum coactiliferum	Tomato-bush		
Stenopetalum lineare	Narrow Thread-petal		
Swainsona sp.	Swainson-pea		
Templetonia egena	Broombush Templetonia		
Tetragonia eremaea	Desert Spinach		
Tetragonia moorei	New Zealand Spinach		
Thysanotus exiliflorus	Inland Fringe-lily		
Triodia basedowii	Hard Spinifex		
Triodia lanata	Woolly Spinifex		
Thryptomene elliottii			
Velleia connata	Cup Velleia		
Vittadinia cuneata var.	Fuzzy New Holland Daisy		
Vittadinia dissecta var. hirta	Dissected New Holland Daisy		
Vittadinia sp.	New Holland Daisy		
Sarcozona praecox	Sarcozona		
Sonchus oleraceus	Common Sow-thistle		
Westringia rigida	Stiff Westringia		
Xerochrysum bracteatum	Golden Everlasting		
Zygophyllum apiculatum	Pointed Twinleaf		

Scientific name	Common name	Conservation status	
		EPBC	NPW
Zygophyllum aurantiacum ssp.			
Zygophyllum eremaeum			

*Denotes a weed. R = Rare, V = Vulnerable, EN = Endangered

3.9.3.1 State Listed flora species

Two species (Table 3-18 and Figure 3-31), listed under the South Australia NPW Act, have been recorded within the Project Area. These were all recorded in 2014 and included:

- *Gratwickia monochaeta,* listed as Rare.
- Pungent Honey-myrtle (*Melaleuca leiocarpa*), listed as Rare.

Gratwickia monochaeta occurred in patches of 30 to 100 individuals, often on soils which had undergone minor disturbance within the Project Area (for example, on rolled helicopter pads). Pungent Honey-myrtle was recorded as single or clustered individuals in areas adjacent to low dune crests.

Yellow burr-daisy (*Calotis lappulacea*) was also observed in the northern section of the Project Area, predominately occurring on the dune crests. At the time of the survey in 2014 the Yellow burr-daisy was NPW Act listed (rare) however it was delisted in 2019.

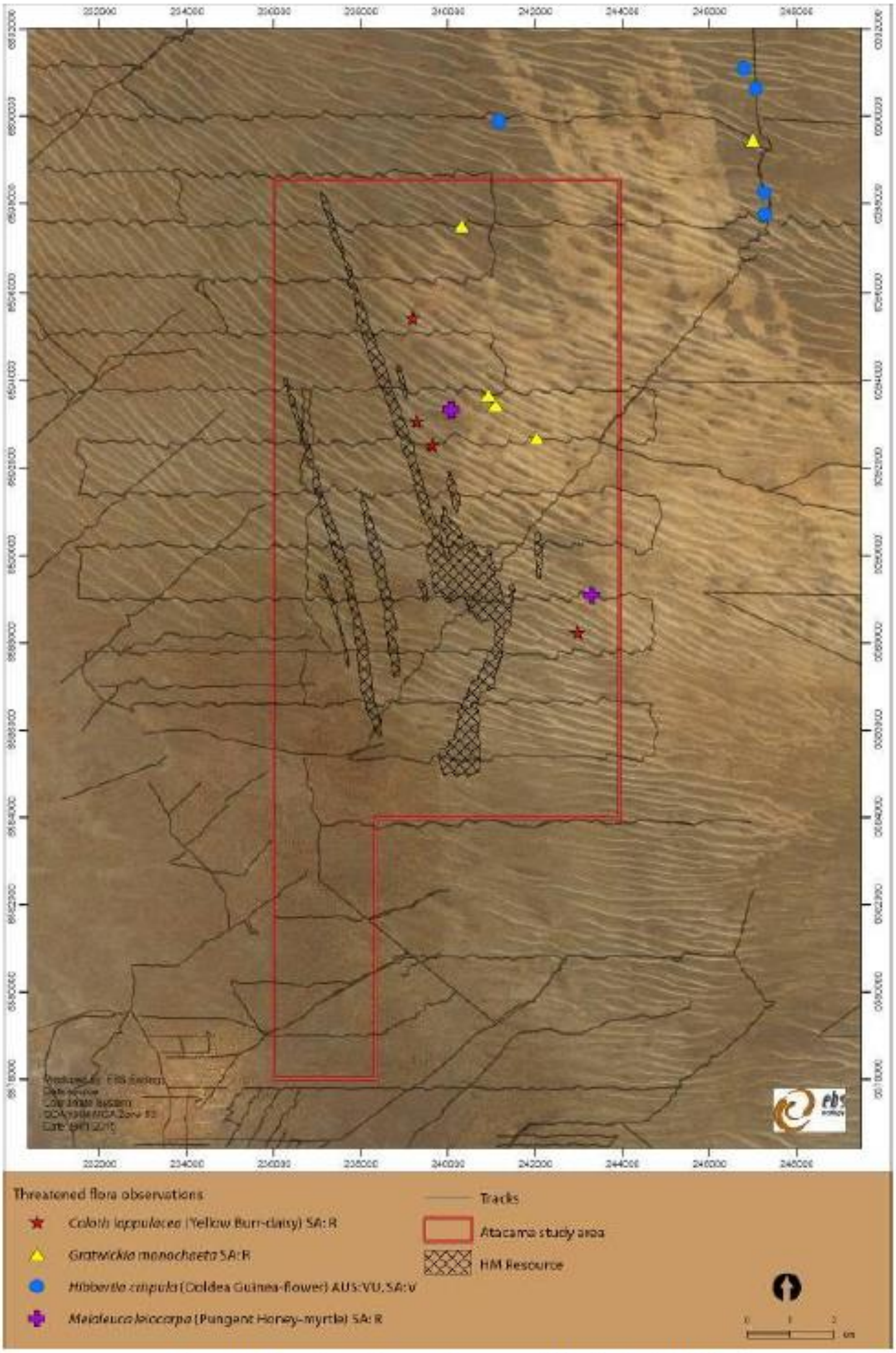

Figure 3-31 Listed flora species observed in the Project Area (Source: EBS 2015a)

3.9.3.2 EPBC Listed flora species and ecological communities

A search of the EPBC Act Protected Matters Search Tool (PMST), incorporating the Project Area and a 5 km buffer, was undertaken in 2022 (ELA, 2022b). The search identified three threatened flora species with potential habitat present within the search area:

- Desert Greenhood (*Pterostyliis xerophilia*) (vulnerable)
- Yellow Swainson-pea (*Swainsona pyrophila*) (vulnerable)
- Ooldea Guinea-flower (vulnerable).

A likelihood assessment was undertaken for these species as per the *Matters of National Environmental Significance – Significance Impact Guidelines 1.1* (DoE, 2013). Results determined all three species are unlikely to occur within the Project Area with the following justifications:

- **Ooldea Guinea-flower** – while there may be some suitable habitat within the Project Area, suitable habitat is limited (and mostly located outside of the Project Area). The closest record remains approximately 2 km north-east of the Project Area (Figure 3-31). No records were identified within the Project Area. despite extensive on-ground survey work undertaken in 2021 (ELA, 2022a). Refer to Section 3.9.3.3 for further survey information.
- **Yellow Swainson-pea** – no records of the species were found in any surveys or within the Project Area, even though this was searched extensively during the on ground truthing. The average annual rainfall for the Project Area is below 250 mm and there is a lack of preferred, heavier, saline soils where water collects within the Project Area (preferred habitat conditions). The closest known record is located approximately 130 km south-east.
- **Desert Greenhood –** In South Australia, this species occurs in dry woodland on or around granite or quartzite rock outcrops. There are no granitic and quartzite rock outcrops within the Project Area, and a noted absence of Broombush (*Melaleuca uncinata*), Yellow Mallee (*Eucalyptus incrassata*), Red Mallee (*Eucalyptus socialis*) and/ or Narrow-leaved red Mallee (*Eucalyptus leptophylla*) (which on the Eyre Peninsula are the species commonly associated with occurrences of the Desert Greenhood). The closest known record is 150-200 km east of the Project Area. Further, this species has not been detected in any ecological survey efforts to date (ELA, 2022b).

The Project has been determined to be a Controlled Action for three species, one of which is the Ooldea-Guinea-flower, and such this species will be discussed in further detail in the following section. The other two EPBC listed flora species will not be discussed further as they are considered unlikely to be present.

3.9.3.3 Ooldea Guinea-flower (Hibbertia crispula)

For more information on Ooldea Guinea-flower including baseline survey effort please refer to Section 8.

3.10 Fauna

An overview of the fauna within the Project Area is described within this section. For a more detailed discussion on baseline information please refer to Appendices B5 *Atacama Baseline Flora and Fauna Assessment – 2014* (EBS, 2015), B6 *Baseline Environmental Investigations Atacama Project* (EBS, 2019a), B7

Targeted Malleefowl Survey (EBS, 2019c) and B8 *Atacama Threatened Species Assessment Spring 2021* (ELA, 2022a).

The Project Area and greater region contains high quality habitat which is largely undisturbed and is home to a diverse range of fauna. Several fauna assessments have been undertaken in and around the Project Area:

- Atacama Baseline Flora and Fauna Assessment – 2014 (EBS 2015a)
- Baseline Environmental Investigations Atacama Project (EBS 2019a)
- Atacama Project EPBC assessment report (EBS 2019b)
- Targeted Malleefowl Survey – Atacama (EBS 2019c)
- Targeted threatened species survey (ELA, 2022a).

Baseline characterization of fauna occurred at nearby J-A in 2005 (SKM, 2005). Monitoring was established by EBS in 2008 and ongoing monitoring has been undertaken in autumn and spring in 2009, and then annual spring surveys from 2010 to 2015, with surveys undertaken every two years from 2017 onwards. (EBS 2009a, 2009b, 2010, 2011, 2012, 2013, 2014, 2015b, 2016, 2018; Jacobs 2021 and 2022a).

3.10.1 Birds

A total of 59 bird species have been recorded in the Atacama Project Area across two surveys (EBS 2015a, ELA, 2022a) (Table 3-19). Budgerigars (*Melopsittacus undulatus*), Weebills (*Smicrornis brevirostris*), Honeyeaters (the White-fronted Honeyeater (*Purnella albifrons*) and the Yellow-plumbed Honeyeater (*Ptilotula ornate*) were the most common species observed.

Table 3-19 Total bird summary

Species	Common name	2021 Survey	2014 survey	Total for all surveys	Conservation status	
		Total records	Total records		EPBC	NPW
Aves (Birds)						
Acanthagenys rufogularis	Spiny-cheeked Honeyeater	1	11	12	-	-
Acanthiza apicalis	Inland Thornbill	0	18	18	-	-
Acanthiza iredalei	Slender-billed Thornbill	11	0	11	-	-
Acanthiza uropygialis	Chestnut-rumped Thornbill	3	14	17	-	-
Accipiter cirrocephalus	Collared Sparrowhawk	0	2	2	-	-
Aegotheles cristatus	Australian Owlet-nightjar	0	1	1	-	-
Ardeotis australis	Australian Bustard	1	0	1	-	V

Species	Common name	2021 Survey	2014 survey	Total for all surveys	Conservation status	
		Total records	Total records		EPBC	NPW
Artamus cinereus	Black-faced Woodswallow	0	6	6	-	-
Artamus cyanopterus	Dusky Woodswallow	1	0	1	-	-
Artamus leucorynchus	White-breasted Woodswallow	0	4	4	-	-
Artamus personatus	Masked Woodswallow	0	40	40	-	-
Barnardius zonarius	Australian Ringneck	4	0	4	-	-
Cinclosoma castanotum	Chestnut Quailthrush (Chestnut-backed Quailthrush)	4	0	4	-	R
Circus assimilis	Spotted Harrier	0	8	8	-	-
Cacomantis pallidus	Pallid Cuckoo	0	5	5	-	-
Caligavis chrysops	Yellow-faced Honeyeater	1	0	1	-	-
Certhionyx variegatus	Pied Honeyeater	0	2	2	-	-
Colluricincla harmonica	Grey Shrikethrush	6	6	12	-	-
Chalcites basalis	Horsfield's Bronze Cuckoo	0	4	4	-	-
Chalcites osculans	Black-eared Cuckoo	0	2	2	-	-
Coracina novaehollandiae	Black-faced Cuckooshrike	0	2	2	-	-
Coracina maxima	Ground Cuckooshrike	0	9	9	-	-
Coturnix pectoralis	Stubble Quail	1	0	1	-	-
Cracticus torquatus	Grey Butcherbird	0	3	3	-	-
Daphoenositta chrysoptera	Varied Sittella	0	7	7	-	-
Dicaeum hirundinaceum	Mistletoebird	0	19	19	-	-
Epthianura tricolor	Crimson Chat	0	9	9	-	-

Species	Common name	2021 Survey	2014 survey	Total for all surveys	Conservation status	
		Total records	Total records		EPBC	NPW
Falco berigora	Brown Falcon	7	3	10	-	-
Falco peregrinus	Peregrine Falcon	0	1	1	-	R
Gymnorhina tibicen	Australian Magpie	3	4	7	-	-
Hieraaetus morphnoides	Little Eagle	1	1	2	-	-
Hirundo neoxena	Welcome Swallow	2	0	2	-	-
Lalage tricolor	White-winged Triller	1	2	3	-	-
Leipoa ocellata	Malleefowl	11	0	11	V	V
Malurus splendens	Splendid Fairywren	0	1	1	-	-
Manorina flavigula	Yellow-throated Miner	13	27	40	-	-
Melanodryas cucullata	Hooded Robin	1	0	1	-	-
Melopsittacus undulatus	Budgerigar	12	74	86	-	-
Merops ornatus	Rainbow bee-eater	5	4	9	-	-
Microeca fascinans	Jacky Winter	13	18	31	-	-
Myiagra inquieta	Restless Flycatcher	0	1	1	-	R
Neophema splendida	Scarlet-chested Parrot	8	0	8	-	R
Nymphicus hollandicus	Cockatiel	0	5	5	-	-
Oreoica gutturalis	Crested Bellbird	4	8	12	-	-
Pachycephala rufiventris	Rufous Whistler	3	9	12	-	-
Pardalotus striatus	Striated Pardalote	1	19	20	-	-
Petrochelidon nigricans	Tree Martin	0	21	21	-	-
Petroica goodenovii	Red-capped Robin	1	4	5	-	-
Phaps chalcoptera	Common Bronzewing	0	1	1	-	-

Species	Common name	2021 Survey	2014 survey	Total for all surveys	Conservation status	
		Total records	Total records		EPBC	NPW
Psephotellus varius	Mulga Parrot	2	10	12	-	-
Ptilotula ornata	Yellow-plumed Honeyeater	0	43	43	-	-
Ptilotula plumula	Grey-fronted Honeyeater	2	0	2	-	-
Podargus strigoides	Tawny Frogmouth	0	11	11	-	-
Pomatostomus superciliosus	White-browed Babbler	0	21	21	-	-
Purnella albifrons	White-fronted Honeyeater	3	44	47	-	-
Rhipidura leucophrys	Willie Wagtail	0	36	36	-	-
Smicrornis brevirostris	Weebill	16	48	64	-	-
Todiramphus pyrrhopygius	Red-backed Kingfisher	0	2	2	-	-
Turnix velox	Little Buttonquail	0	1	1	-	-
Total bird records		**142**	**591**	**733**	-	-
Total bird species		**30**	**47**	**59**	-	-

R = Rare, V = Vulnerable, EN = Endangered

3.10.1.1 State and EPBC listed species

Of the recorded bird species observed in the Project Area, one is nationally listed and six are state listed (Table 3-20). No introduced bird species have been recorded.

Table 3-20 Birds of conservation significance recorded in the Project Area

Scientific name	Common name	EPBC Status	NPW status
Leipoa ocellate	Malleefowl	V	V
Falco peregrinus	Peregrine Falcon	-	R
Ardeotis australis	Australian Bustard	-	V
Cinclosoma castanotum	Chestnut Quailthrush (Chestnut-backed Quailthrush)	-	R
Neophema splendida	Scarlet-chested Parrot	-	R

Scientific name	Common name	EPBC Status	NPW status
Myiagra inquieta	Restless Flycatcher	-	R

R = Rare, V = Vulnerable, EN = Endangered

3.10.1.2 Malleefowl (*Leipoa ocellata*)

For more information on Malleefowl including baseline survey effort please refer to Section 8.

3.10.2 Mammals

A total of 22 mammal species have been recorded in the Project Area across two surveys (EBS 2015a, ELA, 2022a). This includes 17 terrestrial mammals and five microbat species.

Seven small native mammal species were detected being the Native Mouse (*Pseudomys sp.*), , Little long-tailed Dunnart (*Sminthopsis dolichura*), Sandy Inland Mouse (*Pseudomys hermannsburgensis*), Sandhill Dunnart (*Sminthopsis psammophila*), Southern Ningaui (*Ningaui yvonneae*), Mitchell's Hopping-mouse (*Notomys mitchelli*) and Western Pygmy Possum (*Cercartetus concinnus*). Large native mammals included Western Grey Kangaroo (*Macropus fuliginosus*), Red Kangaroo (*Macropus rufus*) and Dingo (*Canis lupus*).

Five introduced mammal species have been recorded in the area including the camel (*Camelus dromedarius*), fox (*Vulpes vulpes*); feral cat (*Felis catus*), rabbit (*Oryctolagus cuniculus*) and house mouse (*Mus musculus*).

Of the recorded mammal species observed in the Project Area, one (Sandhill Dunnart) is nationally and state listed. The Southern Marsupial Mole (*Notoryctes typhlops*) has also been observed in the Project Area and was previously NPW Act listed, it has since been delisted.

Table 3-21 Total mammal results

Species	Common name	2021 survey	2014 survey	Total for all surveys	Conservation status	
		Total records	Total records		EPBC	NPW
Mammalia (Mammals)						
Austronomus australis	White-striped Free-tailed Bat	0	2	2	-	-
**Camelus dromedarius*	Camel	7	0	7	-	-
Canis lupus	Dingo	1	0	1	-	-
Cercartetus concinnus	Western Pygmy-possum	1	7	8	-	-
Chalinolobus gouldii	Gould's Wattled Bat	0	14	14	-	-
**Felis catus*	Domestic cat (Feral cat)	0	8	8	-	-

Species	Common name	2021 survey	2014 survey	Total for all surveys	Conservation status	
		Total records	Total records		EPBC	NPW
Macropus fuliginosus	Western Grey Kangaroo	2	0	2	-	-
Macropus rufus	Red Kangaroo	0	19	19	-	-
**Mus musculus*	House Mouse	0	23	23	-	-
Nyctophilus geoffroyi	Lesser Long-eared Bat	0	140	140	-	-
Ningaui yvonneae	Southern Ningaui	0	2	2	-	-
Notomys mitchellii	Mitchell's Hopping-mouse	4	3	7	-	-
Notoryctes typhlops	Southern Marsupial Mole (Itjaritjari)	0	47	47	-	V
**Oryctolagus cuniculus*	Rabbit (European Rabbit)	0	29	29	-	-
Ozimops petersi	Inland Free-tailed Bat	0	4	4	-	-
Pseudomys hermannsburgensis	Sandy Inland Mouse	2	9	11	-	-
Pseudomys sp.	Native Mouse	1	0	1	-	-
Sminthopsis dolichura	Little Long-tailed Dunnart	4	10	14	-	-
Sminthopsis psammophila	Sandhill Dunnart	0	4	5	EN	V
Tachyglossus aculeatus	Short-beaked Echidna	1	0	1	-	-
Vespadelus regulus	Southern Forest Bat	0	1	1	-	-
**Vulpes vulpes*	Red Fox	1	0	1	-	-
Total mammal records		**24**	**322**	**346**	**-**	**-**
Total mammal species		**10**	**16**	**22**	**-**	**-**

*denotes an introduced specie. R = Rare, V = Vulnerable, EN = Endangered

3.10.2.1 Sandhill Dunnart (Sminthopsis psammophila)

For more information on Sandhill Dunnart including baseline survey effort please refer to Section 8.

3.10.3 Reptiles

A total of 45 reptile species have been recorded in the Atacama Project Area across two surveys (EBS 2015a, ELA, 2022a). Southern Spinifex Ctenotus (*Ctenotus atlas*) was the most common species observed, followed by the Sandplain Ctenotus (*Ctenotus schomburgkii*), Starred Knob-tailed Gecko (*Nephrurus stellatus*) and Linga Dragon (*Diporiphora linga*).

No EPBC Act or NPW Act listed reptiles have been recorded within the Project Area.

Table 3-22 Total reptile results

Species	Common name	2021 Survey	2014 survey	Total for all surveys	Conservation status	
		Total records	Total records		EPBC	NPW
Reptilia (Reptiles)						
Brachyurophis fasciolatus	Narrow-banded Snake	2	2	4	-	-
Brachyurophis semifasciatus	Half-girdled Snake	1	5	6	-	-
Ctenophorus cristatus	Crested Dragon	0	2	2	-	-
Ctenophorus fordi	Mallee Dragon	3	4	7	-	-
Ctenophorus isolepis	Military Dragon	1	8	9	-	-
Ctenophorus pictus	Painted Dragon	6	0	6	-	-
Ctenotus atlas	Southern Spinifex Ctenotus	15	28	43	-	-
Ctenotus leae	Centralian Coppertail	1	0	1	-	-
Ctenotus regius	Eastern Desert Ctenotus	1	0	1	-	-
Ctenotus taeniatus	Eyrean Ctenotus	0	1	1	-	-
Ctenotus schomburgkii	Sandplain Ctenotus	6	15	21	-	-
Cyclodomorphus melanops	Spinifex Slender Bluetongue	0	11	11	-	-
Delma butleri	Unbanded Delma	3	2	5	-	-
Delma petersoni	Painted Snake-lizard	0	3	3	-	-
Demansia reticulata	Desert Whipsnake	0	1	1	-	-
Diplodactylus wiru	Desert Wood Gecko	3	8	11	-	-

Species	Common name	2021 Survey	2014 survey	Total for all surveys	Conservation status	
		Total records	Total records		EPBC	NPW
Diporiphora linga	Linga Dragon	5	12	17	-	-
Eremiascincus richardsonii	Broad-banded Sandswimmer	1	0	1	-	-
Gehyra purpurascens	Purple Dtella	0	6	6	-	-
Gehyra variegata	Tree Dtella	0	4	4	-	-
Gekkonidae sp.	Unidentified Gecko	11	0	11	-	-
Lerista desertorum	Great Desert Slider	0	1	1	-	-
Lerista labialis	Eastern Two-toed Slider	5	9	14	-	-
Lerista taeniata	Ribbon Slider	2	3	5	-	-
Lerista terdigitata	Southern Three-toed Slider	0	1	1	-	-
Lerista timida	Dwarf Three-toed Slider	0	3	3	-	-
Lialis burtonis	Burton’s Snake-lizard	3	4	7	-	-
Liopholis inornata	Desert Skink	1	6	7	-	-
Lucasium bungabinna	Southern Sandplain Gecko	6	6	12	-	-
Lucasium damaeum	Beaded Gecko	3	11	14	-	-
Menetia greyii	Dwarf Skink	2	0	2	-	-
Moloch horridus	Thorny Devil	2	4	6	-	-
Morethia boulengeri	Common Snake-eye	1	0	1	-	-
Morethia butleri	Butler’s Snake-eye	0	7	7	-	-
Nephrurus laevissimus	Pale Knob-tailed Gecko	1	3	4	-	-
Nephrurus sp.	Knob-tailed Gecko	2	0	2	-	-
Nephrurus stellatus	Starred Knob-tailed Gecko	1	17	18	-	-
Pogona minor	Dwarf Bearded Dragon	6	9	15	-	-

Species	Common name	2021 Survey	2014 survey	Total for all surveys	Conservation status	
		Total records	Total records		EPBC	NPW
Pseudonaja modesta	Five-ringed Snake	1	1	2	-	-
Ramphotyphlops bicolor	Southern Blind Snake	0	4	4	-	-
Strophurus assimilis	Thorn-tailed Gecko	2	2	4	-	-
Strophurus elderi	Jewelled Gecko	0	3	3	-	-
Varanus eremius	Desert Pygmy Goanna	0	4	4	-	-
Varanus gilleni	Pygmy Mulga Goanna	0	11	11	-	-
Varanus gouldii	Sand Goanna	5	0	5	-	-
Total reptile records		**102**	**221**	**323**	**-**	**-**
Total reptile species		**30**	**36**	**45**	**-**	**-**

Figure 3-32 is a map detailing all listed (Federal and State) fauna species observed in the Project Area.

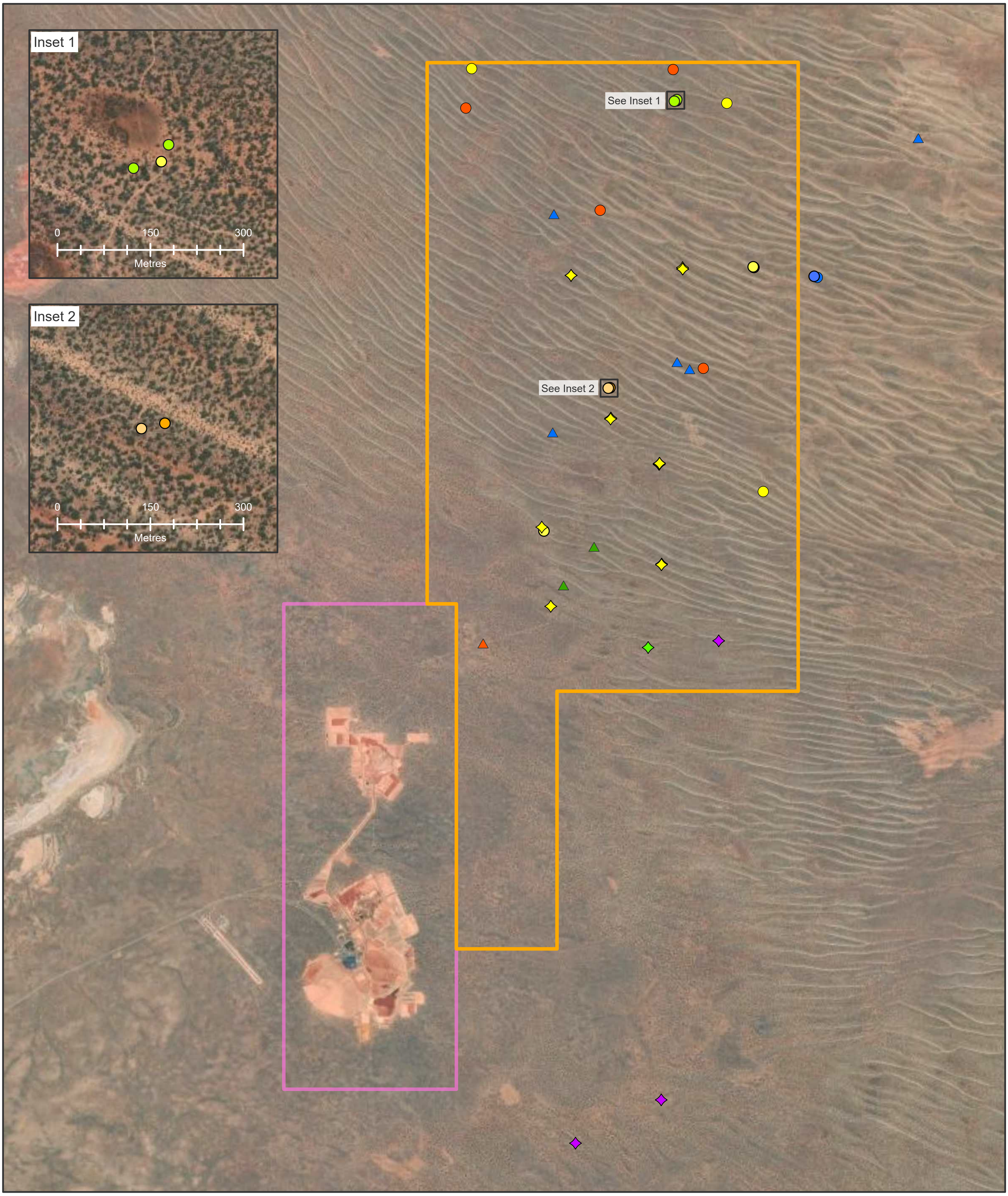

Figure 3-32 Listed fauna species observed in the Project Area

Project Area

ML 6315

Threatened fauna observations

Australian Bustard

Chestnut Quailthrush

Scarlet Chested Parrot

Peregrine Falcon

Restless Flycatcher

Southern Marsupial Mole

Sandhill Dunnart (old nest - unconfirmed)

Sandhill Dunnart records (EBS Ecology 2014)

Malleefowl Evidence 2021

Bird

Feather

Nest (old)

Tracks

0 2 4

Kilometres

Datum/Projection:
GDA 1994 MGA Zone 53

Project: 20409-OK Date: 2/20/2023

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3.11 Caves

There are no caves within the Project Area.

3.12 Local community

The Atacama Project sits within the Yellabinna Regional Reserve, which sits within the provision of the *Native Title Act 1993*. The Far West Coast (FWC) People are the registered native title holders and traditional owners and are represented by the FWCAC. Surrounding areas outside of the Reserve boundaries sit within the Pastoral Unincorporated Area and are overseen by the Outback Communities Authority (OCA), which is responsible for the management and local governance of the unincorporated areas of South Australia and is pursuant to the *Outback Communities (Administration & Management) Act 2009*. The OCA is a hybrid between local government and community self-management and oversees the area surrounding Atacama Project Area in lieu of a traditional local government.

3.12.1 Region

An overview of the demographics in the Region is described within this section. For a more detailed discussion on baseline information please refer to Appendix C2 *Atacama Project Social Impact Assessment* (WSP, 2023).

3.12.1.1 South Australia

South Australia is home to a wide variety of major operating mines including gold, copper, iron, coal, zinc, silver and graphite across the state. Mining in South Australia contributes to approximately $8.7bn corresponding to 7.9% of South Australia's total economic output. Mining is the second-highest export industry behind agriculture, forestry and fishing, with 43% of South Australia's total exports (WSP, 2023).

3.12.1.2 Eyre Peninsular and Southwest region

The Eyre region is recognized as native lands of the Far West Coast Aboriginal Peoples. The Eyre Peninsula hosts over 100 parks, conservation areas and reserves including local government administrated land, land managed under the FWC Native Title determination and an Aboriginal Protected Area (WSP, 2023).

Localities in the Eyre Peninsular include Port Lincoln, Whyalla, Ceduna, Coffin Bay and Cummins. The total resident population of the area is 57,092, with an Aboriginal and/or Torres Strait Islander population of around 7% (WSP, 2023). The region generates over $4 billion in revenue each year, with key industries including agriculture, manufacturing, fishing and mining. Tourism is a growth area with employment in the sector growing almost 80% in the last decade (WSP, 2023). Mining is typically centred on iron ore extraction as well as heavy mineral sands. Mining is considered an emerging land use type in the region (WSP, 2023).

The Project Area is isolated from towns and population centres with the closest community group being the Yalata Aboriginal community, approximately 75 km south of the site (Figure 3-33). Beyond this, the closest population centre is Ceduna, 290 km from the Project Area.

Figure 3-33 Project Area in relation to population centres

- Project area
- Ceduna LGA
- Population centres

0 50 100
Kilometres

Datum/Projection:
GCS GDA 1994
Project: 20409-SH/OK Date: 2/8/2023

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3.12.1.3 *Ceduna and Thevenard*

The Ceduna local government area (LGA) is the nearest local government area to the project and includes the township of Ceduna and surrounding localities including Thevenard, Smoky Bay, Denial Bay and Koonibba. The LGA covers an area of 5,487 km^2 with a total population of 3,505.

Ceduna town has a resident population of approximately 1,995 people. Ceduna (including Thevenard) is approximately 400 km from Port Lincoln and is the major service town for the West and Far West Coast region, providing essential amenities and social infrastructure including businesses, medical and health service centres, education facilities, and Ceduna Airport.

Over half the population of the Ceduna LGA reside within the Ceduna area. It is a multi-cultural community with people of a number of nationalities in the town and immediate region. The majority of residents (78%) are Australian born, with approximately 25% of the residents identifying as Aboriginal and/ or Torres Strait Islander. The most common language spoken at home (other than English) is Pitjantjatjara (2.1%) (WSP, 2023). The most common industry of employment is Combined Primary and Secondary Education at 6.1%, followed by grain-sheep or grain-beef cattle farming at 4.9%. Several specialized industries also operate in the region including offshore longline and rack aquaculture. Ceduna's economy relies on major industries including agriculture, mining, aquaculture and tourism, with whale watching and an annual Oyster Festival that attracts crowds of up to 6,000 to 8,000 visitors over two days on the October long weekend.

Ceduna LGA is one of the more disadvantaged LGAs in Australia (Elton 2019, WSP 2023). The remoteness of the region and the high proportion of Aboriginal communities within the population who face severe and adverse health and socio-economic conditions place these communities in vulnerable position.

Thevenard, a suburb of Ceduna, is located approximately3 km south-east of the Ceduna main business area and includes Port Thevenard (the Port). The major export cargoes handled through the Port are grain, seeds, salt, gypsum and mineral sands. The Port is in close proximity to residential coastal properties, and the railway line.

3.12.1.4 *Penong*

Penong is a small township of approximately 280 people, located approximately 71 km west of Ceduna along the Eyre Highway. Penong is a mix of farming and cropping area with the majority of the residents living outside the township itself (WSP, 2023). The small township is primarily a service town for passing traffic including tourists travelling to Cactus Beach or Western Australia. Penong is self-sufficient in providing access to essential services and community amenities and social infrastructure. Penong businesses include a pub, a café and small retail shop. There is a RSL Hall, a newly renovated primary school, and nearby there is the Penong Woolshed Museum, and several camping grounds.

3.12.1.5 *Aboriginal communities*

There are a number of Aboriginal communities to the north, east and west of Ceduna. The main communities are Yalata located approximately 200 km to the west of Ceduna and the Maralinga Tjarutja (Oak Valley) community located approximately 300 km north from Yalata.

Yalata was created in 1952 to accommodate people who had been displaced following the closure of the Ooldea United Aboriginal Mission. The community is southern Anangu, a community which speaks the southern dialect of *Pitjantjatjara* as their first language. Aboriginal law and culture are a central focus in the community. There are several facilities and social amenities maintained in Yalata including a community store, health clinic, swimming pool, learning hub and youth centre.

Maralinga Tjarutja (Oak Valley) is an Aboriginal remote community of the Maralinga Tjarutja Aboriginal Council LGA, located on the southern fringe of The Great Victoria Desert, approximately 516 km northwest of Ceduna within the Maralinga Lands. Maralinga Tjarutja has a resident population that ranges from 80-100 people but can swell to 1,500 people with visitors during cultural events and activities. The remote community is self-sufficient. *Pitjantjatjara* is the language spoken. Access permits are required to travel through the Maralinga Lands, and Maralinga Tjarutja (Oak Valley) is serviced with a store, mechanics garage, health clinic, aged care centre, a school and an airstrip.

The Wangka Wilurara Transitional Accommodation Centre known as Town Camp is located on Goode Road, approximately two kilometres from the main town centre of Ceduna. Town Camp was established by Housing SA, the Aboriginal and Torres Strait Islander Commission and Ceduna Council to provide a service for Aboriginal people who visit Ceduna from their communities and homelands to access services and supplies.

Koonibba is an Aboriginal community with a resident population of approximately 140-200 people, approximately 270 km southeast of the Project Area. It is governed by the Koonibba Aboriginal Community Council Inc with many families with historical and cultural connections to the town.

Scotdesco is a small Aboriginal community of approximately 50 people, situated on 25,000 acres of property called Tjilkaba. The property is open to the public offering camping and tourist activities with a focus on Aboriginal culture and history.

3.13 Landowners and land use

3.13.1 Landowners

Landownership details are included in Section 1.6 and title information for adjacent tenements are included in Section 1.4.

3.13.2 Zoning

The Project Area is out of council areas and subject to the Planning and Design Code, Remote Areas Zone.

3.13.3 Land use

The Project Area lies within the Yellabinna Regional Reserve. Key dates in the historical and current land use are shown in Table 3-23..

Table 3-23 Timeline of historic and current land use within Yellabinna Regional Reserve

Year	Event
1990	Yellabinna Regional Reserve established.

Year	Event
2004	J-A deposit established
2007	Native Title Mining Agreement for Production between Far West Coast Native Aboriginal Corporation and Iluka Resources Limited
2009	J-A production commenced
2013	Native Title acknowledged for Yellabinna Regional Reserve. Yumbarra Conservation Park Co-management Board formed

Within the region, Aboriginal people used a major pathway from the coast inland to Ooldea soak, a permanent freshwater soak, which is also a ceremonial site, meeting place and trading centre near the north western boundary of the Yellabinna Regional Reserve.

The first European exploration of the region occurred in 1840-41, with exploration across the Mallee wilderness from 1861. European exploration occurred between the Ooldea Soak to Mount Finke in 1875. The lack of surface water, salty bores and droughts constrained agriculture to the coastal loamy sands. The region has always been unsuitable for pastoral activities due to the lack of permanent water supply and the presence of dingoes (*Canis lupus dingo*) (DEWNR 2013).

Yellabinna Regional Reserve was proclaimed on the 25[t] January 1990 (DEW, 2022). The western boundary of the Yellabinna Regional Reserve was historically used as a travelling stock route that crossed Lake Ifould and then passed Poondinga Rockhole. Figure 3-34 shows other reserves present within and surrounding the Yellabinna Regional Reserve. These areas combined cover 3 million hectares (ha) of predominantly Mallee vegetation that is largely undisturbed from human activity and its secondary effects (DEWNR 2013). The dominant land uses of these combined conservation areas are:

- conservation of wildlife, landscape and historic features
- aboriginal land use
- mineral exploration
- tourism.

Current land use within the Yellabinna Region Reserve includes ecological conservation, cultural practices, and mining of heavy mineral sands at Iluka's J-A mine, in addition to a small amount tourism along Googs Track to the east. Further heavy mineral sand deposits are under evaluation for future mining in the Yellabinna region.

There are no known plans for future land use changes by others. The Project Area does not fall within the Murray Darling Basin, Adelaide Dolphin Sanctuary or a Marine Park.

Figure 3-34 Locality of Reserves (Source: DEWNR, 2013)

3.13.4 Policies

The Project Area is located outside of a council in the Pastoral Unincorporated Area, in the Eyre and Western Region. The Project Area is covered by the South Australian Planning and Design Code under the *Planning, Development and Infrastructure Act 2016*. It is zoned Conservation and is part of the Yellabinna Regional Reserve. Under the *National Parks and Wildlife Act 1972,* section 34 allows for multiple use classification of regional reserves. Regional reserves provide for the conservation of wildlife and the natural or historic features of the land while permitting use of natural resources. Mineral production is permitted in Regional Reserves with the approval of the Minister for Environment and Water and the Minister for Energy and Mining. Consideration should be given to the management plan of the Reserve (DEM 2022b and DEM 2022c).

3.13.5 Restrictions

A copy of the Crown Lease for Crown Record 5952/890 obtained on the 13 October 2022 recorded no Public Utility Easements for the site. The nearest Defence Land is the Woomera Prohibited Area (WPA) approximately 33 km north of the Project Area (Figure 3-35). The Cultana Training Area is approximately 550 km to the east of the Project Area.

Mining related tenements adjacent to the Project Area under the Mining Act are shown in Figure 3-36, noting that this figure only shows the locations of ELs. There are no Retention Leases (RLs), private mines or other mining related tenements in the vicinity with the exception of those relating to J-A (which are shown early in Figure 1-1). Petroleum tenements under the *Petroleum and Geothermal Energy Act, 2000* are shown in Figure 3-37. There are no geothermal tenements near the Project Area.

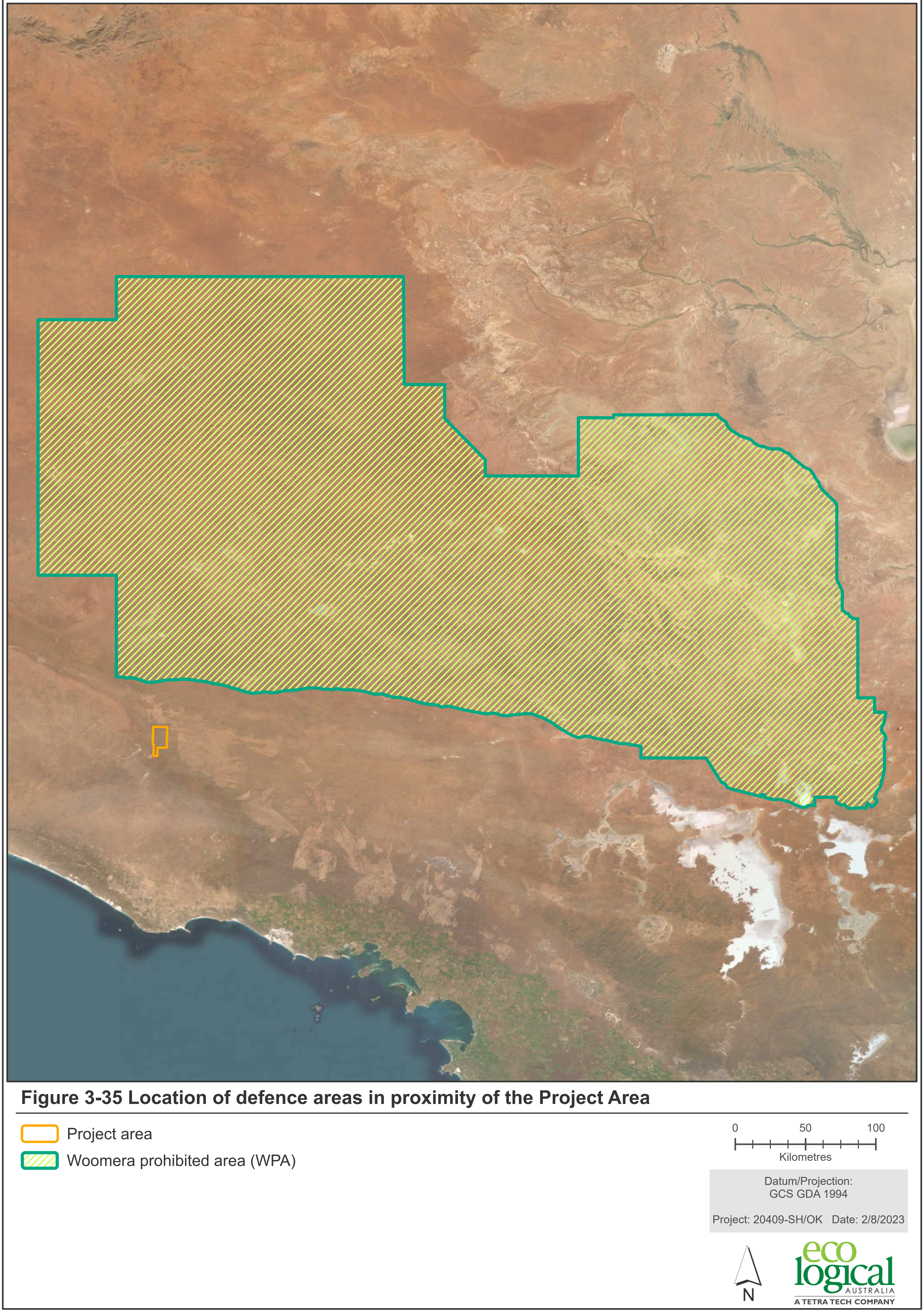

Figure 3-35 Location of defence areas in proximity of the Project Area

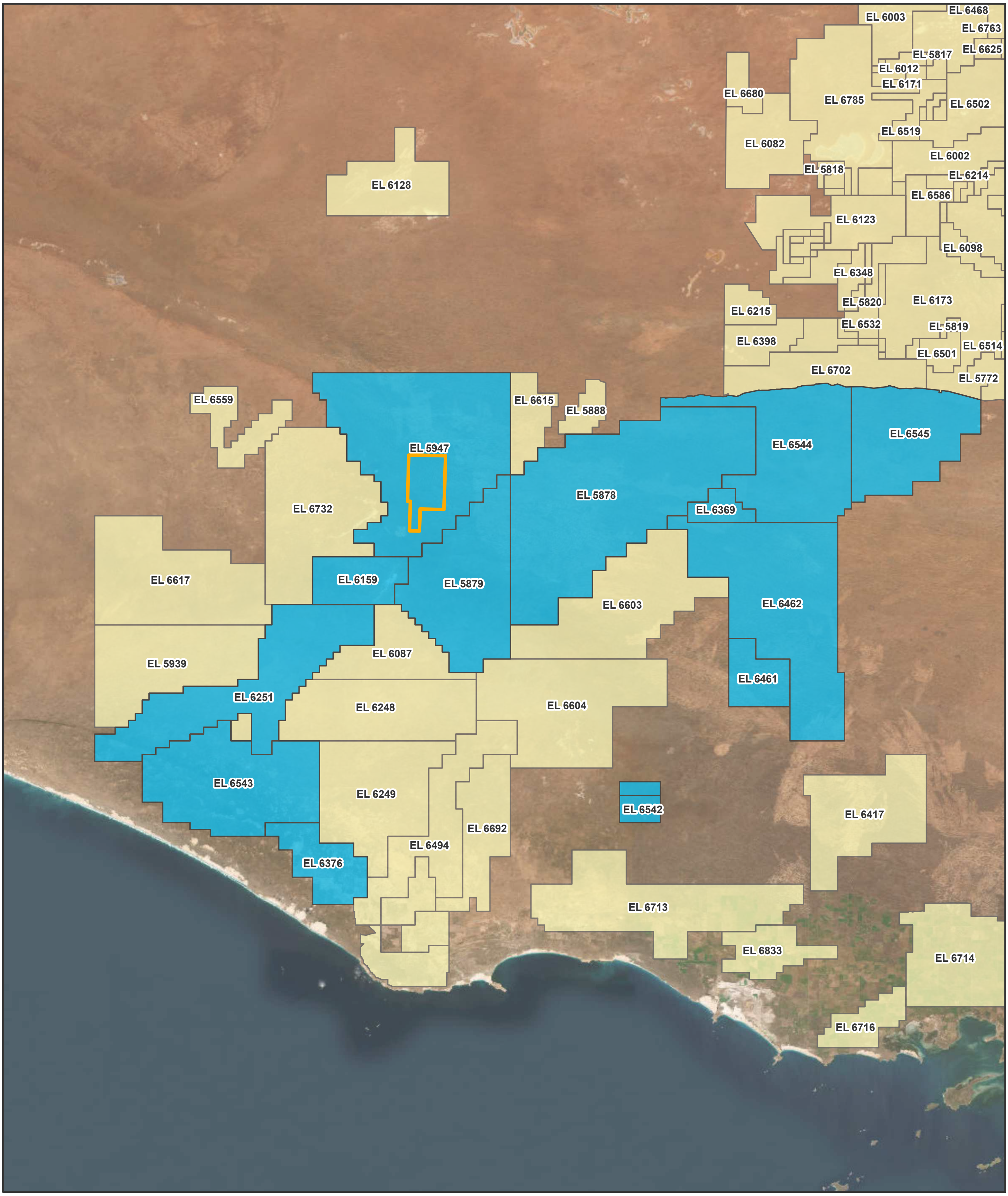

Figure 3-36 Location of mining tenements in proximity of the Project Area

Project area

Iluka exploration tenements

Other exploration tenements

0 25 50

Kilometres

Datum/Projection:
GCS GDA 1994

Project: 20409-SH/OK Date: 2/8/2023

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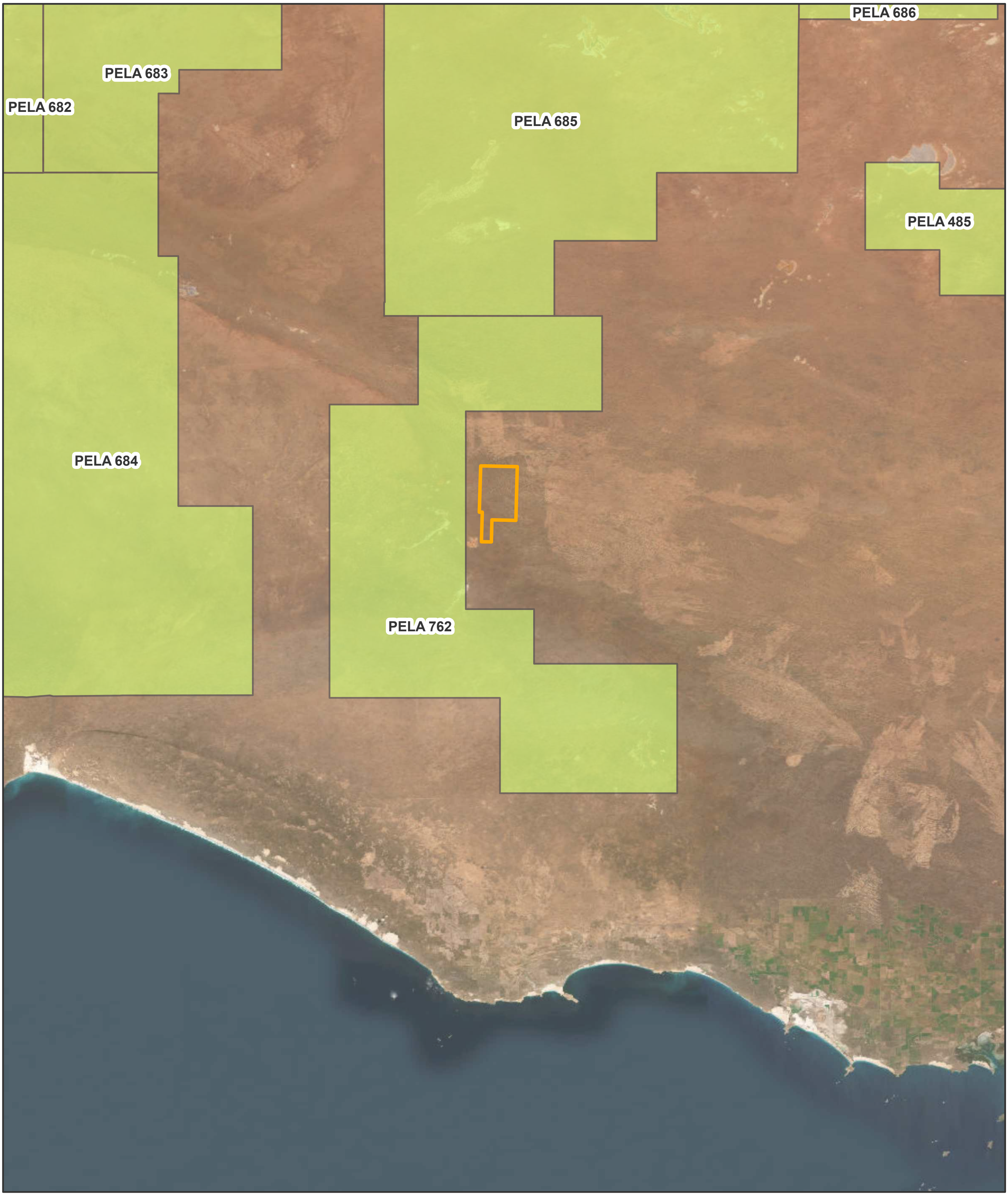

Figure 3-37 Location of petroleum tenements in proximity of the Project Area

3.14 Proximity to infrastructure and housing

An overview of socio-economic baseline is described within this section. For a more detailed discussion on baseline information please refer to Appendix C2 *Atacama Project Social Impact Assessment* (WSP, 2023).

There are a range of services and infrastructure established in the Far West Coast regional centre of Ceduna (Table 3-24). The Ceduna Health Service (SA Health, Government of South Australia) is the key medical and health service provider in the Far West Coast.

Services for Yalata are not detailed in the tables below. Entry into Yalata is restricted to permit holders and services are restricted to a monthly GP fly in clinic, store, school, child health centre and Lutheran church.

Table 3-24 Ceduna District Health Service

Amenity items	Service description
General Hospital amenities	15 overnight beds and 4 day beds, 2 dialysis chairs and 38 beds for people requiring high and low level aged care; on-site parking; disabled access; General Practitioners
Emergency care	24-hour ambulance and emergency
Specialist services	Physiotherapy, podiatry, diabetes education
Dialysis services	Renal hemo-dialysis (specialised equipment to cleanse the kidneys)
Dental	Public and private health care
Maternity and obstetrics	Shared care arrangement with General Practitioners, community midwives to provide and care and services to women before, during and childbirth
Residential aged care	10 beds for people who require high level care at the hospital, and 29 beds for people with low level needs for care at the Far West Senior Citizens Lodge
Community Health Services – Aged care	Home based aged care services
Adult activity centre	Aged and adult therapy services
Ceduna Koonibba Aboriginal Health Service	Specialised health services for Aboriginal communities within the district

Source: SA Health 2014

Details of infrastructure and associated service providers in the region are detailed in Table 3-25.

Table 3-25 Regional infrastructure and service providers

Summary of regional infrastructure and service providers	
Electricity	SA Power Networks provide off-grid electricity to the Aboriginal lands including the Yalata community, 75 km south of the Project Area. The nearest connection to the South Australian electricity grid is located at Ceduna.

Summary of regional infrastructure and service providers	
Water Supply	SA Water provides water, wastewater and related services as far west as Ceduna, 290 km south-east of the Project Area. There is no recorded use of groundwater other than for road construction and maintenance within many kilometres of the borefield, due to the high salinity, deep water table and generally low yields.
Communications	A Code Division Multiple Access (CDMA) phone tower is located at the Yalata community some 75 km south of the Project Area however this is too far from site for reception. There are fibre optic cables running along the Eyre Highway and the transcontinental railway line that runs through Ooldea siding some 70 km north of the Project Area.
Other	A dog fence constructed to protect the pastoral areas in the south from the wild dogs in the north, stretches 5,300 km and is located 40 km to the south of the Project Area.
Road	The Eyre Highway, connecting the eastern States to WA, is the major interstate road closest to the Project Area. Current access to the site is along a minor road north from the Eyre Highway. Traffic data is available for the Eyre highway as far west as Ceduna. The data is based on Annual Average Daily Traffic (AADT), which is the total volume of traffic travelling in both directions during one 24 hour period. 2019-2021 data shows that traffic volumes on key roads within Ceduna range between 1000-2,200 vehicles per day (vph), with between 18 and 33% of the traffic considered as heavy vehicles (Hatch, 2022). Traffic volumes along the Eyre Highway range between 550-850 vpd with volumes increasing from west to east. Between 37.5 and 58% of the traffic volume is considered heavy vehicles (Hatch, 2022). The Ooldea to Yalata Road is a public road approximately 130 km long between Eyre Highway and Ooldea. The road is unsealed and maintained by the Department of Planning, Transport and Infrastructure (DPTI). As outlined in Table 3.2, a Development Application for the upgrade of this road was lodged by Iluka as part of the Jacinth Ambrosia Mining Project. Approval for the upgrade of Ooldea Road was granted in May 2008. No traffic estimates are publicly available for the Ooldea to Yalata Road.
Rail	The Trans-Australian railway between Adelaide and Perth passes through the region. Ooldea siding is approximately 70 km from the Project Area.
Air	There is an airport at Ceduna serviced by Regional Express, which provides a daily passenger service to and from Adelaide. There are also airstrips at Ooldea siding and the Yalata community, the latter of which is constructed to Royal Flying Doctor Service standard.
Port	Port Thevenard is located 270 km from the Project Area and 3 km south-east from the centre of Ceduna. The major export cargoes handled through the port include gypsum, grains, seeds, salt and heavy minerals.

The Project Area is isolated with the Yalata Aboriginal community, located 75 km to the south the nearest populated area. The J-A Project has a workforce accommodation camp of up to 200 people and will be expanded to house the new workforce for the Atacama Project. Ceduna, the closest large population centre is 290 km to the southeast of the Project Area (WSP, 2023). The majority (60%) of the J-A workforce live in the Adelaide metropolitan area. Ceduna and Thevenard provide 18% of the workforce and Streaky Bay provides 7% of the workforce (WSP, 2023).

Road access to the Project Area is via the shared Ooldea Haul Road (linking the Eyre Highway to the nearby J-A mine site), which was upgraded and is maintained by Iluka for the J-A Project. This road is used by Iluka and the local communities of Yalata, Maralinga and Maralinga Tjarutja (Oak Valley). The Ooldea Haul Road is used to transport material from J-A to Port Thevenard for shipping.

3.15 Amenity

Amenity values are as described within the Yellabinna and Warna Manda Parks Management Plan (DEW, 2019) and includes variable habitat and vegetation associations, geological and cultural features (e.g., rock holes); and high-quality endemic ecosystems minimally affected by anthropogenic disturbance and incursion of exotic species. The Yellabinna Reserve protects the largest intact area of mallee woodland in the world. The woodlands link the Eyre Peninsula Woodlands to the Great Victoria Desert, the Nullarbor Plain, Maralinga Tjarutja lands and Mamungari Conservation Park and are critical to biodiversity conservation and may contribute to the resilience of species to the effects of climate change. The Yellabinna Regional Reserve provide for the physical, mental and spiritual wellbeing of the FWC Aboriginal people. A series of songlines connect sites throughout the area and have significance to other Aboriginal groups beyond the FWC region. Culturally significant sites such as Mount Finke are part of the Yellabinna Regional Reserve (DEW, 2019). Mount Finke is approximately 160 km east of the Project Area.

3.16 Radiation

An overview of radiation is described within this section. For a more detailed discussion on baseline information please refer to Appendix B9 *Atacama Baseline Radiation Survey Report* (SA Radiation, 2016).

A baseline radiation survey was conducted in 2016 (SA Radiation) with 219 sample locations collected within the Project Area (Figure 3-31). Implied uranium and thorium levels in the soil were measured using a RS-125 Super SPEC scintillation detector in assay mode at each site. Approximately 20-50 g of surface soil was collected using a hand trowel to a depth of approximately 100 mm at each of the 219 sampling locations, with 23 samples selected and analysed to confirm the insitu testing. Gamma dose at ground level was also recorded for each of the sampling locations. Radon monitoring was taken over a 12-month period at five locations in the Project Area. Dust monitoring was undertaken over a total of 12 months, with samples collected every three months at six locations within the Project Area. Dust collected was analysed for uranium and thorium.

Uranium and thorium

Implied uranium and thorium concentrations in the soil were obtained using a RS-125 Super SPEC scintillation detector in assay mode at all 219 sampling locations. Measurements were taken at ground level, in areas that were flat and appeared to be of homogenous soil. Refer to Table 3-26 for a summary of the results.

Table 3-26 Summary of RS-125 total uranium and thorium readings (SA Radiation, 2016)

Aspect	Uranium (ppm)	Thorium (ppm)
Minimum	0.0	0.0
Maximum	4.5	9.5
Average	**0.75**	**2.97**

From the 219 sampling locations a select number (23) were chosen for ICPMS analysis of the passive dust uranium and thorium concentrations, with radon and thoron concentrations observed over a 12-month period. These 23 sites were chosen based on the following criteria:

- sample locations that recorded the maximum, minimum and average combined uranium and thorium concentration as indicated by RS-125 measurements (sampling locations 34, 95, 168, 173, 182 and 216)
- sample locations that recorded the maximum, minimum and average gamma dose rates as indicated by Atomtex measurements (sampling locations 14, 26, 29, 88, 103 and 125)
- sampling locations that were not near the above sites so as to achieve a more even distribution of samples across the study area (sampling locations 1,5, 9, 49, 54, 61, 114, 115, 162, 195 and 204).

Six sampling locations were then selected to collect passive dust using the Australian Standard for gravimetric sampling (AS/NZS 3580.10.1:2003) over four consecutive three month periods. The dust was then analysed for uranium and thorium. The average concentration of thorium in Australian soils is approximately 4.4 ppm (UNSCER, 2000), while the average concentration collected in the study area was 4.2 ppm. The average concentration of uranium in Australia is 1.1 ppm (Geoscience Australia, 2009), which is below the detection limit for uranium in soil samples (approximately 3 ppm), and as such the results here are not sufficiently low to allow a comparison to the average Australian concentrations.

Table 3-27: Uranium and thorium in dust from gravimetric sampling locations

Site	Uranium Concentration (ppm)	Thorium Concentration (ppm)
1	<3.1	4.9
20	<2.1	3.4
114	<2.9	5.6
196	<2.4	5.6
204	<1.4	2.4
217*	<3.2	<3.2
Average	-	**4.2**

*Site 217 data has been produced from gravimetric sampling as part of the Typhoon Sonoran Baseline Survey. This site dust was collected 6 months earlier than dust from other sites.

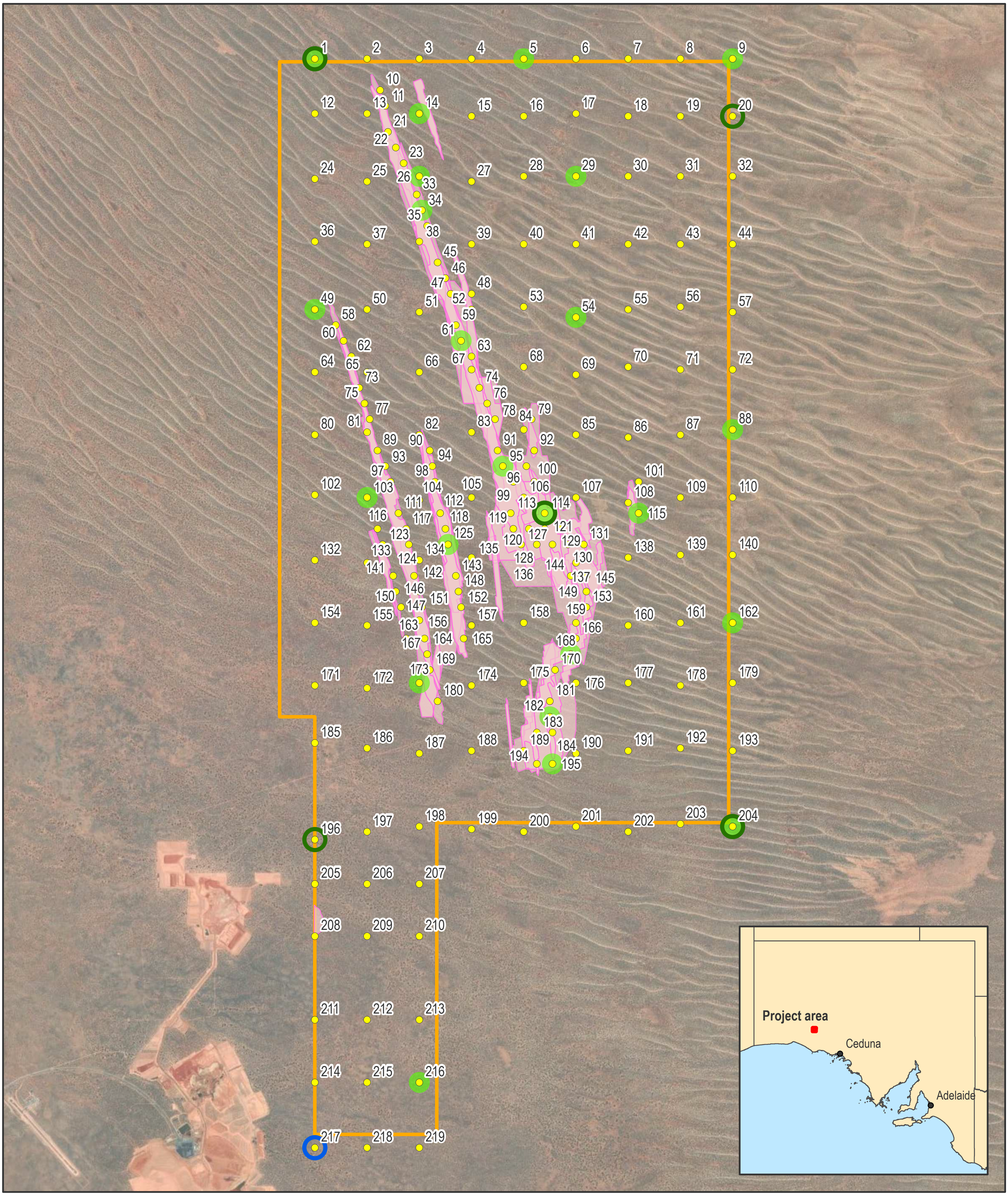

Figure 3-38 Project area with numbered survey sites for radiation baseline

Project Area

HM Resources

Sample location

Sample locations selected for uranium and thorium analysis

Sample location selected for soil, gamma and passive dust analysis

Sample location selected for soil, gamma, radon, thoron and passive dust analysis

0 2 4

Kilometres

Datum/Projection:
GDA 1994 MGA Zone 53

Project: 20409-OK Date: 2/8/2023

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A summary of the uranium and thorium concentrations at the selected sampling locations is provided in Table 3-28.

Table 3-28 Uranium and thorium concentrations in selected soil sampling locations

Sampling location number	Uranium (ppm)	Thorium (ppm)
1	<0.5	2.0
5	<0.5	2.0
9	<0.5	2.0
14	<0.5	3.0
26	<0.5	2.0
29	<0.5	2.0
34	0.5	5.5
49	<0.5	2.5
54	<0.5	2.0
61	<0.5	1.5
88	<0.5	1.5
95	<0.5	2.0
103	0.5	4.5
114	<0.5	1.5
115	<0.5	2.0
125	3.0	10.0
162	<0.5	2.5
168	<0.5	1.5
173	0.5	3.5
182	1.0	7.0
195	<0.5	2.0
204	<0.5	2.5
216	1.0	4.5
Minimum	**<0.5**	**1.5**
Maximum	**3.0**	**10**
Average	**0.7**	**3.0**

A further three samples were analysed for full uranium and thorium decay series using alpha and gamma spectroscopy the results are presented in Table 3-29.

Table 3-29 U-238, U-235 and Th-232 decay chain concentrations

Radionuclide decay series	Sampling location number		
	114	54	125
U-238 decay series	**Measurements expressed as Bq/kg**		
U-238	4.1 ± 0.7	6.4 ± 0.9	30 ± 2
Th-230	<30	<60	<49
Ra-226	5.9 ± 0.9	12 ± 1	34 ± 3

Radionuclide decay series	Sampling location number		
	114	54	125
Pb-210	<6.1	22 ± 3	40 ± 4
Po-210	5 ± 3	15 ± 6	58 ± 18
U-235 Decay series	**Measurements expressed as Bq/kg**		
U-235	0.19 ± 0.03	0.30 ± 0.04	1.39 ± 0.08
Pa-231	<13	<14	<14
Ac-227	<2.6	<3.2	<3.1
Th-227	<2.6	<3.2	<3.1
Th-232 Decay series	**Measurements expressed as Bq/kg**		
Th-232	5.3 ± 0.5	8.3 ± 0.7	41 ± 3
Ra-228	6 ± 1	8 ± 1	40 ± 4
Th-228	5.9 ± 0.6	7.9 ± 0.8	40 ± 4

The average concentration of uranium in Australia is 1.1 ppm, and 3.0 to 5.5 ppm for thorium (Geoscience Australia, 2009). The measured concentrations within the Project Area are therefore considered to be slightly lower than the Australian average.

Radon and Thoron

Five sampling locations were selected for measurement of radon (Rn222) and thoron (Rn220) over a 12-month period. Data was collected with Track-Etch detectors placed within protective containers. Results are presented in Table 3-30 and Table 3-31.

The World Health Organization states that the combined outdoor Rn222 plus Rn220 concentration varies worldwide between 5 and 15 Bq/m^{3,} with frequent fluctuations due to factors such as seasonal changes/ weather conditions (SA Radiation, 2016). Similar concentrations (10 Bq/m^3) are reported as typical for outdoors by United Nations Scientific Committee on the Effects of Atomic Radiation (UNSCEAR, 2000) reports. The average Rn222 and Rn220 concentrations in the Project Area were 5.25 Bq/m$_3$, at the lower end of the outdoor concentration range.

Table 3-30 Average Rn222 concentrations

Site	Average Rn222 concentration (first 6 months) Bq/m^3	Average Rn222 concentration (subsequent 6 months) Bq/m^3
1	<1.11*	<1.11 (<1.11, <1.11)
20	<4.44*	5.55 (7.7, 3.7)
114	3.7	<2.4 (3.7, <1.11)
196	3.7	5.55 (7.4, 3.7)
204	<1.11	1.85 (3.7, 0)

Site	Average Rn222 concentration (first 6 months) Bq/m³	Average Rn222 concentration (subsequent 6 months) Bq/m³
Average across all sites = 3.05 Bq/m³		

*The radon monitors in site 1 and site 20 were damaged during the first 6-month measurement period, so only combined Rn222 plus Rn220 concentration was measured. The combined concentration at site 1 and site 20 was <1.11Bq/m3 and <4.44Bq/m3 respectively.

Table 3-31 Average Rn220 concentrations

Site	Average Rn220 concentration (first 6 months) Bq/m³	Average Rn220 concentration (subsequent 6 months) Bq/m³
1	<1.11 (<1.11, <1.11)*	2.59
20	<4.44 (<7.4, <3.7)*	0
114	0 (0, 0)	1.30
196	4.44 (3.7, 7.4)	0
204	2.6 (2.6, 2.6)	5.55
Average across all sites = 2.20 Bq/m³		

*The radon monitors in site 1 and site 20 were damaged during the first 6-month measurement period, so only combined Radon and Thoron concentration was measured. The combined concentration at site 1 and site 20 was <1.11Bq/m3 and <4.44Bq/m3 respectively.

Gamma

Gamma dose rates were measured using a RS-125 at ground level at the 219 sampling locations. The average terrestrial dose rate in the study area as measured by the RS-125 (16.6 nSv/h) is low compared to the average gamma terrestrial dose rate in Australia (69 nSv/h).

Table 3-32 Summary of gamma dose rates

	Terrestrial gamma dose rate in the study area (nSv/h)	Total gamma dose rate in the study area (nSv/h) (cosmic and terrestrial)
Minimum	1.7	21.5
Maximum	50.0	65.4
Average	**16.6**	**39.6**

The data obtained throughout the baseline radiation survey (SA Radiation Pty Ltd, 2016) for the Project Area show that:

- Thorium concentrations were typical when compared to the background concentrations in Australia.
- Uranium concentrations were lower than typical concentrations in Australia.
- Rn222 and Rn220 concentrations in the air, and uranium and thorium levels in dust were very low, with some measurements below minimum detectable levels.
- Thorium concentrations in airborne dust were consistent with concentrations found in soil samples.

- Average gamma terrestrial dose rate (16.6 nSv/h) in the Project Area is low compared to the average in Australia (69 nSv/H).

3.17 Air quality

An overview of air quality is described within this section. For a more detailed discussion on baseline information please refer to Appendix B10 *Iluka Atacama Air Quality Baseline Review (Jacobs, 2022b)*.

The existing ambient air quality in the Project Area is typical of a semi-arid environment with dust being generated by wind erosion of exposed surfaces from unsealed roads and tracks, sand dunes and potentially through bushfire ash. Data from BoM weather stations located in the region was reviewed and used to summarise seasonal winds within the vicinity:

- **summer:** dominant southerly or south-easterly winds, but less pronounced than for coastal sites
- **autumn:** southerlies become less dominant and wind speed reduces overall
- **winter:** dominant wind is not pronounced, but may be northerly
- **spring:** returning to summer pattern with more southerly winds; wind speeds increasing (Jacobs, 2022b).

For more information on climate please refer to Section 3.2.

Dust deposition

No dust deposition data has been collected at the Project Area in the development of this baseline. Instead, proxy data from the nearby J-A Mine has been used for the baseline analysis. In accordance with AS/NSZ 3580.10-1, four (4) background monitoring stations were selected for baseline dust deposition, being identified as DU17, DU21, DU23 and DU24 (Figure 3-38). Given that dust deposition rates decrease rapidly as distance increases from the dust source, background sites for J-A Mine provide an acceptable approximation for Atacama (Jacobs, 2022b). Results from these four monitoring stations was collated from April 2009 to September 2019 (Table 3-33). A clear minimum in winter (June through to August) was observed, so a seasonal breakdown was undertaken.

Table 3-33 Statistical results for deposited dust-insoluble solids (g/m$_2$/month) (Jacobs, 2022b)

Statistic	All months	Winter months	Non-winter months
Total No. of samples	393	107	286
90th percentile	1.55	0.81	1.75
70th percentile	0.85	0.50	0.96
50th percentile (median)	0.57	0.50	0.68

A peak in measured dust deposited is observed around summer, and a minimum during the winter months. As such, background values were determined for those two periods separately. Conservative, high estimates for background deposited dust typically used as input to a modelling assessment, are the

90th percentile monthly averages as outlined in Table 3-33. It is noted that these monthly averages are similar to the background estimate determined by Katestone (2008): 1.2 g/m^2/month (40 mg/m^2/day), as part of the Air Quality Assessment for the J-A Mining Lease Proposal (MLP).

PM_{10}

No PM_{10} data was collected at the Project Area, or available in the surrounding wider region. As such, a PM_{10} proxy was used for the development of this baseline. It was agreed with the EPA that the most appropriate proxy would be the EPA's Whyalla's Schulz Reserve monitoring station, approximately 550 km to the Southeast of the Project Area. Hourly data was analysed over three years (2016 to 2018) using the Tapered Element Oscillating Microbalance (TEOM) method. Overall, the PM_{10} concentrations were higher in spring and summer due to higher wind speeds.

Given the seasonal differences in the measured PM_{10} at Whyalla-Schulz, adoption of winter and non-winter background values was considered beneficial, otherwise particulate impacts may be overstated in the winter months due to the elevated background. A statistical summary of the results is provided in Table 3-34.

Table 3-34 Statistical results for PM_{10} ($\mu g/m^3$)

Statistic	Non-winter months 2016-2018	Winter months 2016-2018
Number of 24-hour averages	779	27[3]
99th percentile	36.4	49.[4]
90th percentile	24.2	16.[6]
70th percentile	18.0	12.4
Average	15.9	12.3

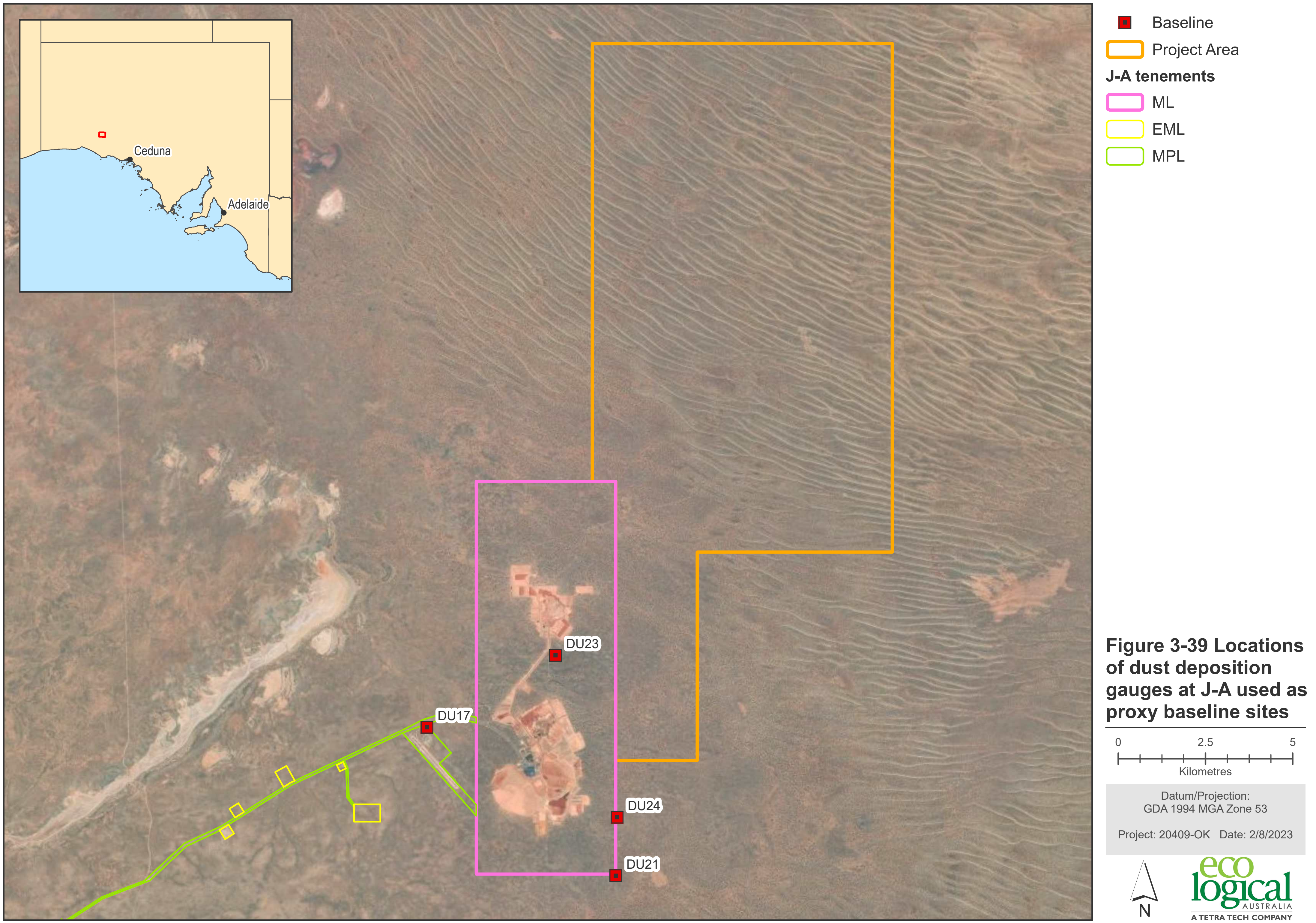

Figure 3-39 Locations of dust deposition gauges at J-A used as proxy baseline sites

Datum/Projection:
GDA 1994 MGA Zone 53

Project: 20409-OK Date: 2/8/2023

The estimated background 24-hour PM_{10} concentrations for the Project are detailed in Table 3-35. It is noted that Katestone (2008) used a higher value of 30 mg/m^3 for their background PM_{10} based on Whyalla-Schutz measurements from 2004 to 2006 (as part of the Air Quality Assessment for the J-A MLP), however it is noted by Jacobs (2022b) that this estimate appears to have been affected by industrial emissions during that time period. Typically, based on their experience on other projects in South Australia, Jacobs find background 24-hour PM_{10} values to be less than 25 mg/m^3, which is consistent with the baseline presented herein (Jacobs, 2022).

Table 3-35 Background PM_{10} concentrations

Period	Background 24-hour average PM_{10}
Non-winter months	24 (mg/m^3)
Winter months	17 (mg/m^3)

$PM_{2.5}$

No $PM_{2.5}$ data was collected at the Project Area, or available in the surrounding wider region, as such a $PM_{2.5}$ proxy was used for the development of this baseline. It was agreed with the EPA that the most appropriate proxy would be the EPA's Port Augusta monitoring station approximately 545 km to the Southeast of the site, as no PM2.5 data is available from the EPA's Whyalla stations. Data was analysed between 2017 to 2019. A statistical summary of the results is provided in Table 3-36.

Table 3-36 Statistical results for $PM_{2.5}$ (µg/m^3)

Statistic	Non-winter months 2017-2019	Winter months 2017-2019
Number of 24-hour averages	670	263
99th percentile	22.0	16.0
90th percentile	10.4	7.4
70th percentile	7.8	6.2
Average	7.4	5.9

The estimated background 24 average $PM_{2.5}$ concentrations for the Project Area detailed in Table 3-37.

Table 3-37 Background $PM_{2.5}$ concentrations

Period	Background 24 hour average $PM_{2.5}$
Non-winter months	10 mg/m^3(average 7.4 (mg/m^3)
Winter months	7.4 mg/m^3(average 5.9 (mg/m^3)

3.18 Odour

No odour monitoring has been undertaken as part of the development of this baseline chapter.

There are no known odourous emissions in the Project Area, or at the existing nearby J-A site. The closest receptor is the J-A accommodation village (14 km from the Project Area) followed by the Yalata Aboriginal community, located 75 km south of the Project.

3.19 Noise

No noise monitoring has been undertaken as part of the development of this baseline chapter.

The adjacent J-A operation, infrequent exploration drilling on Iluka's ELs and wind blowing through vegetation are the only identified noise sources in the region.

There are no sensitive receptors surrounding the Project Area. The closest receptor to the Project Area is the J-A accommodation village (14 km) followed by the Yalata Aboriginal community, located 75 km south of the Project.

3.20 Heritage (Aboriginal, European and geological)

An overview of heritage (Aboriginal, European and geological heritage) is described within this section. For a more detailed discussion on baseline information please refer to Appendix B11 *Atacama Project-Baseline Desktop Assessment, Report Prepared for Iluka Resources Ltd. (IHC, 2020) (CONFIDENTIAL)*.

3.20.1 Aboriginal

The baseline desktop assessment undertaken for the Project (Independent Heritage Consultants (IHC), 2020) included relevant Aboriginal heritage register searches, a review of previous heritage work carried out in the area and provided an overview of relevant heritage guidelines and legislation.

The Project Area is located within FWCAC managed land. The FWCAC represents the Aboriginal People in the region from six distinct groups which include: Mirning, Kokatha, Wirangu, Yalata, Maralinga Tjaratja (Oak Valley) Peoples and the descendants of Edward Roberts. The groups in this region had significant movement, likely related to droughts, with water more readily available along the coast than in inland areas.

A major pathway from the coast was inland via Ooldea soak, a permanent freshwater soak, which is also a ceremonial site, meeting place and trading centre. Many historical accounts indicate that occupation was focused on permanent water sources, mostly along the coast, but rains filled inland rock holes in winter periods. A diversity of plants and animals were important to the Aboriginal people of the region. The desktop assessment showed that the most common sites recorded on the Aboriginal Heritage Register (Taa wika) were artefact sites with high artefact densities near desert waterholes.

The region provided resources which were used by Aboriginal communities, including after European arrival. Various archaeological features confirm the use of the landscape by the Aboriginal people, with cultural stories and artefact sites recorded.

The Taa Wikka DPC-AAR Register search returned no entries for Aboriginal site or objects within the Project Area. The South Australian Museum database search returned hundreds of artefacts recorded from Ooldea and Ceduna, but none from Yellabinna. The Museum has several items of skeletal remains recorded at regional centres including Ceduna, Fowlers Bay and Streaky Bay, however the remains may have come from outlying areas surrounding the regional centres.

While no Aboriginal Heritage sites are listed on any of the main statutory databases within the Project Area, this result should be interpreted with caution due to the limited heritage work carried out in the Project Area and any previously discovered sites may not have been provided for listing.

The IHC (2020) report identified that large swathes of the Project Area had had broad overview surveys undertaken with the assistance of helicopters, with targeted inspection in the areas of interest identified (Figure 3-40). The Project Area has not yet had a full[6] Aboriginal cultural heritage survey conducted but this is planned with the FWCAC for 2023.

3.20.2 European

First European exploration of the Region occurred in 1840-41, with exploration across the Mallee wilderness from 1861. Further exploration occurred between Ooldea Soak to Mount Finke in 1875. Pastoral runs were established around the same time in the wider region. Following expiration of the original pastoral leases, the land south of Yellabinna was progressively surveyed and made available for agriculture. The lack of surface water, salty bores and droughts constrained agriculture to the coastal loamy sands.

The interior dune fields remained largely untouched and unexplored until the 1960s. European heritage items found in the region tend to be related to the early industries, exploration camps, communication infrastructure and settlements associated with sealers and whalers and other marine trades. Given European explorers relied on rock holes and wells for water, it could be expected that there would be both Aboriginal and European heritage items around the waterholes. No European heritage surveys have been carried out within the Project Area.

Searches were undertaken using the following heritage databases for European heritage:

- The Australian Places Inventory – for all places on the State and Commonwealth heritage registers and lists
- The Australian Heritage Database – for World Heritage Places, National Heritage Places and Commonwealth Heritage Places
- The South Australian Heritage Places Database – for places of State and Local heritage significance

[6] Surveys have been undertaken to date however this have been for exploration programs over selected parts of the Project Area. A full survey has not yet been completed.

- The Register of the National Estate (non-statutory).

Further searches for information around the region were undertaken in the:

- The South Australian Archives
- The State library of South Australia
- National library of Australia.

No listed European heritage sites were identified in the vicinity of the Project Area. The closest heritage site identified is the Ooldea campsite of Daisy Bates.

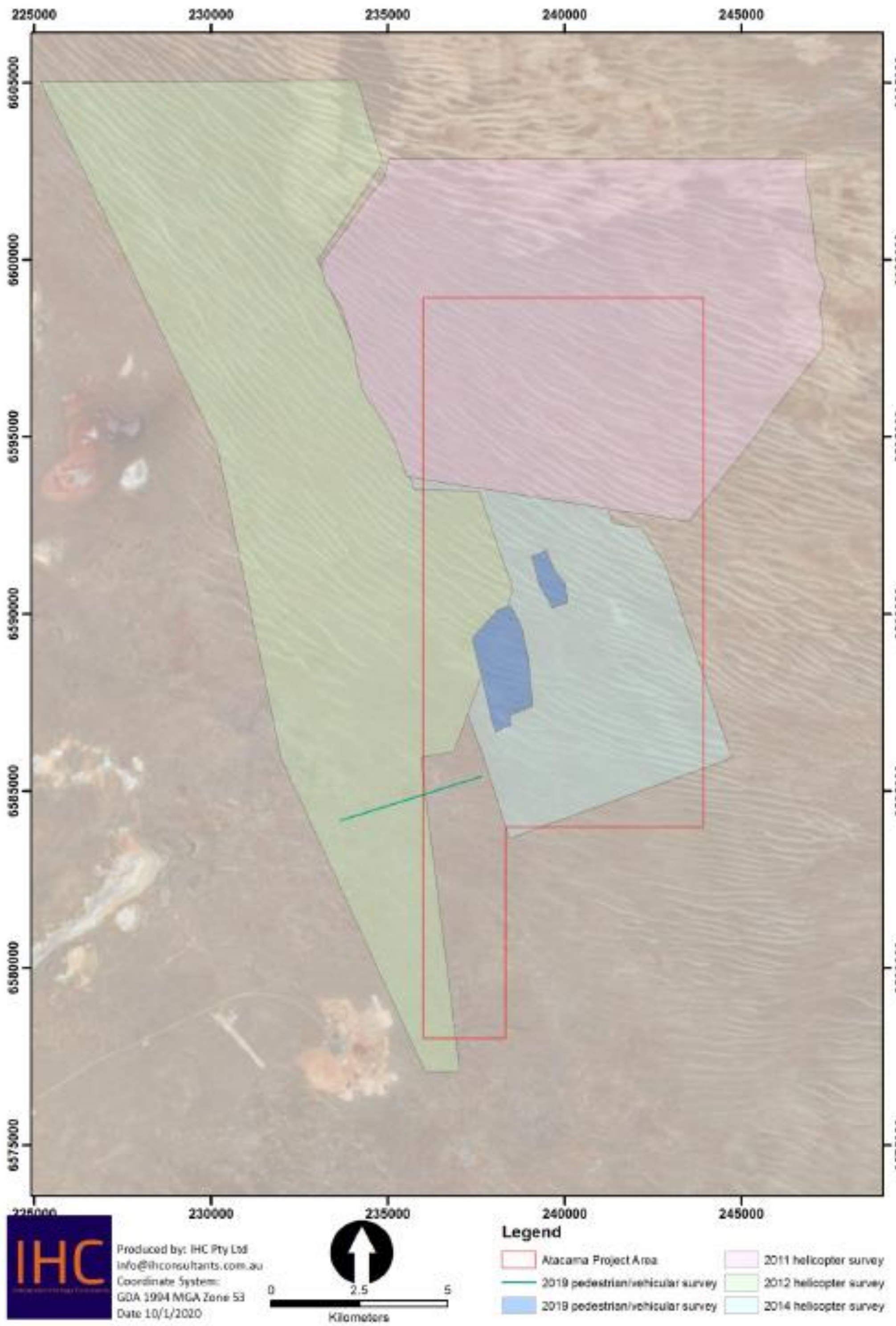

Figure 3-40 Previously surveyed polygons for the Atacama Project

3.20.3 Geological

Geological heritage sites are features considered to be of such geological or physiographic significance that are worthy of preservation.

The IHC report (2020) identifies the key geological sites in the region relate to the availability of water. Near the Project Area, a rare form of water management was employed by Aboriginal people. Clay dams had been built to capture and retain water and were semi-circular walls of clay, sometimes with boughs and foliage included. The dams were constructed in clay pans and other suitable depressions. These dams and naturally occurring waterholes were a major source of permanent water and formed the nucleus of human occupation in the region. The naturally occurring granite waterholes have been expanded and cleared by Aboriginal people. The waterholes have been categorized as the Ooldea water routes and were nominated for national heritage listing in 2017 (IHC, 2020).

A review of the South Australian Division of the Geological Society of Australia publications “Geological monuments in South Australia, Parts 1-9” (2002) and “Geological Monuments (Geological Heritage Sites) in South Australia, Part 10” (2018) identified one site, FN30 Cook Quarry lies to the south Ooldea township, beyond the Western boundary of the Project Area and approximately 1 km north of Cook. The quarry was used to supply the ballast for the Railway. The quarry faces are approximately 10 m high and display excellent exposures of the Nullarbor Limestone and its weathered, karst surface. The Quarry face provides a clear section through the karst terrain of the Nullarbor Plain. The site is considered to be of State significance.

The Program for Environment Protection and Rehabilitation (PEPR) for the nearby J-A Mine undertook a search on the Australian Heritage Places Inventory (AHPI) in for natural heritage sites in the region, which showed the presence of the natural heritage sites:

- Yellabinna Region (i.e., Yellabinna Regional Reserve) (ID: 19424) Listed on the Register of the National Estate
- Yellabinna Area (i.e., Yellabinna Regional Reserve) (ID: 6049) Listed on the Register of the National Estate.

The AHPI was managed by the Commonwealth Government, however their support of the database was withdrawn in 2020 and access to the AHPI has since been removed and an updated search cannot be undertaken.

3.21 Proximity to conservation areas

The Atacama Project is located within the Yellabinna Region Reserve (Figure 3-41). This Regional Reserve comprises 2,012,225 ha to the north and north-west of Ceduna and was proclaimed in 1990 as an area for protection of a significant habitat within South Australia. The Yellabinna Regional Reserve is managed by the Yumbarra Conservation Park Co-management Board – a partnership between the FWCAC and DEW.

The Yellabinna Regional Reserve Management Plan simultaneously enables appropriate and sustainable mineral exploration and mining, along with conservation.

Dominated by parallel dunefields in the south-east extension of the Greater Victorian Desert, Yellabinna Regional Reserve also contains the largest, least modified corridor of Mallee in South Australia and has importance to several Aboriginal groups in the region.

The wilderness values of Yellabinna Regional Reserve are also recognized through its containment of a 500,000-ha wilderness protection area to the south-east of the Atacama Project, which was proclaimed in 2005 in recognition of the wilderness protection areas' ecological and biological significance, remoteness and the pristine quality of the natural environment. No mineral exploration and/ or mining related activities are allowed to occur within the wilderness protection area.

3.22 Pre-existing site contamination and previous disturbance

3.22.1 Regional reserve related activities

The region has predominantly been preserved as a regional reserve (Yellabinna Regional Reserve proclaimed in 1990). The dominant land uses of the reserve are conservation of the wildlife, landscape and historic features, mineral exploration, Aboriginal land use, and tourism. The Project Area is largely undisturbed, with remnant native vegetation and there is no evidence of grazing pressures on the landscape.

Given the lack of activity in the Project Area it is unlikely that pre-existing contamination has occurred as a result of these activities.

3.22.2 Exploration activities

Potential sources of contamination associated with exploration activities include hydrocarbon and/or drilling mud leaks and spills from drilling and supporting equipment and minor heavy metal contamination at surface from discarded broken sample bags. Exploration drilling also results in localised disturbance to ground surface and vegetation at drill pads and along tracks.

Exploration activities are managed through the Mining Act and *Mining Regulations 2020.* Iluka hold appropriate exploration licences for these activities and will comply with all requirements of their licence.

Contamination from exploration activities, if present at all, is likely to be limited in extent and nature due to transient sources and limited volumes of potential contaminants to be brought to site.

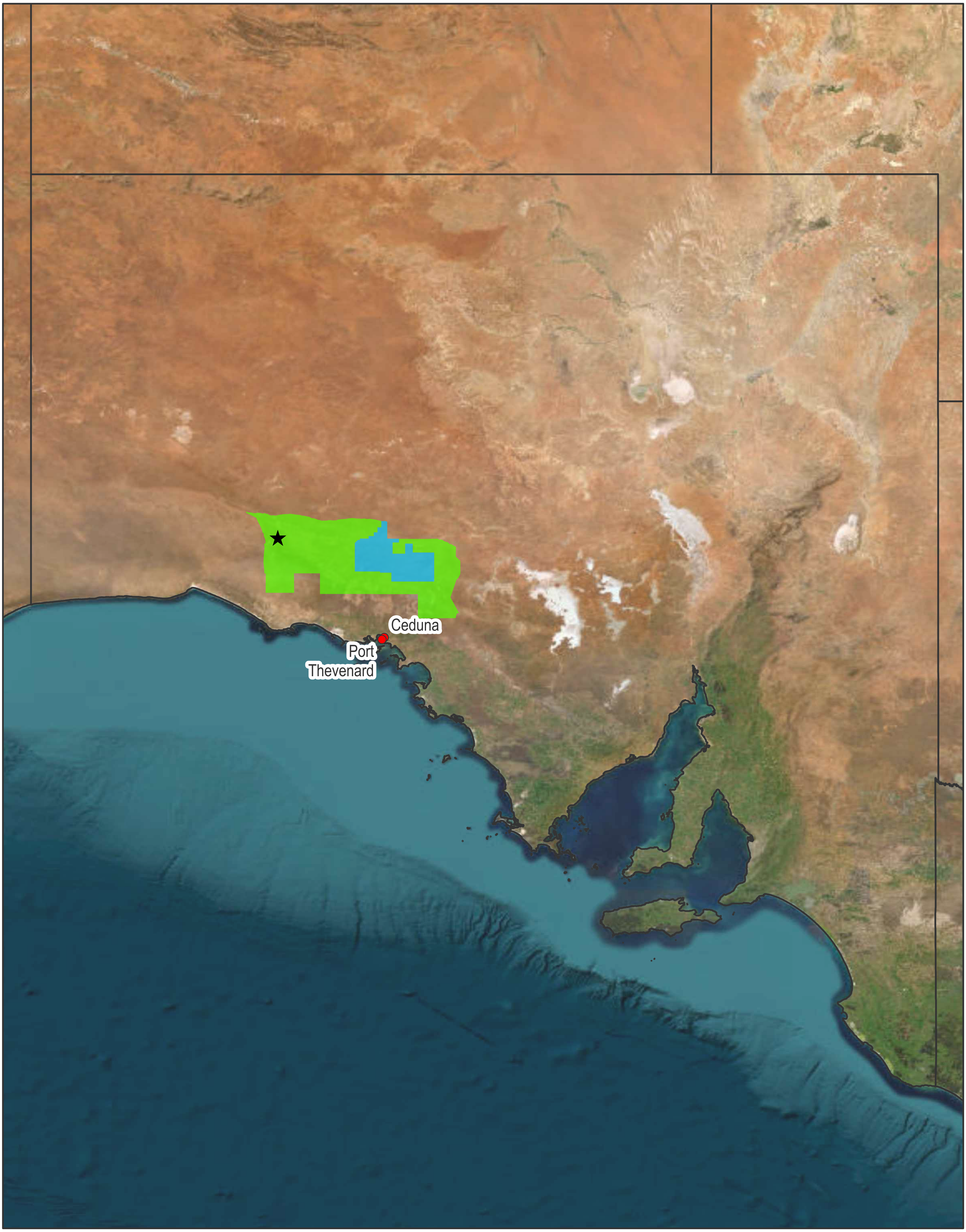

Figure 3-41 Proximity to conservation areas

★ Proposed Action Area

Yellabinna Regional Reserve

Yellabinna Wilderness Protection Area

N

0 150 300

Kilometres

Datum/Projection:
GCS GDA 1994

Project: 20409-OK Date: 2/8/2023

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4 DESCRIPTION OF THE PROPOSED MINING OPERATIONS

This chapter provides an overview of the proposed mining operations relevant to the development and operation of the proposed ML.

The information contained within this chapter has been described sufficiently to provide an environmental and social impact assessment (detailed in Section 7) undertaken in accordance with the requirements of TOR 006.

Please note that the information provided on the activities and layout is correct at the time of writing the MLP and the PFS for the Project. A DFS will occur after the submission of the MLP and as such the layout and activities may be subject to change. Changes will be assessed against relevant State and Federal guidance and any further approvals sought (if required).

The following terms are used within this section and as such defined/ redefined here:

Project Area: The area in which the Project will occur and the boundary of which has been used to study the environmental baseline (see Figure 1-1 for boundary).

Conceptual Footprint: The area within the Project Area in which native vegetation clearance will occur for the Project.

4.1 General description and maps/plans of operations

A new ML tenement (the focus of this document) is required to develop the Project; however, some aspects of the Project will require changes and upgrades on the currently approved J-A tenements (the content of the Change in Operations document – Appendix D). Table 4-1 presents a summary of the key Project elements, and their location to assist the reader in understanding the scope and spatial layout of the entire Project.

Please note that this chapter will not discuss elements which occur on J-A tenements further (except where required for context) and these elements are not impact assessed in later chapters as they do not form part of the scope of the ML assessment. For more information on these elements please refer to Appendix D.

Figure 4-1 shows the location of the Project as well as detailing key project elements. Note that the layout is worst case as it is not expected that all these soil materials will need to be stockpiled all at the same time. i.e., pits will be backfilled as mining progresses. This figure is an interactive PDF so please hover over the numbers for a zoomed in view of those aspects of the Project layout.

Table 4-1: Proposed Mining Lease key project elements

Project element	Description	
	New aspects of the Project which will occur on the Atacama ML	**Upgraded Project aspects which will occur on J-A tenements**
Project location	The Atacama Project is located within the Yellabinna Regional Reserve, approximately 800 km north-west from Adelaide, 290km north-west of Ceduna and 270km from the Port of Thevenard. It is located approximately 5 km north-east of the existing J-A mine site. Figure 1-1 shows the location of the Project.	NA
Project disturbance	Approximately 2,057 ha of native vegetation will be cleared within the Atacama Project Area	Approximately 128 ha of native vegetation will be cleared within ML 6315 associated with the access road between Ambrosia and Atacama, the Sand Tailings Stockpile and a further 2 ha will be cleared on MPL 111 for the camp expansion. This native vegetation clearances will be managed under existing clearance procedures.
Mining method	Progressive dry mining of four open pits will occur with the following average dimensions: • Western Pit: approximately 5,000 m long, 350 m wide and 60 m deep • Central Pit: approximately 3,900 m long, 290 m wide and 45 m deep • Eastern Pit: approximately 5,800 m long, 470 m wide and 75 m deep • Southern Pit: approximately 675m long, 345m wide and 60m deep.	NA
Mining rate	A total of approximately 185 Mt of overburden and 25 Mt of ore will be mined. Approximately 4.16 Mt of Heavy Mineral Concentrate (HMC) will be produced for transport over the LOM.	NA
Mine life	Approximately seven (7) years including overburden stripping. This does not include rehabilitation and closure monitoring.	J-A's total mine life will be extended by approximately four (4) years by inclusion of this deposit.

Project element	Description	
	New aspects of the Project which will occur on the Atacama ML	Upgraded Project aspects which will occur on J-A tenements
Commodities	Heavy mineral sands	Heavy mineral sands and calcrete.
Processing	Material will be trucked to a stockpile at either ROM 1 or ROM 2, adjacent to the pit and then slurry pumped from the ROM stockpile via a new Mining Unit Plant (MUP) to J-A for processing.	Processing will occur at J-A through the current wet concentrator plant (WCP) and then through a newly installed wet high intensity magnetic separator (WHIMS) wash plant. The Atacama ore will be processed through the existing J-A WCP. Processing may occur as a blend with Ambrosia ore, alternatively Atacama and Ambrosia ore may be processed separately through the WCP.
Tailings Storage Facility	No tailings storage facilities proposed at the Project Area.	A self-supported Sand Tailings stockpile will be constructed at J-A for the storage of sand tailings material from the Atacama and Ambrosia blend. This supports the strategy to process Atacama and Ambrosia blend material through the existing WCP. The Sand Tailings stockpile will be constructed partly on the existing disturbance footprint of Jacinth and natural ground. There will be a resultant landform change at Jacinth which has been agreed to in principle by key external stakeholders and Traditional Owner groups. Fine tailings (<53 micron) will be co-disposed with sand material from Atacama and Ambrosia; and deposited in voids consistent with the current approved J-A backfill plan. No significant landform change is envisaged.
Power demand and supply[7]	No power supply will be installed at the Project Area, with the exception of generators during construction and lighting towers during operations.	Power will be sourced from the onsite (diesel/ solar) power station at J-A. This will be upgraded. The instantaneous power demand at Atacama will be approximately 4 MW greater than the J-A peak demand. Based on average consumption, this would equate to approximately 17,000 MWh of additional power in a given year.

[7] Power consumption will change through the course of the study as design definitions improve

Project element	Description	
	New aspects of the Project which will occur on the Atacama ML	**Upgraded Project aspects which will occur on J-A tenements**
Water demand and supply[8]	Two ponds will be constructed on the Project Area- a 2.5ML RO pond and a 2.5ML process storage pond. There will be no water abstraction on the Project Area.	The existing wellfields at J-A mine will provide the water for the Atacama Project. The existing wellfield is located approximately 40 km west from the J-A mine site. The wellfield will provide approximately 13.2 ML/day to both J-A and Atacama. The wellfield has a design capacity of 31.1 ML/day. The total raw water demand across both projects is 14.7 ML/day. The majority of the water used onsite is recycled from the existing WCP and tailings pumping systems at J-A. Dust suppression at Atacama will be 1.5ML/day of process water. RO water will be used for dust suppression, amenities and workshop requirements and also within the HMC wash plant. The RO plant at J-A will be upgraded to allow for this use. A water balance is provided in Figure 4-9 which demonstrates the water inflows and outflows across both sites.
Operating hours	Mining will occur 24hrs a day, 7 days a week, with processing through the J-A WCP.	NA
Transport and logistics	There is no transportation of product from the Project Area.	While the production life at J-A will be extended there will be no annual increase in truck movements via the existing route from J-A to Port Thevenard. The same trucking route will be used. Changes to the bunker at Port Thevenard are unexpected, however if required, may be limited to expansion of the bunker largely within the site footprint.
Workforce	There will be no camp facilities within the Project Area.	It is expected that total staff numbers (including contractors) at J-A will increase by up to 350 full time equivalent (FTE) depending on the roster patterns. This will be spread across the current site rosters. Accommodation for the workforce will be at the existing J-A camp, which will require upgrades.

[8] Water use will change through the course of the study as design definitions improve

Project element	Description	
	New aspects of the Project which will occur on the Atacama ML	**Upgraded Project aspects which will occur on J-A tenements**
Radiation	Low levels of uranium and thorium mineralisation are associated with the Atacama ore bodies 0.16-0.65 Bq/g.	Low levels of uranium and thorium mineralisation are associated with the waste (tailings) from Atacama which will be stored at J-A (0.01-0.1 Bq/g). Increasing levels of uranium and thorium is associated with the HMC storage after processing with up to 0.6 to 1.7 Bq/g for magnetic concentrate (ilmenite) and 3.7 to 5.0 Bq/g. for non-magnetic concentrate (zircon), which will also be stored at the J-A ML. These levels are similar to that already managed at J-A.

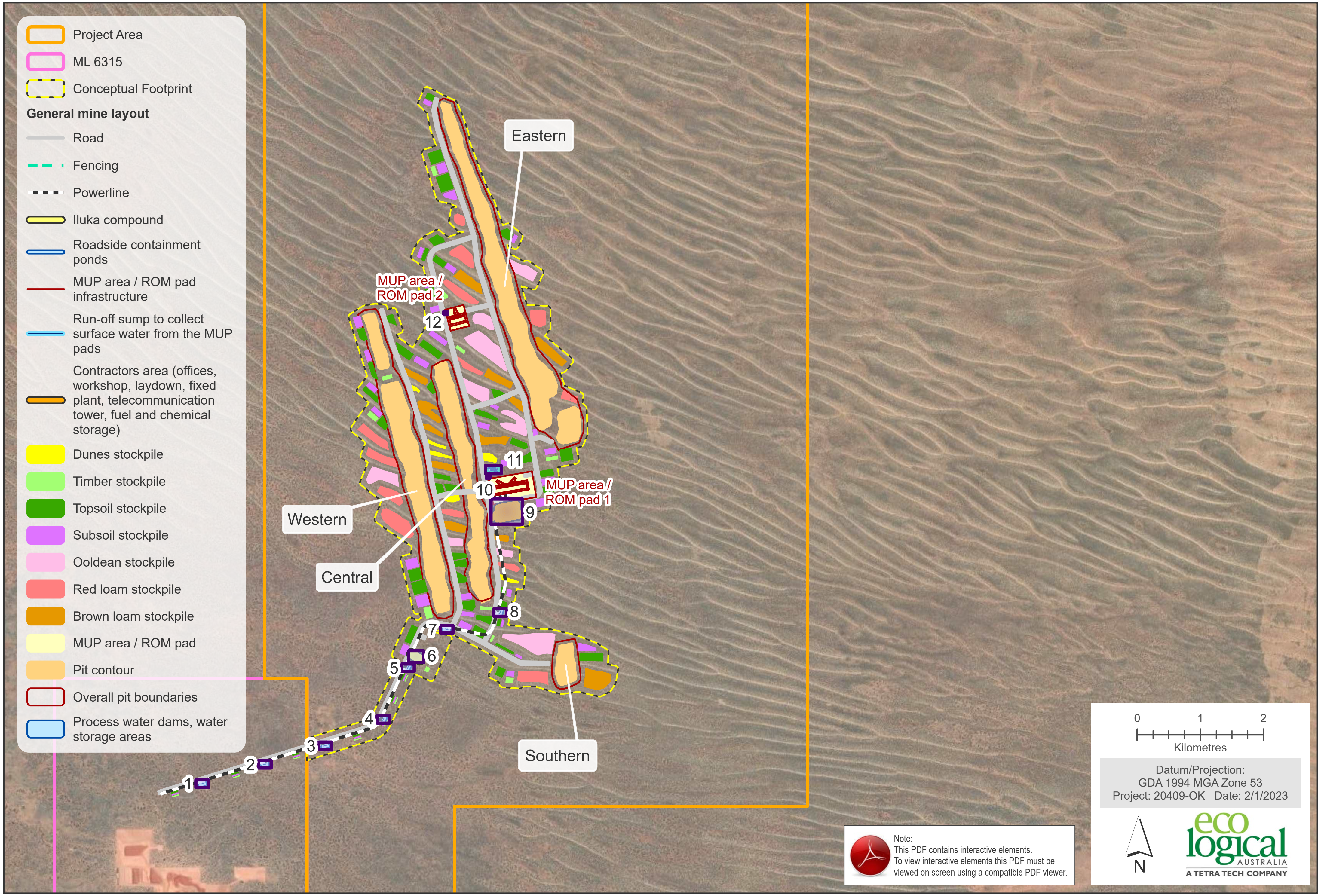


Figure 4-1: Atacama Project General Mine Layout

4.2 Options

The Project is required to develop known mineral sands resources to sustain Iluka's current production rate of zircon and meet material demand within the proposed timeframe. The Project will also utilise existing infrastructure on ML 6315 and associated tenements, including processing facilities and haul roads. As part of the Atacama Project Pre-Feasibility Study (PFS) three project options were investigated, including:

- **Project option 1:** A greenfield development with mining, processing (new or repurposed MUP and concentrator) and tailing to all occur within the Project Area. Ore would be trucked from the pits to the MUP and pumped to a new WCP located at Atacama, with concentrate then trucked off site through ML 6315. This option would run concurrently with mining operations at J-A.
- **Project option 2:** Processing and tailings management to occur within the existing J-A WCP and ML 6315 footprint, and mining to occur within the Atacama Project Area. Mineral sand material will be trucked to a ROM stockpile adjacent to the pit(s) and then slurry pumped from the ROM stockpile with a new MUP to ML 6315 for processing. The slurry will either be blended with slurry from the Ambrosia MUP in a surge bin located at Ambrosia or pumped directly to the WCP (both of which are located on ML 6315).
- **Project option 3:** Iterations of the above options with a smaller pit shell targeting high grade pits only.

Greenfield options for the Project have been ruled out for financial reasons and are not part of the Project scope.

Project Option 2 –Processing at J-A existing facilities was chosen as the preferred option. The Project will progress as a concurrent development with J-A. This option is considered the best financially and environmentally as:

- it will have the best balance between capital expenditure and operating expenditure over the LOM
- it will have a reduced disturbance footprint by avoiding on-site processing
- it will result in reduced impacts to groundwater in the Project Area as a result of no placement of tailings material
- disturbance at Atacama will be limited to mining, roads and stockpiles
- it will make best use of the disturbance area already approved at nearby J-A tenements by using the existing processing and storage facilities and expanding the existing tailings facilities
- slurry pumping will have a lower traffic volume than would be incurred within the ore exclusively trucked option.

The justification for the Project is predicated on there being sufficient demand for mineral sands product in the global market and on the Project being able to be economically developed in the medium-long term. To date, the outcome of ongoing studies indicate there is sufficient global product demand and the forecast economics for implementation, operation and closure of the Project is positive.

A fourth option would be the 'No Go' alternative (i.e., not mining the Atacama resource and leaving the resource within the ground) the impact of this option would mean that the life of mining (LOM) for the J-A operations would not be extended beyond its current LOM and the majority of resultant socio-economic benefits of the operations (e.g., royalties, jobs, training) would also cease at this time. As noted above the 'No-Go' alternative would also leave the identified Atacama deposit in situ and mean that other deposits around the world will be developed to meet the predicted global demand for zircon. The 'No Go' alternative would mean the clearance of native vegetation within the Project Conceptual Footprint will not be created and the resultant impacts of the Project associated with this will not occur. The 'No Go' alternative would also mean that the opportunity to utilise existing disturbance and mine/ processing infrastructure at the J-A tenements to develop the Atacama deposit will not be possible (offering no additional value/ benefits for the impacts already created at J-A).

Aspects of the Project where alternatives have been/ will continue to be evaluated as feasibility assessments continue for the Project include:

- access roads
- technologies/ mining method
- power generation/ sourcing
- mine/ infrastructure layout
- mining unit options
- tailings storage facilities.

All tailings production will occur on ML 6315 after processing through the J-A WCP. The Atacama PFS assessed three options:

- **Tailings option 1:** Returning of all tailing material including modified co-disposal (ModCoD) (a mixture of quartz sands and clay fines) and sands to the Atacama voids and construction of two types of tailings storage facility's (TSFs), one for the ModCoD and one for sand stacking both located at Atacama.
- **Tailings option 2:** 100% ModCoD or single stream tailings (SST) of Atacama material stored at either a newly constructed cell at Jacinth or Ambrosia.
- **Tailings option 3:** Tailings of J-A and Atacama tailings which would be managed at Jacinth for sand stacking (on-path) and Ambrosia (for ModCoD).

Tailings option 1 was considered unacceptable due to the high-drainage characteristics of the overburden and its associated water losses, the potential for hypersaline water mounding beneath Atacama and the potential for geochemical impacts to effect Lake Ifould. Managing the tailings within the Atacama pit voids would also increase the strip ratio of the ore body. Processing of HM would still occur at J-A therefore the return of the tailings from J-A to Atacama would require increased infrastructure and energy resources.

Tailings option 2 was considered unacceptable due to the high cost and potential impacts to the environment. A SST cell at Jacinth (cell 7) on top of the existing cells 4-6 was analysed in 2020 and deemed to be unstable due to poor foundation conditions (i.e. from constructing an embankment on top of contractive tailings). A SST concept at Ambrosia was also considered which would have involved the construction on natural ground outside the current Ambrosia pit(s) perimeter, but was excluded due to high capital costs associated with the construction of the TSF embankments.

Tailings option 3 was therefore identified as the preferred option. This option has a minimal increase in tailing rehabilitation costs for J-A due to utilising an existing footprint and current techniques. The tailings from Atacama (once processed at J-A) will be split into ModCoD and sands. ModCoD will be accommodated at Ambrosia within the planned voids and would result in the Ambrosia pits being filled to near natural ground elevation (i.e., the pre-mining elevation). The sands will be placed in a newly created sand stacks at Jacinth North, which will sit above the natural surface. Tailings option 3 will minimise transport and backfill costs. A preliminary materials balance suggests that the addition of Atacama material within Ambrosia will result in an increase to the surface elevation of between 1-3 m. Further assessment will occur as part of Definitive Feasibility Studies (DFS).

4.3 Reserves, products and market

4.3.1 Ore reserves and mineral resources

Mined materials will comprise zircon, ilmenite, rutile, monazite and xenotime bearing mineralised sands.

A summary of the Mineral Resource Estimate underpinning the Project is shown in Table 4-2. Reporting is in accordance with the guidelines of the Australasian Code for Reporting of Exploration Results, Mineral Resources and Ore Reserves, 2012 Edition (JORC Code). All tonnages are dry in situ metric tonnage and figures stated are as of 31 December 2021.

No mineral resources will be sterilised as all facilities and infrastructure will be removed from site as part of the site closure.

Table 4-2 Mineral resource estimate

Mineral Resource category[9]	Material tonnes (Mt)	In-situ HM tonnes (Mt)	HM grade (%)	Clay grade (%)	HM assemblage[10]			
					Ilmenite grade (%)	Zircon grade (%)	Rutile grade (%)	Monazite & Xenotime grade (%)
Indicated	41.4	6.0	14.4	8	70	16	2	0.4
Inferred	30.2	2.5	8.2	8	70	13	2	0.3
Total	**71.6**	**8.5**	**11.8**	**8**	**70**	**15**	**2**	**0.3**

4.3.2 Production rate and products

An estimated 25 Mt of ore will be mined over the LOM at a rate of approximately 3.6 Mt per annum and an estimated overall increase of 4.1 Mt of additional product compared to current rates from J-A. The size of the pits may flex based on the economics on the date the operation is developed.

All mineral sands will be sold or processed with no HMC remaining on site (at either Atacama or J-A), with the exception of tailings (at J-A) as part of the proposed backfill plan. A stockpile of up to 1 Mt of ilmenite (magnetic HMC) will be stored at J-A at any given time. The stockpile will be drawn down for approximately 3-4 years after the completion of mining at Atacama.

A new WHIMS plant will be constructed on the J-A site which will separate the Atacama HMC into magnetic (ilmenite) and non-magnetic (zircon and rutile) components. The magnetic component (Ilmenite) will be processed downstream into synthetic rutile at Iluka's Capel Mineral Separation Plant (MSP) in WA. The non-magnetic components (zircon and rutile) will be processed at Iluka's MSP in Narngulu in WA (Geraldton). Rare Earth tailings from the two MSP's will be transported to the Eneabba Rare Earth Refinery in WA for processing into rare earth oxides and carbonate.

Processing of the HMC (which is undertaken in WA) will result in five products for sale:

- synthetic rutile
- premium zircon
- chemical grade zircon
- HyTi (rutile) 92
- rate earth oxides and carbonates.

[9] Mineral resources are inclusive of ore reserves

[10] The mineral assemblage is reported as a percentage of the in-situ HM content

End markets for the products mined are predominately European and Asian consumers.

At current rates of production and mineral resource, the estimated LOM for the Atacama Project is 7 years, including overburden stripping. Downstream mineral separation and export to market are outside the scope of the Atacama Project and this MLP, and as such are not discussed further within this document.

4.4 Exploration activities

4.4.1 Mineral resource drilling

Additional exploration activities are planned for the Project. The focus of these activities is to confirm the nature and extent of the Mineral Resources at Atacama and other factors to enable the efficient mining of the resource.

Additional drilling will be undertaken to increase confidence in the Mineral Resource classification. Infill drilling may be required to define proposed pit edges. Any exploration or resource definition drilling will be undertaken using air core drilling. Air core drill rigs will be either track mounted or mounted on a light 4WD truck. Support vehicles for exploration or resource definition drilling will include light 4WD vehicles and light trucks and trailers.

Samples will be logged by a geologist who will record the estimated clay fines, washing characteristics, colour, lithology, dominant grainsize, coarsest grainsize, sorting, induration type, hardness, estimated rock and estimated HM, whether the sample was dry or if wet and whether water had been injected during drilling. The presence of HM is determined by panning a portion of each sample to separate the heavy mineral from the sand and a volumetric, visual assessment made. Samples with an estimated HM content of 0.5% or greater are considered 'mineralised' sufficiently to require assay.

New tracks for exploration drilling access will generally be created using a dozer (blade up) towing a heavy roller, which leaves root stock and minor vegetation in place and makes the track less susceptible to vehicle damage while also improving (and potentially expedites) natural revegetation. In areas of proposed drilling with woody vegetation coverage (i.e., where overhanging branches may impede vehicle movements) trimming the vegetation with a chainsaw will be undertaken.

New track designs are verified in advance (including obtaining the relevant internal permits) of the dozer/ rolling by experienced field crews in a Polaris ATV, or similar, to ensure no sites of cultural or environmental significance are disturbed by exploration activities.

Whilst some tolerance is provided for drill hole placement, closely spaced infill drilling may require some holes to be drilled on dune slopes and possibly also on dune crests. This would require benching or cutting of the dunes with the dozer blade to establish safe drilling platforms. The minimum area required for safe operation would be disturbed only and the disturbed sand would be pushed sideways either side of the track to assist in subsequent rehabilitation.

Rehabilitation of drill sites is undertaken immediately (or as soon as possible) after the hole has been completed if outside of the mine path. Material not selected for analysis is returned to the drill hole, or sump, which is then backfilled after the sump has dried out. The area of disturbance is raked, flagging removed, and the site left clean. Any vegetation, rocks, etc. which were moved from the site before drilling, are then placed back over the disturbed areas to minimise the any visual impacts to the site. Excess drill spoil that cannot be placed back into the hole is buried in a sump and covered with at least 0.3 m of topsoil.

Where rutting occurs on access tracks, travel will stop, and the tracks levelled with tyres or similar to prevent further rutting. A Bobcat skid steer or track loader may also be utilised for rehabilitation activities. Disturbed track areas which are no longer required are lightly scarified and available timber and bushes, etc. are dragged on to the tracks to restrict third party access, minimise soil erosion and encourage regrowth. In instances where permanent clearance is required this will be managed through the mining offsets arrangements this are discussed in further detail in Section 4.9.

4.4.2 Other exploration activities

Other exploration related activities besides resource drilling may be required to be undertaken on the Atacama ML at times. These could include:

- geotechnical drilling, sampling, supporting field testing, and monitoring infrastructure installation works (i.e., vibrating wire piezometers, soil suction sensors, inclinometers, extensometers, tiltmeters, or similar) using air-core, mud-rotary, sonic, diamond coring, or similar techniques
- non-intrusive geophysical surveys (airborne, gravity, ground electromagnetic, moving loop electromagnetic, passive seismic or ambient noise tomopgraphy techniques may be used)
- soil sampling, surface sampling with samples collected using handheld augers or trowels
- using drones for short distances in reconnaissance work
- hydrogeological drilling, field testing, sampling, and monitoring well installation works using air-core, mud-rotary, sonic, diamond coring, or similar techniques.

Rehabilitation would be similar to that described in the Section above. If activities are conducted within the proposed disturbance footprint for the mine, rehabilitation of drill sites will be incorporated into the mine rehabilitation plan and activities.

4.4.3 Test pit

Iluka will be applying for approval under EL 5947 (via an EPEPR) to undertake a test pit within the proposed Atacama ML boundary (ML boundary described in Figure 1-1 and Appendix A). The EPPER will be submitted during the period in which this document (the MLP) will be assessed.

The exact location and size of the test pit is still being refined however the aim of the pit will be for Iluka to undertake advanced exploration activities to refine the mining method, test the trafficability of the material and collect metallurgical samples.

It has been mentioned here as if the ML is granted then the rehabilitation of the test pit will occur as part of the larger ML rehabilitation execution plan described within this document. It the ML is not granted Iluka will undertake rehabilitation of the test pit as outlined within the EPEPR submission.

4.5 Mining activities

4.5.1 Type or types of mining operation to be carried out

All mining is to be via an open-cut operation. Overburden is to be mined with a combination of load and haul ex-pit, with truck and excavator and in-pit dozer push direct return. Ore is to be mined with load and haul truck and excavator after which material will be taken to one of the two run of mine (ROM) stockpiles, ore material is then feed into the MUP, via a dozer or front-end loader (FEL), to remove oversized material (i.e., rocks and other debris) before being slurry pumped to the J-A WCP for processing.

4.5.2 Open pit

Four pits will be constructed at Atacama with the following average dimensions:

- Western: on average approximately 5,000 m long, 350 m wide and 60 m deep
- Central: on average approximately 3,900 m long, 290 m wide and 45 m deep
- Eastern: on average approximately 5,800 m long, 470 m wide and 75 m deep
- Southern: on average approximately 675 m long, 345m wide and 60 m deep.

Overall pit wall slope angles will average 32 degrees. Conceptual cross-sections of the four pits are shown in Figure 4-2, an interactive PDF with cross sections available for viewing by hovering above the cross-section locations.

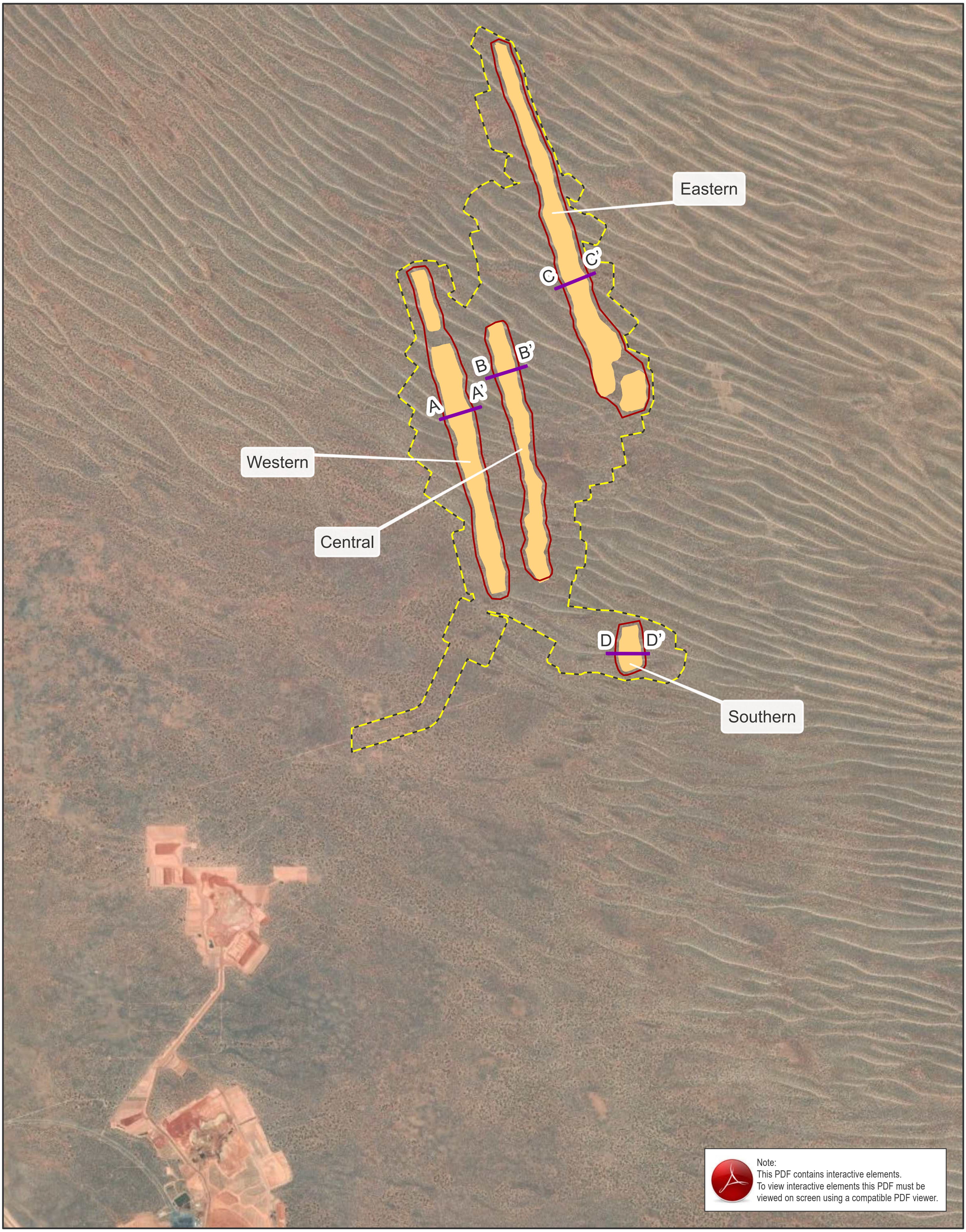
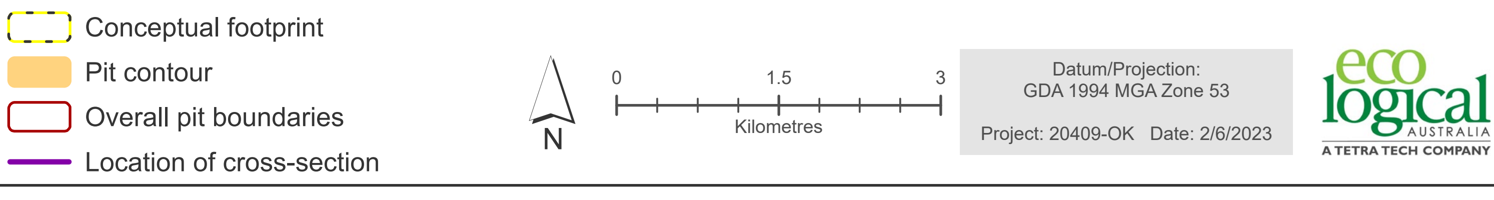


Figure 4-2 Location of Atacama pits cross-sections



4.5.3 Underground workings

There are no plans for underground mining at Atacama.

4.5.4 Material movements

Over the LOM approximately 189 Mt of overburden and 25 Mt of ore will be moved. Expected rates of movement are as shown in Table 4-3, and these will be updated annually on Project commencement. Should exploration drilling identify further resources (either on the Proposed ML or ML 6315) then the LOM may be extended. There may be a possibility of increases in annual production if the Atacama mine is campaigned through the JA concentrator for discrete years of the mine life.

Table 4-3 Expected material movements over life of Atacama mine

Aspect	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6	Year 7	Total
Ore movement (Mt)	4.2	3.7	3.5	3.4	3.4	3.6	3.3	**25.1**
Waste movement (Mt)	20.6	34.3	26.7	37.7	35.1	20.0	14.2	**188.6**
Strip ratio	4.8	9.2	7.7	11.1	10.3	5.5	4.3	-

4.5.5 Stockpiles

Removal of topsoil, subsoil and overburden is required to access the ore. The general intended locations of various stockpiles at Atacama are included in Figure 4-1, these are further discussed in the following sections.

4.5.5.1 Overburden stockpiles

Overburden is typically removed using conventional earthmoving equipment such as excavators, dump trucks and tractor scoops. The overburden is categorised as brown loam, red loam, dunes and Ooldea sands, and is either stockpiled for later use in rehabilitation or direct returned as part of surface rehabilitation activities.

The overburden stockpiles are built by paddock dumping and end tipping of the overburden material. Stockpile design and construction (including tip head safety) will be in accordance with Iluka's geotechnical design criteria. Generally, angles of repose will range from 30–32^0 depending on material type; a factor of safety of 1.3 will apply to stockpiles above 20 m in height in conjunction with a risk-based approach.

No stockpiles will be placed on dune crests or on dune slopes greater than approximately 5-6 degrees.

No overburden will remain in stockpiles at the completion of mining as it will all be utilised during the rehabilitation process.

Low-grade ore is also stockpiled separately for potential future processing or would be returned to the pit voids if considered cost prohibitive to process.

Figure 4-1 shows the location of proposed overburden stockpiles in the Project Area. Table 4-4 provides further explanation on each overburden category.

Table 4-4 Overburden stockpile characteristics

Overburden category	Characteristics
Brown/ red loam stockpiles	Brown loam and red loam is to be stockpiled separately and constructed as flat-topped landforms. Bunding is to be added to the final lift as a safety measure to control vehicle movements
Dunes stockpiles	Yellow sands encountered during the removal of dunal features are to be stockpiled as a separate substrate to be reinstated as part of the rehabilitation of dunal features post mining. This material is nominally part of the Aeolian sand unit shown in Figure 3-14.
Ooldea sands stockpiles	Ooldea sands is to be stockpiled separately and constructed as a flat-topped stockpile. Bunding is to be added to the final lift as a safety measure to control vehicle movements.

4.5.5.2 Vegetation stockpiles

Where clearance of vegetation is required, the overstorey timber is to be retained and stockpiled separately for later replacement as part of rehabilitation. The vegetation stockpiles are to be located adjacent to topsoil stockpiles to assist in protecting from wind erosion. Vegetation stockpiles will be approximately 2-4m high.

Figure 4-1 shows the locations of vegetation stockpiles.

4.5.5.3 Topsoil/ subsoil stockpiles

Topsoil and subsoil profiles are stripped during the clearance process. These profiles will be stockpiled separately in areas adjacent to the pits. Stockpiles will be separated according to the vegetation association they were sourced from.

The topsoil/ subsoil stockpiles will be located away from natural drainage lines and constructed to a maximum height of 2 m (topsoil) and 4 m (subsoil). The stockpiles will be monitored for evidence of erosion and soil stabilisation methods will be implemented if required.

Figure 4-1 shows the locations of vegetation stockpiles.

4.5.5.4 *Ore stockpiles*

Ore will be stockpiled in the two ROM pad areas. The stockpile will be approximately 15 m high, with a 12° angle of repose and stockpiled in a 150 m radius block of the proposed MUP location.

Figure 4-1 shows the locations of the two ROM pads where ore will be stockpiled.

4.5.5.5 *Water movement through the stockpiles*

The arid climate of the Project Area means the vegetation and soil stockpiles only contain naturally occurring soil moisture and no groundwater or added water. Generally, water will evaporate, forming a crust on the outside of the stockpiles prior to run off occurring. A toe bund will be constructed around each ore stockpile to retain any potential run off water and provide space for evaporation to occur.

Ore stockpiles will be stored on one of the ROM pad areas, with any water run off directed through to the sumps to the north of each ROM pad (see Figure 11). Any water runoff will be either evaporated or integrated to the local dust suppression for the site.

4.5.6 Use of explosives

Based on the nature of the operations (mineral sand mining) blasting activities are not usually employed. However, in exceptional circumstances it may be required. In the event that blasting is required, blasting activities will be undertaken in accordance with relevant standards and statutory requirements (including gaining necessary approvals).

4.5.7 Types of mining equipment

Indicative mining and mobile equipment associated with the operation is listed in Table 4-5. Exhaust emissions from diesel powered engines will be estimated for each financial year as part of Iluka's National Pollutant Inventory (NPI) reporting. NPI and National Greenhouse and Energy Reporting System (NGERS) reporting.

Table 4-5 Indicative mining and mobile equipment

Equipment type	Number	Emissions *	Predicted exhaust outputs (tCO_2-e)
Mining and rehabilitation			
Hydraulic excavator – face/ shovel, 200–600 tonne	1-2	E, N, V	46,076
Dozer – track, 110 tonne	5-8	E, N, V	44,283
Haul trucks			
Off-highway rear dump haul truck, 100-250 tonne	16-22	E, N	173,395
Ancillary			

Equipment type	Number	Emissions *	Predicted exhaust outputs (tCO_2-e)
Grader – motor, 20 tonne	3	E, N	3,280
Loader – wheel (IT), 14–18 tonne	2	E, N	881
Haul trucks, 40 tonne	2-5	E, N	2,571
Dozer, track, 40 tonne	1-2	E,N	6,351
Hydraulic excavator, 100–150 tonne	1-5	E, N, V	5,016
Truck – water, 10–45 KL	3	E, N	7130
Loader – wheel, 50 – 100 tonne	3	E, N	33,441
Tractor, 20 tonne	4	E, N	
Miscellaneous			
Miscellaneous plant and equipment will also be utilised during operations, including but not limited to light vehicles, cranes, forklifts, emergency service vehicles and mobile work platforms as required.			

** Key: V (Vibration), E (Exhaust) or N (Noise)*

Noise outputs are not provided as there are no receivers within the vicinity of the mine site to be impacted. Noise will be the standard machinery operation noise levels.

Fire ignition sources are limited to rock strikes during MUP processing, maintenance (including welding), earth moving fleet, onsite vehicles and refuelling trucks.

4.5.8 Mine dewatering

Mining is likely to occur no deeper (on average) than 125 mAHD and the local groundwater elevation is approximately 95 mAHD. Therefore, the mining activity will occur well above the local groundwater elevation, which precludes the requirement for dewatering during operations.

4.5.9 Sequence of mining and rehabilitation of operations

. Mining will occur 24 hours a day, seven days a week. Pre-stripping of overburden at the Atacama deposit will occur 24 hours a day, seven days a week.

The mining sequence for the Atacama pits is based on current projections for blending with Ambrosia ore. It may be subject to change as the Project scope is further defined. It is intended to commence mining operations at Atacama around mid-2024.

A proposed timeline for the works is included in Figure 4-3.

Pits	Y1		Y2		Y3		Y4		Y5		Y6		Y7		Y8	
	2024		2025		2026		2027		2028		2029		2030		2031	
	Jan-24	Jul-24	Jan-25	Jul-25	Jan-26	Jul-26	Jan-27	Jul-27	Jan-28	Jul-28	Jan-29	Jul-29	Jan-30	Jul-30	Jan-31	Jul-31
South										Stripping overburden		Ore production				
Eastern						Stripping overburden		Ore production								
Western				Stripping overburden	Ore production											
Central		Stripping overburden	Ore production													

Figure 4-3 Atacama Project mine timeline

Mining operations are not expected to result in the excavation of sulphide materials (for information on ASS please refer to Section 3.3). The ore material contains low levels of NORM (Section 7.14 and Table 4-1), however this doesn't meet the definition of radioactive material as defined by the RPC Act.

Rehabilitation objectives have been considered at all stages of the Atacama Project. Prior to commencing mining, all vegetation, topsoil and overburden will be removed from the disturbance area and stockpiled separately on site. Progressive rehabilitation will begin once mining is completed and as the active mine area moves, the resultant mine void will be backfilled with the stockpiled overburden material as soon as practical. This will allow for these areas to be used as future stockpile areas for forward works in order to minimise the disturbance footprint, as well as the clearance of native vegetation at the mine. As a result of reducing native vegetation clearance by using their backfilled areas for stockpiling no further progressive rehabilitation of the area can occur until mining operations are completed.

Following the completion of mining, the remainder of the rehabilitation activities (i.e., replacement of top and subsoil and seeding) of the Atacama site will commence. These rehabilitation activities (i.e., once mining stops) are expected to take up to 20 years based on current assumptions following completion of mining. A proposed rehabilitation timeframe and sequence are present in Figure 4-4 and Figure 4-5.

Pits			Y1R	Y2R	Y3R	Y4R	Y5R	Y6R	Y7R	Y8R	Y9R	Y10R	Y11R	Y12R	Y13R	Y14R	Y15R	Y16R	Y17R	Y18R	Y19R	Y20R	Y21R	Y22R
	2029	2030	2031	2032	2033	2034	2035	2036	2037	2038	2039	2040	2041	2042	2043	2044	2045	2046	2047	2048	2049	2050	2051	2052
South																								
Eastern										North to south progression														
Western							Northern section									Central section					Southern section			
Central									Northern section								Central section			Southern section				
Infrastructure zone												North to south progression												
Access road																								North to south progression
Rehabilitation / closure	Rehandle overburden						Topsoil rehabilitation																	

Figure 4-4 Proposed rehabilitation timeline

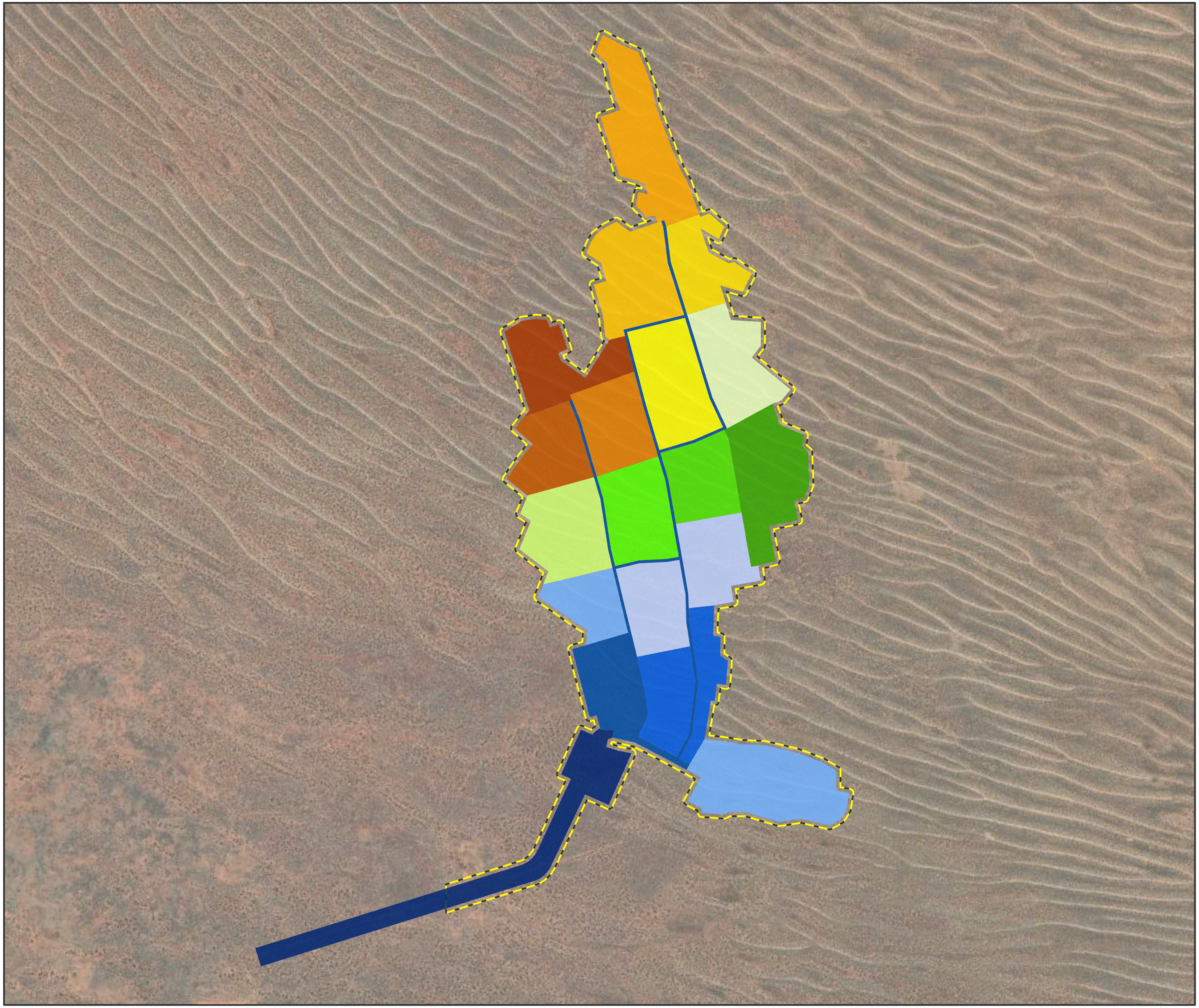


Figure 4-5 Atacama Project mine closure and rehabilitation schedule

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4.5.10 Rehabilitation strategies and timeline

Rehabilitation activities will be similar to those undertaken at the existing J-A site which are detailed in the existing J-A Rehabilitation Management Plan (Appendix F). This Management Plan will be updated to incorporate the management of both sites together (J-A and Atacama) and will be provided within the PEPR submission (provisionally to occur in late 2023). This is referred to throughout as the J-A-A Rehabilitation Management Plan.

The existing soil profile typically consists of topsoil of approximately 10 cm in the swales and up to 50 cm on the top of dunes. To mimic the existing soil profile upon completion of the rehabilitation program, the saddle formed between the cut dunes will have mixed materials, topped with 1 m thickness of carbonates (brown loam) and 10 cm of topsoil re-instated to surrounding ground level. Each soil horizon will be ripped to prevent compaction of the soils, with the final topsoil layer ripped on the contour to assist in erosion control. Revegetation will be undertaken at the time of the rehabilitation earthworks and final surface ripping.

Final shaping of the new landform to design levels, including battering dune slopes to 1:6 at the crest to reduce erosion and placement of overburden to create a saddle between the cut dunes, emplacement of capping material, timber and revegetation will subsequently occur in accordance with the J-A-A Rehabilitation Management Plan.

A key limiting factor in the timing of completion of rehabilitation activities is the seed collection rate. At J-A the seed collection must be undertaken within 50 km of the site to ensure endemic local species only are used for rehabilitation activities. The rare collection time (based on permits), current hand collection methods, limited seed stock in an arid environment and inaccessible landscape restricts the rate at which this work can be undertaken. An independent rehabilitation fleet will be used at each site (J-A and Atacama). All of these assumptions have been used in calculating assumed rehabilitation timeframes of the Atacama Project presented within this MLP.

Work will continue post this MLP submission to investigate how to reduce the rehabilitation timeframes wherever possible.

Aside from providing key rehabilitation of vegetation, reseeding of the created landforms is required for soil stability including erosion and sediment control.

Rehabilitation will generally be undertaken in a north to south direction (Figure 4-5) as works move off the disturbance footprint. No works will be undertaken in previously rehabilitated areas.

All infrastructure and buildings will be removed from site as part of mine closure unless agreement is reached with the landowners to retain infrastructure for their use.

After the completion of rehabilitation activities there will be a period of monitoring to demonstrate that Iluka have met the Project's closure criteria, after which and once the tenement is surrendered the land will be returned to a Regional Reserve.

4.5.11 Modes and hours of operation

Mining will occur 24 hours a day, seven days a week. Pre-stripping of overburden at the deposit will also occur 24 hours a day, seven days a week.

4.6 Crushing, grinding, processing and product transport

Atacama ore will be trucked to one of the two ROM stockpiles adjacent to the pit, fed through the MUP to remove oversize (rocks and agglomerated particles greater than 10 mm) and mixed with water (supplied from ML 6315) for slurry pumping to the ML 6315 site for processing. Pre-screening of slurry may be done at the Atacama site to produce material for road sheeting.

4.6.1 Crushing and grinding plant

There will be no grinding or crushing activities within the Project Area.

4.6.2 Processing plant

4.6.2.1 Processing overview

Slurry provided from the Atacama site will be processed on a continuous basis 24 hours a day. The WCP will be modified to produce HMC at rates of up to 180 t/h, with reject sand tails placed at Jacinth North and ModCoD as part of the Ambrosia backfill. A WHIMS plant will be installed in series to the existing concentrator on ML 6315, which will separate the magnetic (ilmenite) from non-magnetic (zircon and rutile) HMC, as they will be transported to different destinations in WA for downstream processing. The magnetic HMC may be washed at J-A to reduce salinity before being shipped to Capel, WA.

Fire ignition sources are limited to rock strikes during processing and maintenance including welding. Noise sources haven't been measured due to the lack of sensitive receivers.

4.6.2.2 Mining Unit Plant

The Atacama Project will have one MUP with a throughput rate of approximately 1300 tph (dry). The MUP will be located at ROM Pad #1 for the first two years after which it will be moved to ROM Pad #2 (Figure 4-6). The MUP will be positioned on a hardstand pad constructed at the ROM stockpiles at each of the two locations. The hardstand pads each have an area of approximately 93,000 m^2 and runoff will be directed towards a stormwater containment pond. The total area of ROM Pad #1 is around 293,000 m^2 and ROM Pad #2 is around 105,000 m^2.

FELs will feed ore from the ROM stockpile into a feed hopper and apron feeder. This will convey the ore onto a vibrating grizzly screen, to remove any oversized material (+300 mm). The undersize feeds into a trommel screen and is then sprayed with process water. The oversize (+10 mm) discharges into the reject chute while the undersize feeds into a ROM sump where it is slurried with process water. Two centrifugal pumps in series will then transfer the slurry to the WCP at J-A via a slurry transfer system as described in the following section.

The oversized material rejected from the MUP grizzly and trommel screens will be deposited via a chute and conveyor onto the ground behind the MUP. A FEL or truck will collect the oversize material and transport it to one of the mining pits where it will be placed on the pit floor behind the mining face.

When required, the medium size material, between 10 and 300 mm, will be used to surface the roads and access ways around the pit to improve trafficability of the mining fleet. A screen may be necessary to separate the ideal material size from the oversize. At the end of LOM, the roads will be stripped, sheeting from the roads and other hardstand areas removed and the material returned to the mine pits.

Where the oversize contains valuable mineralisation, typically associated with the central pit, the oversize may be campaign processed through a small 100 t/h rotating drum scrubber, co-located with the MUP. The resulting sand slurry, containing the liberated zircon and titanium minerals, will join the slurry that is pumped to J-A WCP.

4.6.2.3 Slurry transfer

The WCP, located at J-A, will be a significant distance from the MUP locations at Atacama (ROM Pad #1 or #2). Four set of pumps stations, E2, E3, E4, and E5, will therefore be required over the LOM of the Project, with three sets of booster pump stations initially required (E2, E3, E4) and an additional booster pump station (E5) added when the MUP is moved from ROM Pad #1 to ROM Pad #2. Each set will consist of two centrifugal pumps in series. The locations of the booster pump stations are shown in Figure 4-7. The pump stations will be installed on skids inside an earthen bund.

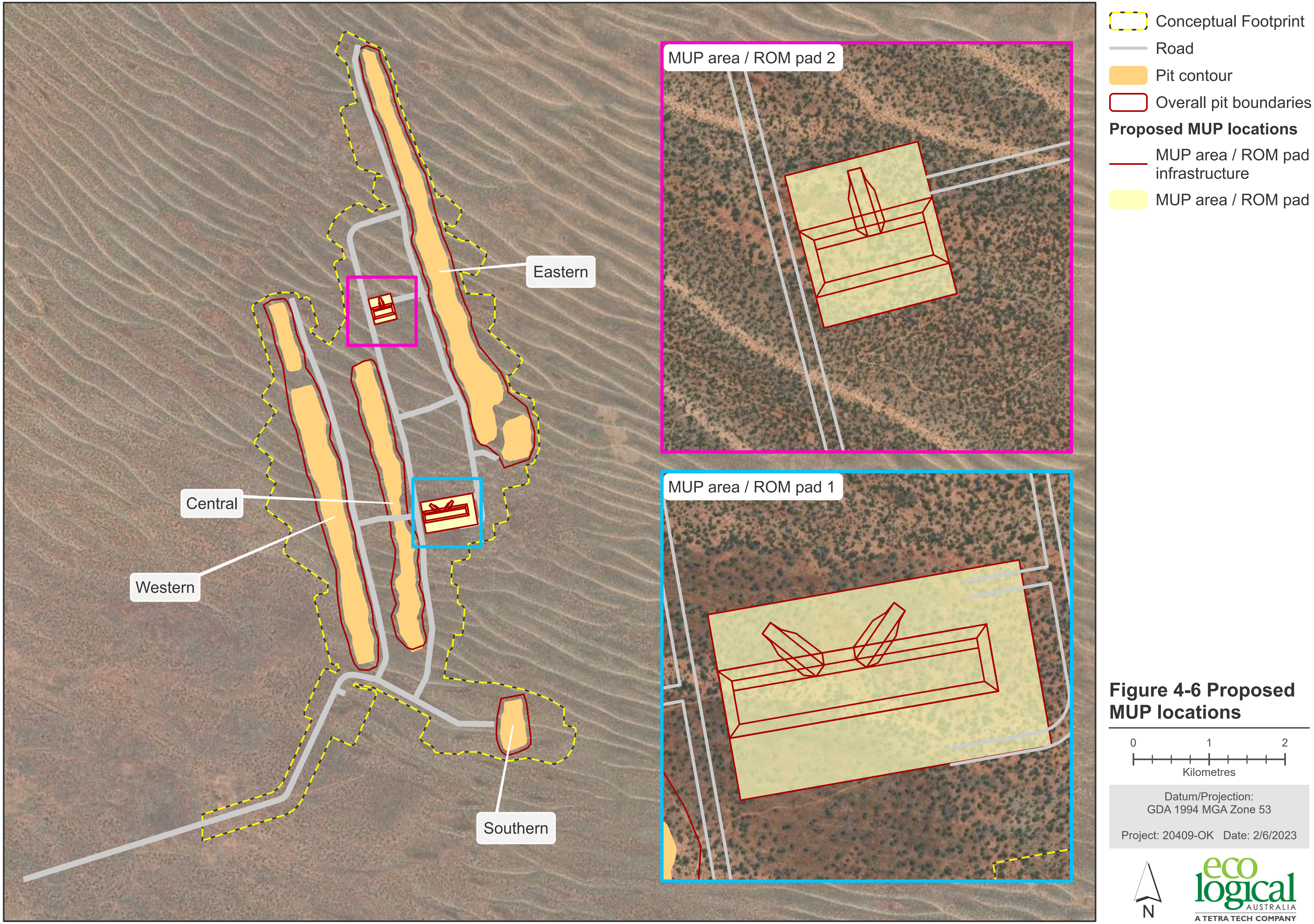

Figure 4-6 Proposed MUP locations

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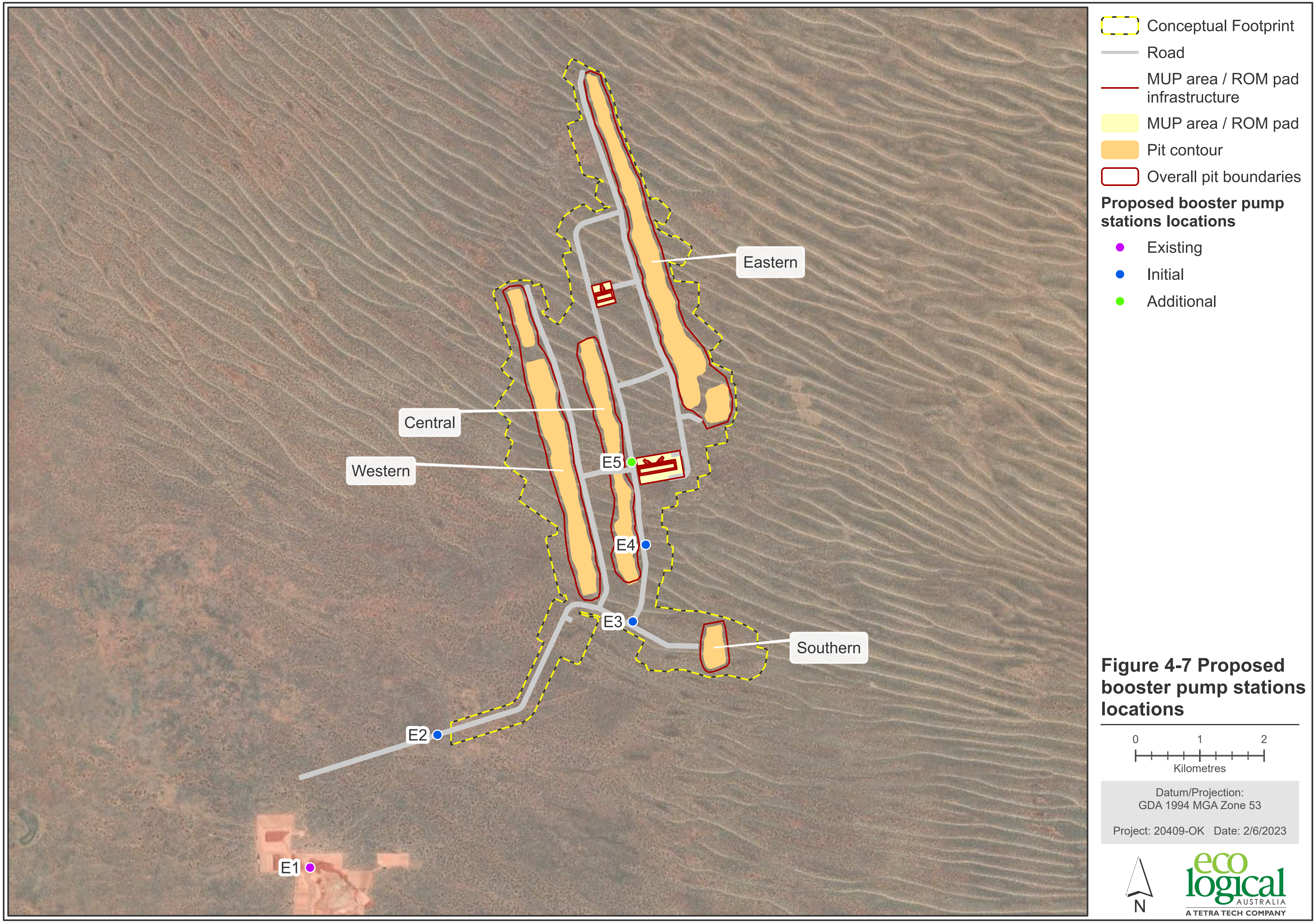

Figure 4-7 Proposed booster pump stations locations

4.6.3 Process water management

The Project Area is located in an arid environment where evaporation far exceeds rainfall (Section 3.2). Water conservation principles such as maximising water recycling and minimising water consumption are integral to the ongoing management of the Project's water resources.

Hypersaline water will be used for process water for the Atacama Project. The process water will be supplied to Atacama from an existing process water pond located off lease within the adjacent J-A ML by a pipeline as outlined in section 4.6.7. A pipeline will be built to connect the Atacama supply line into the existing line at Ambrosia.

Two 2.5 ML capacity ponds will be established to the north of ROM Pad #1 as shown in Figure 1-1. One pond will store process water and one pond will store Reverse Osmosis (RO) water. Both ponds will require a freeboard of 1 m, with the depth of the water to be 2.5 m in each pond. Ponds will be lined with a High-Density Polyethylene (HDPE) liner. Cross sections of ponds are included in Figure 4-8.

During processing, a net average process water consumption rate of approximately 13.2ML per day is expected between the combined J-A Atacama project for operations and processing. The bulk of this process water is required by the MUP for the screening and slurrying of the ore. Process water is a mixture of water extracted from the WCP, tailings water, and bore water.

Approximately 1 ML per day of RO water is expected to be used for dust suppression, workshop and amenities use. Outflows are indicated in Table 4-6.

Stored process water will have a salinity in the range of 40,000 to 60,000 mg/L when measured as Total Dissolved Solids (TDS). The indicative composition of the raw groundwater from the supply bore (palaeochannel) is provided in Table **4-7**. As brine from the RO plant will also make up the process water, the salt concentrations could increase by up to 7%. Flocculants in the processing of ore will be present in the water recovered from the tailings in concentrations of ~134 mg/L.

Table 4-6 Typical average Indicative outflows for combined Atacama/ J-A operations

Process outflows	Daily flows (ML/day)	Annual flows (ML/year)
WHIMS magnetic HMC (process water)	0.3	109.5
WHIMS non-magnetic HMC (process water)	0.1	36.5
Deposited tailings (net process water loss)	11.8	4307
RO water – dust suppression, amenities, workshops, mags washing	1.0	365
Atacama mine dust suppression (process water)	1.5	547.5

Process outflows	Daily flows (ML/day)	Annual flows (ML/year)
Total outflows	**14.7**	**5365.5**

Table 4-7 Indicative composition of groundwater

Analyte[1]	Raw groundwater
pH	4.73
EC	79.2
TDS	51500
Calcium	488
Magnesium	1540
Sodium	12900
Potassium	394
Chloride	21800
Sulfate	4860
Carbonate	<1
Bicarbonate	1
Total Alkalinity	1

[1] Units are mg/L, except for EC, which is mS/cm and pH which is measured in pH units

RO water stored at the pond at Atacama will have the following expected composition, based on the RO plant design specification (Table 4-8).

Table 4-8 Indicative composition of RO water

Parameter	Units	Average Value	Range
pH	-	7.6	6.2 – 9.3
Turbidity	NTU	0.24	<1

Parameter	Units	Average Value	Range
Total Dissolved Solids	mg/L	119	<1,000
Hardness (as $CaCO_3$)	mg/L	9	<450
Sulphate	mg/L	5	<250
Chloride	mg/L	6	<250

Rainfall will be collected in roadside containment ponds and MUP run off sumps and allowed to evaporate.

Due to the arid climate and low rainwater volumes, rainwater has not been considered for input into the process water balance. In the event of a significant rainfall event, any rainwater collected from the mine pits may be pumped into a truck and transferred to the MUP sump. The water will then be used in combination with the process water to slurry the ore and will be pumped offsite (to J-A) with the slurry.

Rainwater collected from the mine pits during ordinary rain fall events may also be used for dust suppression to reduce the RO water demands.

There is no mine dewatering as mining operations are above the water table.

The process water balance across J-A and Atacama during campaigns is shown in Figure 4-9.

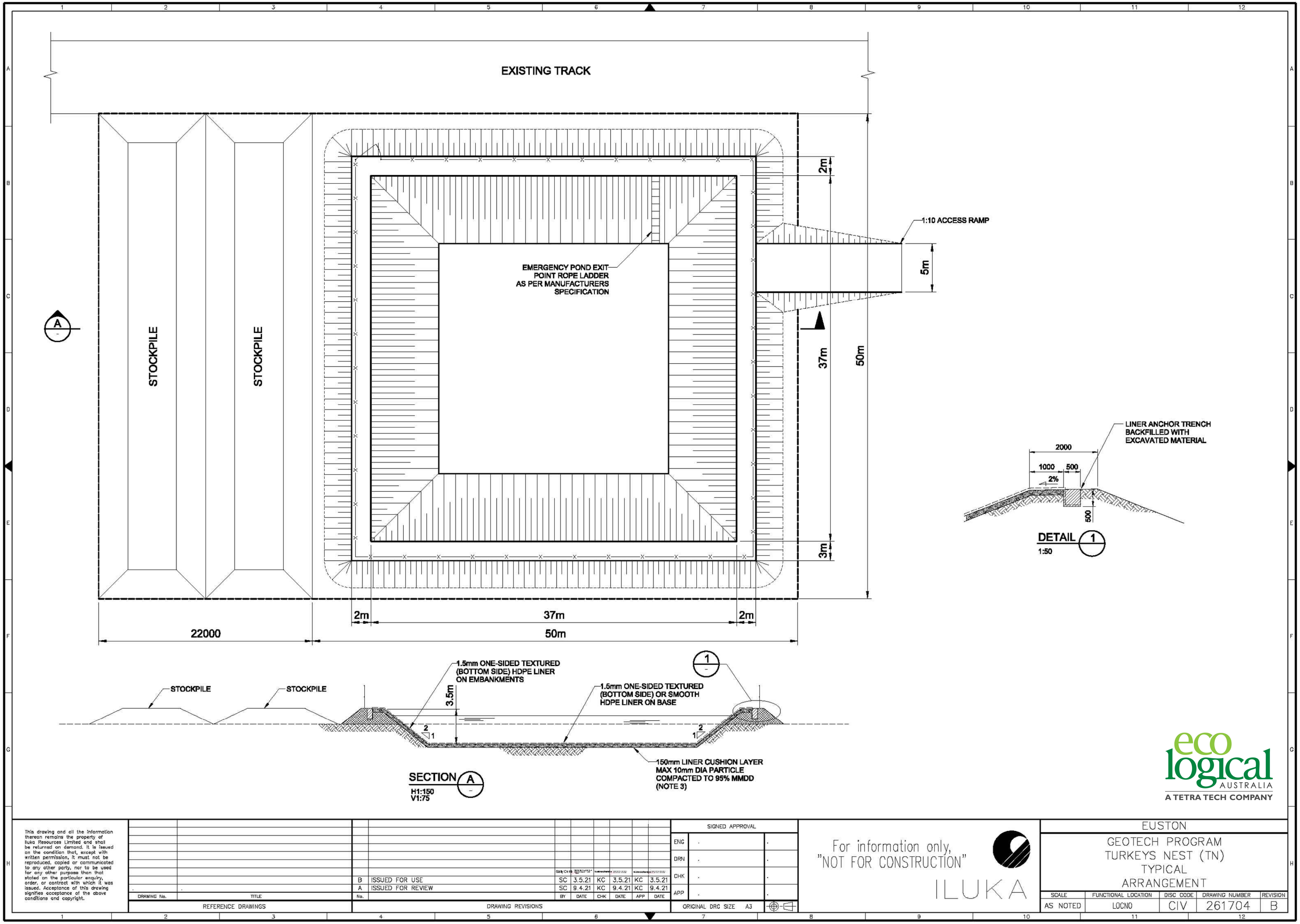

Figure 4-8 Indicative cross-sections of RO and process water ponds

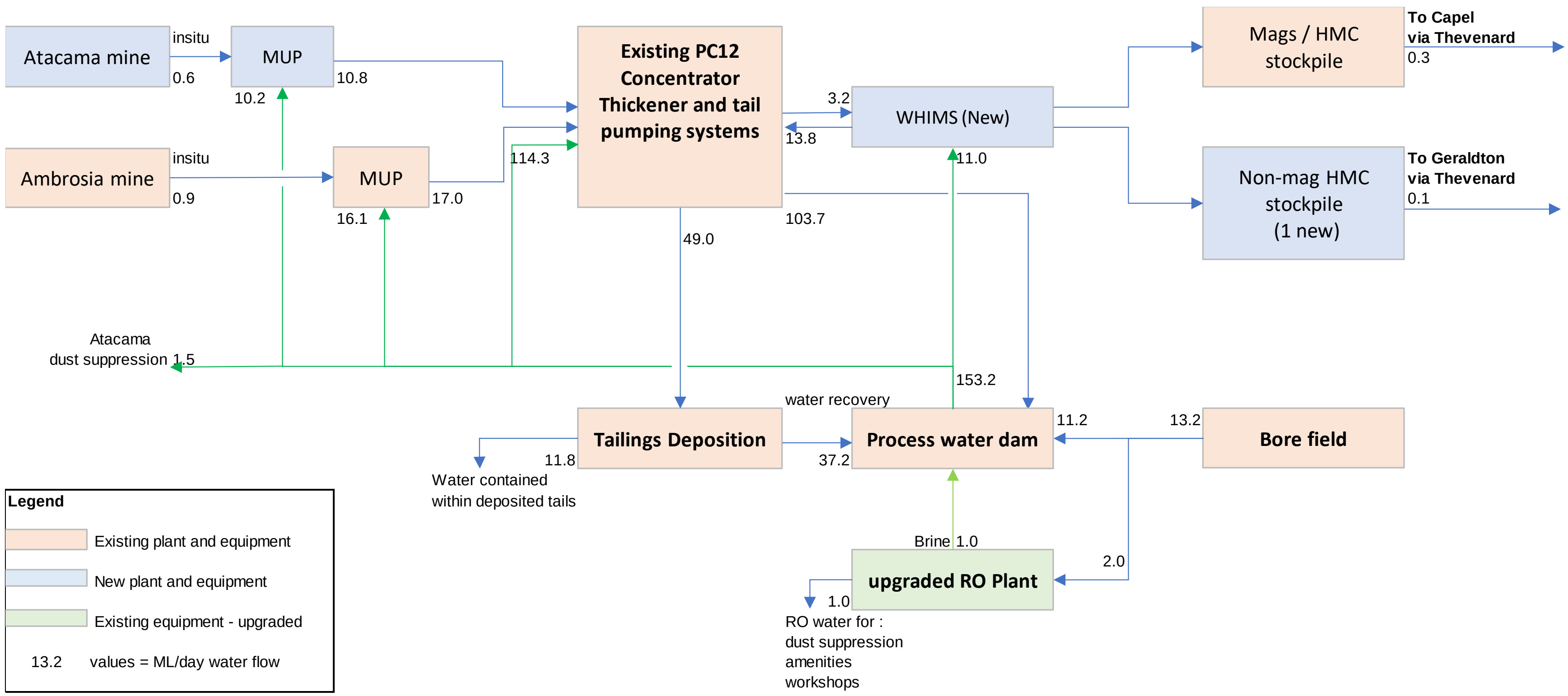

Figure 4-9 Process water flowsheet for J-A-Atacama during processing

4.6.4 Other processing water Project aspects

Infrastructure and works occurring on J-A will be further discussed in the CiO document for changes occurring at J-A in Appendix D.

4.6.5 Type of mobile equipment

Table 4-9 provides the maximum mobile fleet required onsite at peak mine operation at Atacama, this fleet is additional to the J-A fleet. Details of the rehabilitation fleet have not been included in below.

Table 4-9 Mobile Equipment list

Item	Units	Size (tonnes)	Predicted exhaust outputs (tCO2-e)
Loader CAT988	1	51	33,441
Dozer CAT D10	1	70	6,351
Water Cart CAT740	1	40	7,130

4.6.6 Conveyors and pipelines

Three (3) pipelines will be used to transport materials in and out of the Atacama mine site (process water, RO water and ROM slurry). These three pipelines will be installed in a 5-metre-wide preliminary pipeline corridor that runs adjacent to the main access road, the Central pit haul road and the Central to Eastern pit haul road. The proposed route of the road and corridor is shown in Figure 4-10. Cross sections of the proposed road corridor including pipeline locations are included in Figure 4-11. Containment sumps will be provided at the low points to contain any drain down from these pipelines and the road runoff.

The DN 315 slurry line runs from Atacama to a blending tank at the existing Ambrosia Booster #3 and the process water line to Atacama is an extension of the existing process water line to Ambrosia.

There will also be a further two smaller pipelines (nominally 100 m each) at Atacama which will supply RO and process water to the standpipes used to fill the dust suppression spray trucks. Given the small size of these two pipelines they are not detailed in Figure 4-10.

Details of all five of the pipelines are provided in Table 4-10.

No fire ignition or dust sources have been identified associated with the three pipelines.

Table 4-10 Pipeline details for Atacama

Pipeline	Source	Destination	Design flow rate	Length	Nominal diameter	Material of construction
Ore slurry	Atacama MUP	Ambrosia slurry line tie-in	614 m^3/h	9.5 km	DN315	PE100
Process water	Ambrosia process water line tie-in	Atacama MUP	1099 m^3/h	9.5 km	DN500	PE100
RO water	J-A RO tank	Atacama RO pond	42 m^3/h	13 km	DN140	PE100
Dust suppression – RO water	Atacama RO pond	Atacama RO water standpipe	200 m^3/h	0.1 km	DN225	PE100
Dust suppression – process water	Atacama MUP	Atacama process water standpipe	200 m^3/h	0.1 km	DN225	PE100

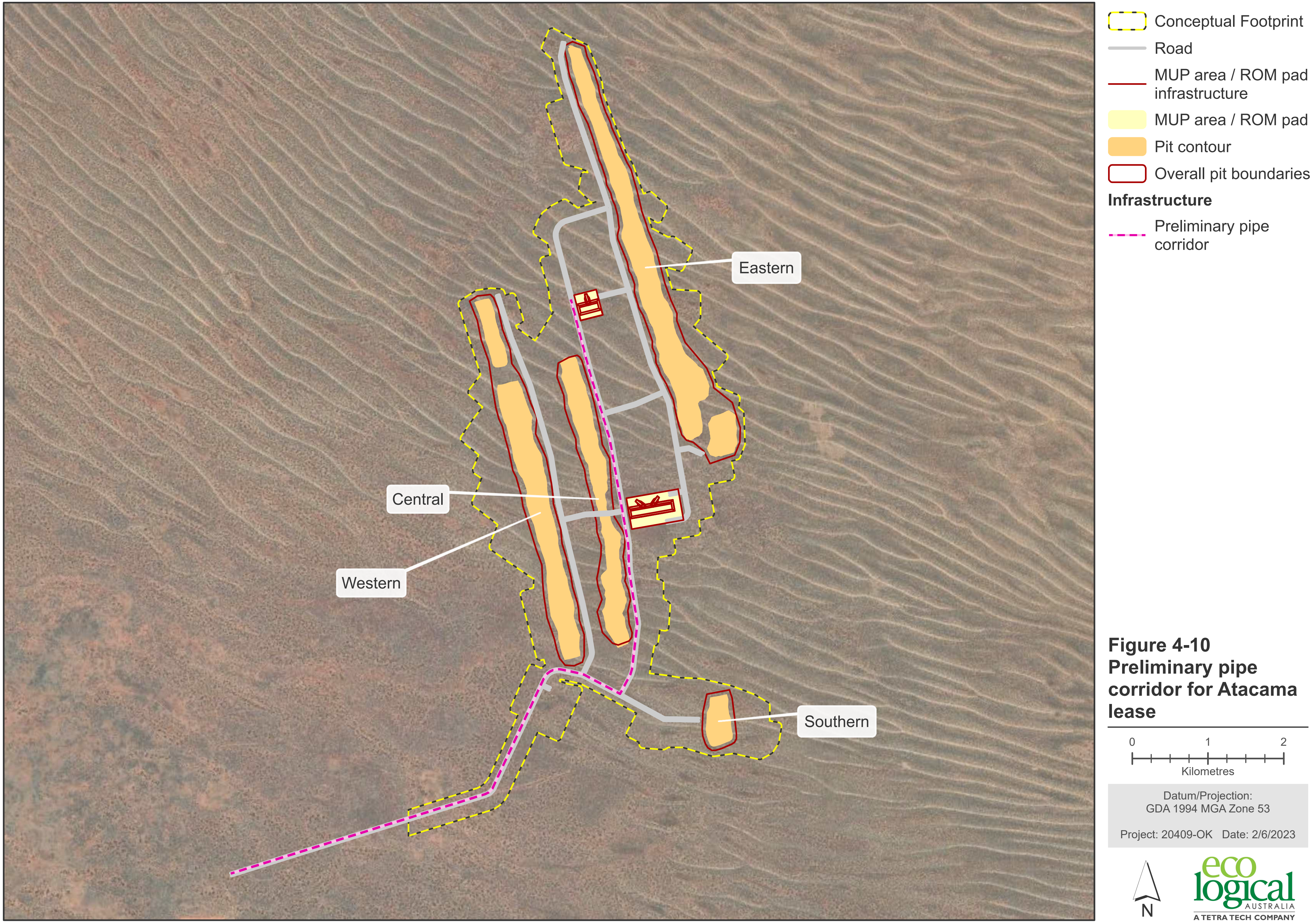

Figure 4-10 Preliminary pipe corridor for Atacama lease

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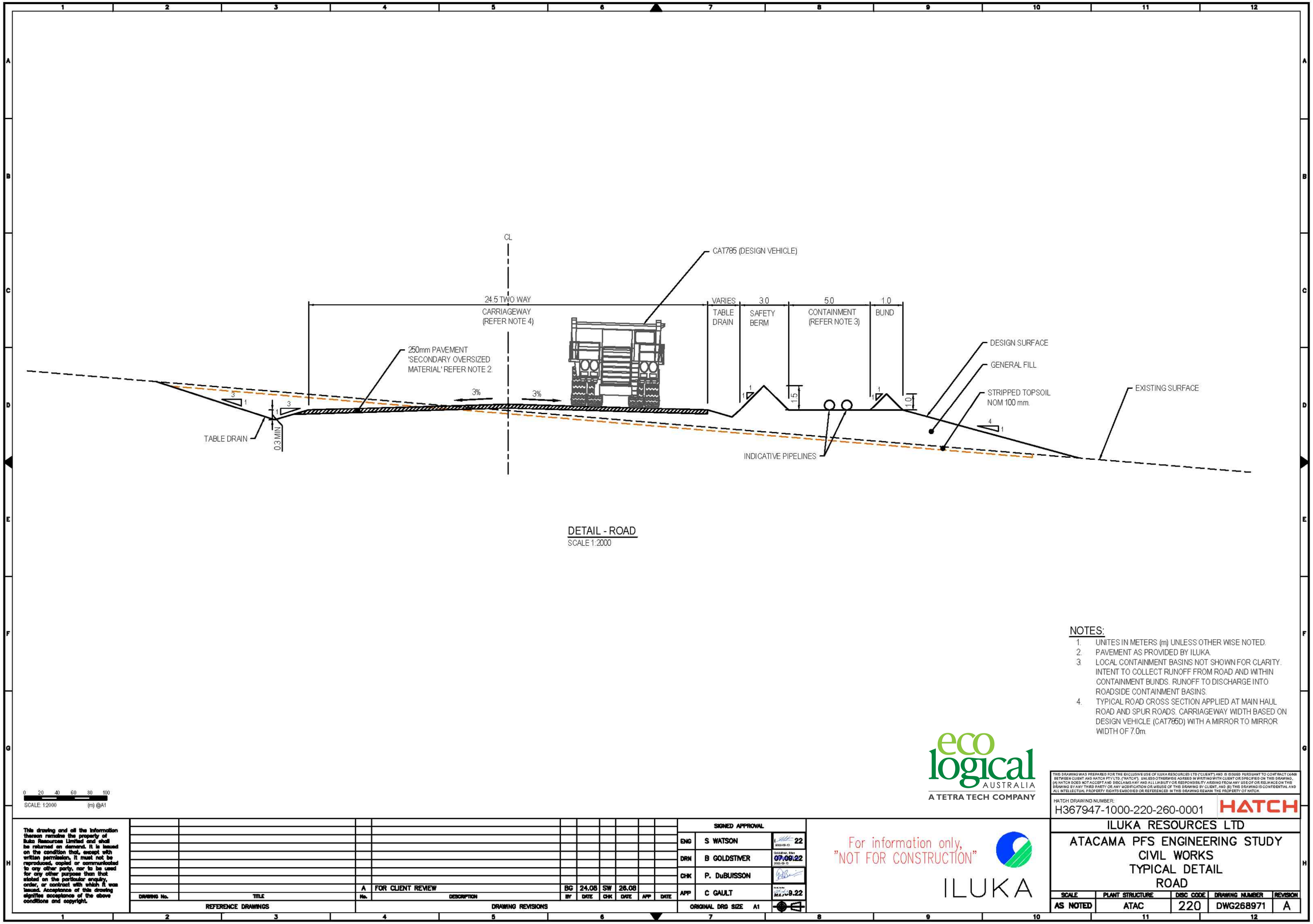

Figure 4-11 Proposed cross section of road and pipeline corridor

4.6.7 Hours of operation

The processing of the Atacama ore in the MUP will be a continuous operation. The operation will be 24 hours per day, seven days a week. Pre-stripping of the mine pits in preparation for the processing will be year-round and will be 24 hours per day, seven days per week.

4.6.8 Rehabilitation strategies and timing

All infrastructure will be removed from site as part of the J-A-A Rehabilitation Management Plan. Infrastructure will only remain on site at the landowner's owner's request.

MUP, concrete pads and pipelines and footings will be removed off site for reuse, recycling, or disposal as appropriate. Pipelines and associated materials including sump ponds and footings will be removed from site for disposal. Areas of disturbance where processing infrastructure was located will be rehabilitated as part of the overall rehabilitation timing as outlined in **Figure 4-4** and Figure 4-5.

All works will be detailed in the J-A-A Rehabilitation Management Plan which will be provided in the PEPR.

4.6.9 Other crushing, grinding, processing and product transport Project aspects

Once the ore material is slurry pumped to J-A it will be further processed through the existing WCP and the to be constructed WHIMS plant. It will then be stored at J-A prior to transport to Port Thevenard. For more information on these Project aspects please refer to the CiO document for changes occurring at J-A in Appendix D or the J-A PEPR.

4.7 Wastes

4.7.1 Waste rock and tailings storage facilities

Minimal waste rock will be produced from the Project. Waste rock is limited to the oversize material which is rejected from the MUP after primary screening (refer to Section 4.6 for more information). Rejected waste rock will be placed in the void(s) and buried at depth during rehabilitation.

The movement of oversize material as well as the percentage the overwise makes up of the total material moved is presented in Table 4-11.

Table 4-11 Movement of oversize

Item	2024	2025	2026	2027	2028	2029	2030	2031
Oversize (bcm)	11,630	87,688	42,768	26,824	25,472	9,590	15,703	27,389
Oversize (%)	5.2%	4.1%	2.1%	1.4%	1.4%	0.5%	0.8%	1.5%

No potentially acid forming material (PAF) is expected to be encountered as a result of the Project. PAF occurs in the Lignite layer which will not be mined. The Marine sands have been found to be potentially non-acid forming.

All tailings will be stored at the J-A mine on ML 6315, primarily within the exiting disturbance footprint. No tailings storage facilities will be constructed in the Atacama Project Area. Tailings will be split into two components at the concentrator stage, a benign coarse sand component and a ModCoD component <53 micron in size.

This is not discussed further within this document as there is no tailings storage occurring in the Project Area.

4.7.2 Other processing wastes

There are no other processing wastes produced from the processing of Atacama ore within the Project Area.

4.7.3 Industrial and commercial wastes

Industrial and commercial wastes will be collected at the Atacama Project Area and transferred to J-A for storage as per J-A's current management practices. Some interim lay down areas for inert wastes and materials may be established at Atacama. Treated sewage from office/crib room ablutions may be disposed at Atacama in accordance with relevant regulatory requirements.

The following outlines the current management practices of Iluka at J-A which will extended to the management of waste at Atacama.

Waste management on the Atacama site will be based on the waste hierarchy of control specified by the *Environment Protection (Waste to Resources) Policy 2010* and requisite waste management objective which is to: achieve sustainable waste management by applying the waste management hierarchy. The Project is expected to generate the following categories of waste:

- general waste
- tyres, industrial and construction waste
- sewage
- oils and other hydrocarbons
- medical waste.

The *J-A Waste Management Plan* will be updated as part of the PEPR to include Atacama to ensure waste is disposed of using best-practice methods taking into consideration the waste hierarchy outlined above. Collection bins will be designated for a particular waste type (e.g., recyclables, paper and cardboard, non-hazardous non-recyclable) and labelled/ colour coded accordingly no demolition, industrial or solid domestic (other than treated sewage) wastes will be disposed of within the Atacama Project Area – consistent with ML6135 condition (Second Schedule 14).

The industrial and commercial waste streams generated by the operation and their management will be similar to those produced by J-A currently and are summarised in Table 4-12 and Table 4-13 for non-hazardous wastes and hazardous waste, respectively.

Table 4-12 Atacama non-hazardous waste management methods

Waste Type	Fate		Method	Average annual J-A volumes (annual)
Aluminium cans	Recycled	Off-Site	Shipped to third-party for processing	1 tonne
Commingled recycling	Recycled	Off-Site	Collected and managed by EPA-licensed waste contractor.	25 tonnes
E-waste	Recycled	Off-Site	Collected and managed by EPA-licensed waste contractor.	2 tonnes
General and putrescible waste	Disposal	Off-Site	Collected by EPA-licensed waste contractor and disposed to approved landfill facility.	155 tonnes
Paper and cardboard	Recycled	Off-Site	Collected and managed by EPA-licensed waste contractor.	1 tonne
Plastic (bulk)	Disposed	Off-Site	Collected by EPA-licensed waste contractor and disposed to approved facility.	4 tonnes
Plastic (bulk)	Recycled	Off-Site	Collected and managed by EPA-licensed waste contractor.	5 tonnes
Scrap steel/metals	Recycled	Off-Site	Collected and managed by EPA-licensed waste contractor.	88 tonnes
Waste timber	Recycled	Off-Site	Collected and managed by EPA-licensed waste contractor.	10 tonnes

Table 4-13 Atacama hazardous waste management methods

Waste Type	Fate		Method	Average annual J-A volumes (annual)
Batteries	Recycled	Off-Site	Collected and managed by EPA-licensed waste contractor.	2 tonnes
Cooking oil	Recycled	Off-Site	Collected and managed by EPA-licensed waste contractor.	1 KL
Fluorescent tubes	Recycled	Off-site	Collected and managed by EPA-licensed waste contractor	0.1 tonnes
Grease trap solids	Disposal	Off-Site	Removed by EPA-licensed waste contractor and disposed to approved facility.	8 KL

Waste Type	Fate		Method	Average annual J-A volumes (annual)
Hydrocarbon-contaminated soil and sludge	Disposal	Off-Site On-Site	Managed in accordance with SA EPA Guidelines: Disposal to EPA approved facilities.	97 tonnes
Medical waste	Disposal	Off-Site	Collected and managed by EPA licensed waste contractor. Treatment via incineration at EPA approved facility.	0.16 tonnes
Sewage sludge (biosolids) (treated)	Disposal	On-Site Off-Site	Treated septic biosolids removed by EPA-licensed contractor with on-site reuse per SA EPA Guidelines (Liquid Biosolids from Domestic Septic Tanks – Disposal onto Agricultural Land, 2003), or disposed to off-site approved community wastewater treatment system.	267 KL
Waste oil and grease	Recycled	Off-Site	Collected and managed by EPA-licensed waste contractor.	40 KL
Tyres	Recycled	Off-Site	Shipped to third-party for processing	3 tonnes

All sewage generated at Atacama will be treated through a SA Health approved on-site wastewater system. The Atacama on-site wastewater system will be fed from site ablutions and crib facilities. The on-site wastewater system will comprise a treatment unit and discharge of treated effluent. The treated effluent will be discharged to soakage. Biosolids will be retained in the primary settling tanks with periodic removal and disposal.

Treated biosolids will either removed for off-site disposal by an EPA-licensed waste contractor or disposed within the Atacama Project Area or J-A ML per SA EPA Guidelines (Liquid Biosolids from Domestic Septic Tanks – Disposal onto Agricultural Land, 2003). On-site disposal of biosolids will be undertaken in accordance with the Biosolids Management Procedure which outlines requirements for disposal location, size, application method/ rate and monitoring in line with these EPA guidelines. The on-site disposal of biosolids does not trigger EPA licensing per Schedule 1(2) of the EP Act as the plant capacity is under 1000 persons and the discharge area is not in a water protection area with no disposal to marine waters.

It is expected that small volumes (approximately 300 m³ per annum) of hydrocarbon contaminated soils will be generated during operation of the Atacama Project Area. Likely sources will include leaks and spill, and soil and residues from vehicle wash down pads, refuelling areas and bunds. Efforts to minimise hydrocarbon contamination of soils will include mitigation measures outlined in the outlined in Section 7.4.

Each incident will be reviewed and assessed for sampling and NEPM-based investigation will be assessed on a case-by-case basis. Based on current J-A operations, most of these events are likely to meet the requirements of trivial contamination per Section 5B of the EP Act and SA EPA Information Sheet 830/09 (January 2009: Site contamination—what is site contamination?) and are expected remain below *National Environmental Protection (Assessment of Site Contamination) Measure (2013)* (ASC NEPM) Ecological Investigation Levels (EIL) or Health Investigation Levels (HIL) thresholds. Trivial contamination will be managed using existing bioremediation facilities at J-A and will not require detailed investigation under the ASC NEPM.

Spills and leaks that exceed the trivial definition will be managed in accordance with the SA EPA Information Sheet (March 2010): Current criteria for the classification of waste—including Industrial and Commercial Waste (Listed) and Waste Soil and the ASC NEPM. If required, off-site disposal will be managed by EPA-licensed contractors with disposal to EPA-approved facilities according to the analytical results and soil classification. Validation sampling (in accordance with the ASC NEPM) will be undertaken following removal of the contaminated soils ensure that there are no further impacts to the soil or a potential threat to groundwater.

4.7.4 Rehabilitation strategies and timing

Waste rock within the Project Area will be limited to rejected rock from the MUP during primary screening which will be buried at depth within the Atacama voids. Treated wastewater will be discharged from the on-site wastewater system(s).

No tailings, other processing wastes and industrial/ commercial wastes will remain in the Project Area post closure. Atacama haul road sheeting material extracted from the Atacama operations and J-A Operations will be placed into the Atacama voids as part of progressive rehabilitation.

All tailings from the processing of Atacama material will be deposited on the J-A site and will be included in the updated and combined J-A-A Rehabilitation Management Plan for consideration as part of the PEPR submission. These tailings will be deposited in accordance with an integrated tailings and rehabilitation schedule for J-A to enable progressive rehabilitation. More details regarding the tailings management and rehabilitation are outlined in the CiO (Appendix D).

4.7.5 Other waste Project aspects

Tailings storage for Atacama tailings will occur on ML 6315 and majority of waste management and transfer will occur at ML 6315. For more information on these Project aspects please refer to the CiO document for changes occurring at J-A in Appendix D, or the J-A PEPR.

4.8 Supporting surface infrastructure

4.8.1 Access and roads

The Atacama Project will require construction of a new haul road from Ambrosia to Atacama and a road network within the Atacama Project Area. No modifications will be made to public roads as part of the Project.

The new Atacama haul road will join the existing haul road at the north-west corner of Ambrosia and follow the alignment of an existing driller's track to Atacama (which will be widened from its current width as part of this Project). The proposed road network to the two MUP locations and four pits is shown in Figure 4-12. Cross sections of the proposed road corridor including pipeline locations are included in Figure 4-10.

The typical Atacama haul road design basis is as follows:

- 24.5 m wide roads where MUP access is not required (based on the criteria that the road should be three times the width of the largest vehicle)
- variable table drains
- 3 m safety berm separating the road and the pipeline corridor
- 5 m pipeline corridor
- 1 m bund on the side of the road infill areas
- 250 mm depth base course.

Additional roads, perimeter tracks (for safely accessing sites for monitoring and maintenance) and temporary tracks will be installed to enable the Project within the proposed project footprint and will be subject to rehabilitation at mine closure.

The Atacama haul road will be suitable for heavy vehicular traffic including fully loaded semi-trailers and road trains, and relocation of the MUP. Where possible, the haul road will follow the existing surveyed track alignment, modified where necessary to accommodate heavy equipment traffic and avoid highest dunes to minimise cuts. Roadside drainage design includes roadside containment ponds to safely capture and contain any stormwater runoff and allow for evaporation of the water. Culverts and roadside containment ponds are shown on Figure 4-12.

During the construction phase, traffic in the Project Area would consist of light and heavy vehicles and some limited oversized loads; the number of which would be determined during detailed design phase. During operation, the haul road will be utilised for the transport of supplies to the Project Area. No accommodation will be provided within the Project Area and operations personnel will commute to the site from the existing J-A camp facilities. The current staffing forecasts suggest an average of two return bus runs per shift to the Project Area.

During the construction phase secondary oversize and/ or extractives may be received from the J-A tenements for road construction.

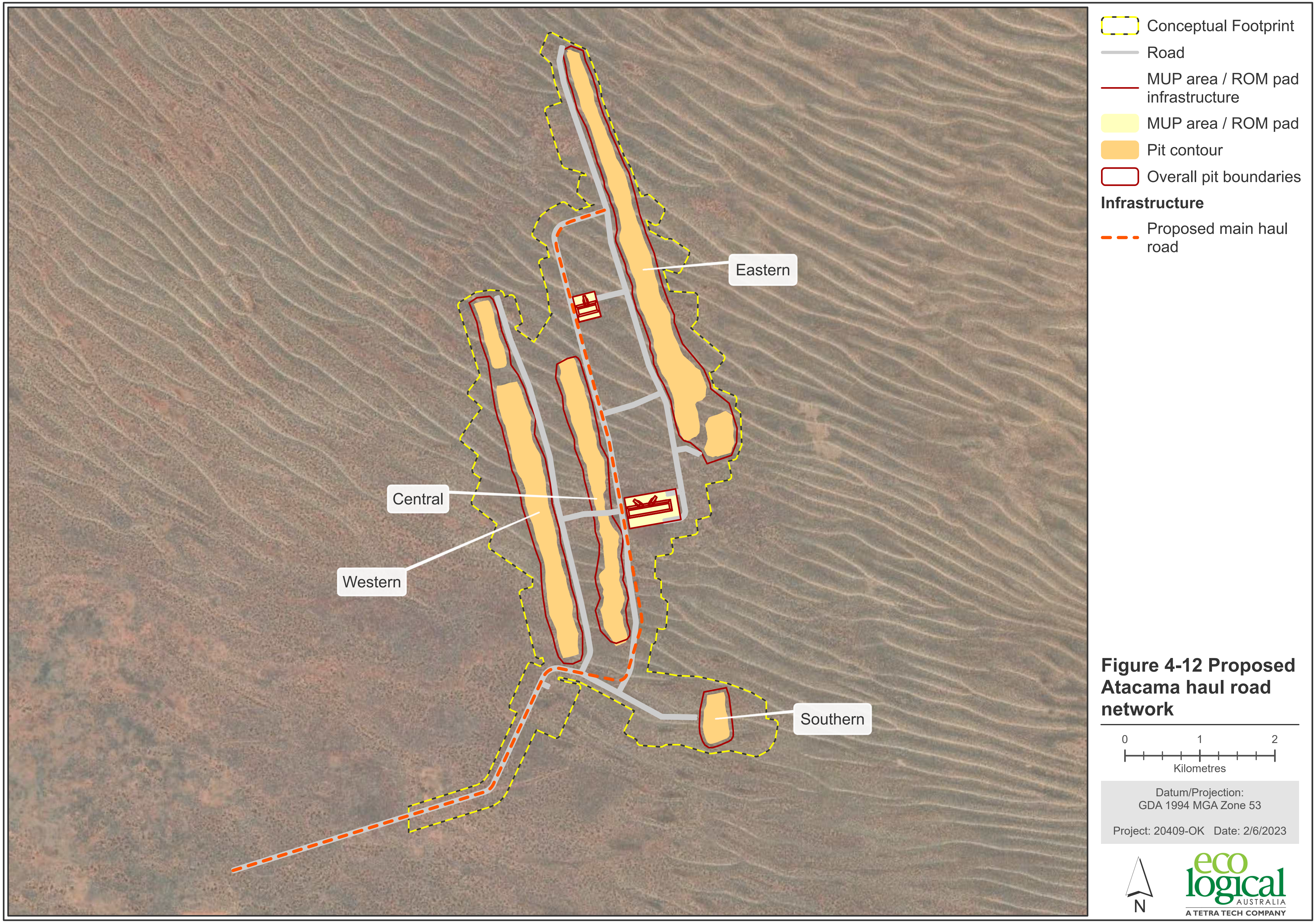

Figure 4-12 Proposed Atacama haul road network

4.8.2 Accommodation and offices

Accommodation for Atacama Project personnel will be provided at the existing J-A village, with no accommodation within the Project Area.

A number of prefabricated buildings and custom maintenance buildings will be constructed within the Project Area. The following buildings will be nominally installed within the Iluka compound identified in Figure 4-1:

- site office
- crib room
- ablutions –
- communications room
- maintenance area consisting of a concrete slab with a fabric dome shelter on top of two 40 foot containers will also be installed

A fixed Mining contractor's compound located next to ROM Pad #1 will include further demountable buildings and is anticipated to be approximately 300 m x 200 m with a combination of concreted areas and hardstand, and a workshop structure similar to the existing operations at J-A. The location of the contractor's compound is shown in Figure 4-1.

A heavy vehicle wash bay will be installed at either the Iluka or contractor's compound.

During the construction phase temporary laydown areas may be required for the Project, these would all occur within the Conceptual Footprint. Concrete will also be required during the construction phase which would be sourced from a temporary mobile concrete batching plant.

4.8.3 Public services and utilities used by the operation

No modifications to public services will be required by the Atacama Project. For communications, a single tower located adjacent to the Iluka compound will be installed at Atacama and the Long-Term Evolution (LTE) network currently installed at J-A extended. An additional repeater station may be required to the north of the site.

4.8.4 Visual screening

The Project Area is not visible from any public access roads, and the final landform at Atacama is unlikely to impact the appearance of the Atacama landscape from public access roads and as such no visual screening, vegetation or otherwise is proposed.

4.8.5 Fuel and chemical storage

Diesel fuel for the Atacama Project fleet will be stored onsite (within the Project Area) in a 100 kL self-bunded tank located within the contractor's area (see Figure 4-1 for location). Fuel will be delivered to site in bulk as required. Storage design requirements for fuel and hydrocarbons will be finalised during detailed design in accordance with Australian Standards. Storage areas will be bunded win accordance with EPA bunding guidelines and/ or relevant Australian standards.

Workshop quantities of oils, greases and other lubricants, degreasers and similar chemicals will be stored within the workshops which will be located at both the contractor's area and the Iluka compound (Figure 4-1). The chemicals will be stored in accordance with EPA guidelines and/ or relevant Australian Standards.

4.8.6 Site security

The Atacama Project Area is remote with formal access only possible through the existing J-A ML 6315. As such, no fixed security infrastructure (e.g., boom gates, fencing, security stations) will be installed.

4.8.7 Erosion, sediment and silt control

Surface water runoff from the disturbed areas, such as MUP/ ROM pads, Iluka compound, contractors compound including operation and maintenance areas, will be directed away from installed infrastructure towards sumps and roadside catchment drains as shown in Figure 4-1. Diversion channels will redirect natural catchments and culverts will be used under roads to direct water towards the roadside catchment drains. The collected rainfall will be allowed to soak and/ or evaporate off and will not contribute to the process water balance for the Project. Sediment will be retained in the stormwater ponds and periodically cleaned out, with the silt included in existing appropriate stockpiles.

4.8.8 Rehabilitation strategies and timing

All infrastructure and associated erosion, sediment and silt control will be removed from the Project Area as part of the rehabilitation plan. Infrastructure will only remain at the landowner's request.

Roads, buildings, concrete foundations, telecommunications towers and will be removed off site for reuse, recycling, or disposal as appropriate. Infrastructure will be rehabilitated as part of the overall rehabilitation timing as outlined in Figure 4-4 and Figure 4-5. All works will be detailed in J-A-A Rehabilitation Management Plan.

4.8.9 Other supporting infrastructure Project aspects

Supporting infrastructure already existing on the J-A tenements will be utilised for the Project. For more information on these Project aspects please refer to the CiO document for changes occurring at J-A in Appendix D or the J-A PEPR.

4.9 Vegetation clearances

4.9.1 Description of vegetation clearance

Native vegetation clearance will be required as part of the construction and operation of the Project. This will be done to the minimum extent necessary and will be progressive over the LOM. Rehabilitation will be undertaken progressively (as outlined in Section 4.5.9) to the greatest extent possible to minimise the size of disturbance which is open at any one time during the operation.

Clearing will take place both within the Project Area and also within J-A tenements. Whilst the scope of this MLP is restricted to clearance within the Project Area, all clearance is presented within this section for context.

Table 4-14 outlines the VA's and total area (ha) of each vegetation association that will be subject to clearing for the Project (noting that the Conceptual Footprint in the Project Area used throughout this document includes a 50 m buffer). Preliminary clearances occurring on ML 6315 and MPL 111 have also been included for context.

Table 4-14 VAs and areas to be cleared for the Project

ID	VA description	Total area to be cleared for the Project (ha)	Total area to be cleared within the Project Area (ha)	Total area to be cleared within ML 6315 (ha)	Total to be cleared on MPL 111 (ha)
1	*Eucalyptus* spp. / *Hakea francisiana* (Bottlebrush Hakea) / *Grevillea stenobotrya* (Rattle-pod Grevillea) Tall Open Shrubland	159	159	0	0
2	*Acacia papyrocarpa* (Western Myall) Open Woodland +/- *Cratystylis conocephala* (Daisy Bluebush) and *Maireana sedifolia* (Bluebush)	685	610	76	0
3	*Eucalyptus oleosa* ssp. Mixed Mallee over *Triodia* spp.	223	223	0	0
04	*Eucalyptus yumbarrana* (Yumbarra Mallee) Mixed Mallee	797	797	0	0
5	*Alectryon oleifolius* (Bullock Bush) Shrubland	0	0	0	0
6	*Atriplex vesicaria* (Bladder Saltbush) Low Open Shrubland	2	1	0	2
7	*Casuarina pauper* (Black Oak) +/- *Acacia papyrocarpa* (Western Myall) Woodland	69	69	0	0
8	*Eucalyptus oleosa* ssp. (Red Mallee) / *Acacia papyrocarpa* (Western Myall) +/- *Myoporum platycarpum* (False Sandalwood) Open Woodland	243	191	52	0
9	*Senna* spp. Open Shrubland	7	7	0	0
	Total area	**2,187***	**2,057***	**128***	**2***

*This number is subject to rounding errors

A total area of 2,187 ha of native vegetation will need to be cleared for the Project. Of this, 2,057 ha occurs within the Atacama Project Area, and 130 ha within ML 6315 and MPL 111. Figure 4-13 details the layout of Conceptual Footprint within the Project Area. Figure 4-14 details areas of clearance required on already approved tenements. None of the VA's observed in the Project Area or on ML 6315 are listed as Threatened Ecological Communities (TECs) under the EPBC Act.

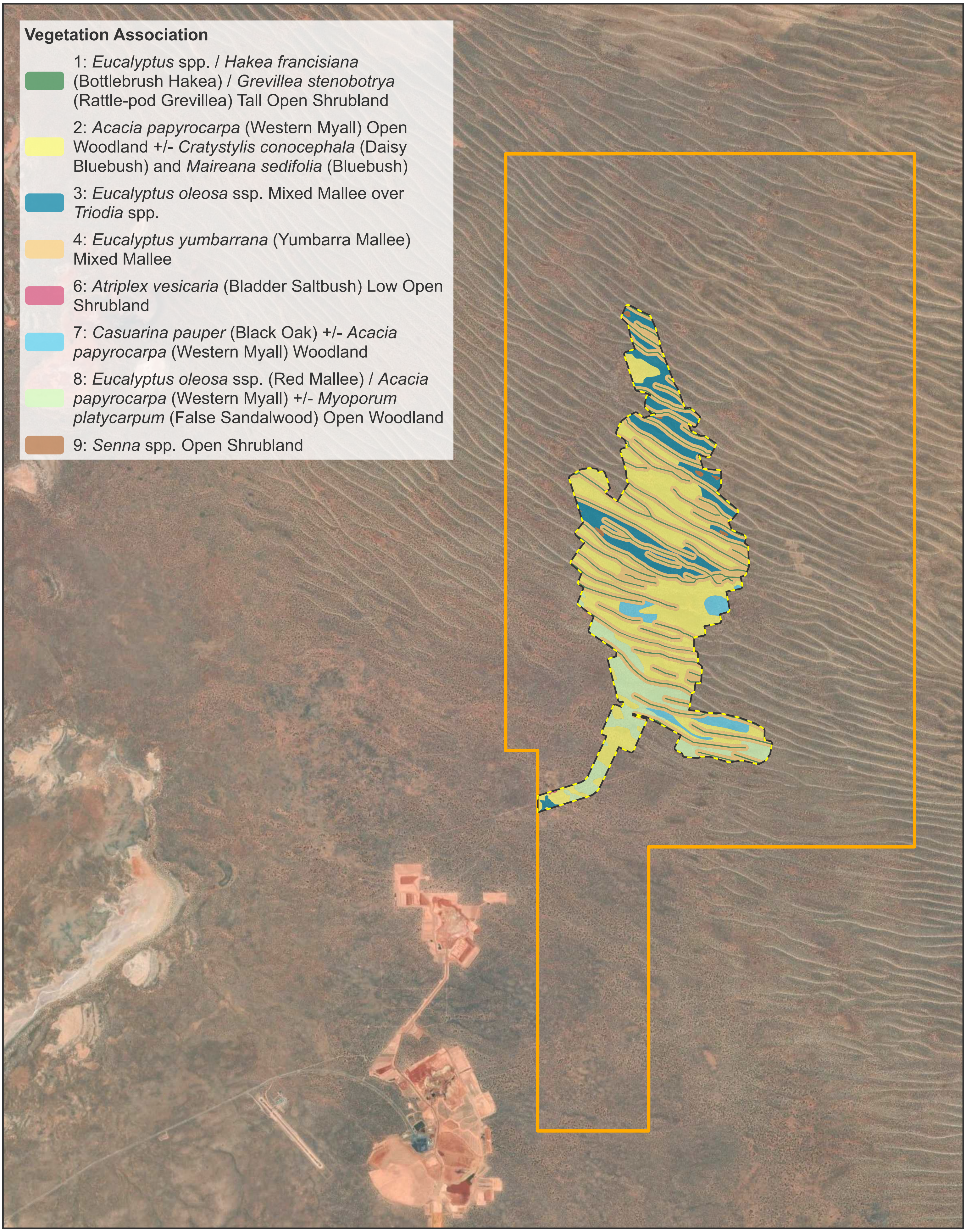

Figure 4-13 Proposed conceptual footprint

Project Area
Conceptual Footprint

N

0 2 4
Kilometres

Datum/Projection:
GDA 1994 MGA Zone 53

20409-OK/SH Date: 2/6/2023

eco logical AUSTRALIA
A TETRA TECH COMPANY

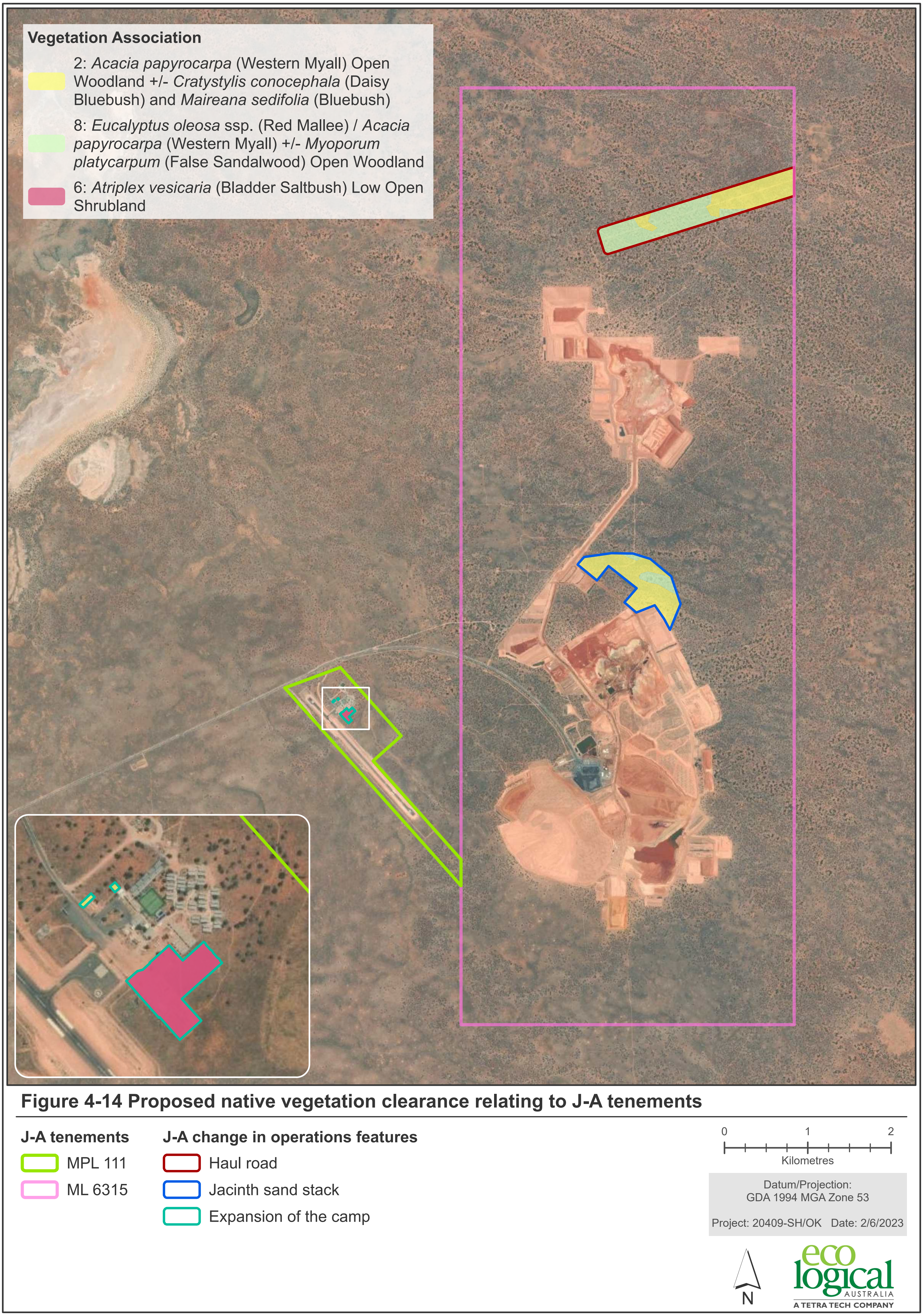

Figure 4-14 Proposed native vegetation clearance relating to J-A tenements

4.9.2 Significant environmental benefit

Any native vegetation clearance in South Australia requires an environmental offset that provides a significant environmental benefit (SEB) under the NV Act and *Native Vegetation Regulations 2017*.

The aim of the environmental offset is to compensate for the loss of native vegetation from an approved clearance activity, hence, a SEB must provide an environmental gain over and above the impacts of any approved clearance (DEWNR, 2017). To achieve a SEB the Native Vegetation Council (NVC) can approve the establishment and management of on land native vegetation; the protection and management of existing areas of on land native vegetation; the entry into a Heritage Agreement which provides for ongoing protection of established native vegetation on land (Must also be approved by the Minister); or monetary contribution/ payment into the Native Vegetation Fund.

An indicative estimate of the SEB requirement for the Project has been assessed by an Accredited Consultant (Eco Logical Australia) based on Rangeland Assessment Method (RAM) sampling undertaken in 2019 within the Project Area by EBS Ecology. The SEB estimate is an allowance for disturbance for the entire Project (i.e., it allows for native vegetation clearance occurring on ML 6315 and within the Project Area) and has been assessed based on the assumption that direct impacts to native vegetation will occur to 100% of land within the Conceptual Footprint. The likelihood is that not all of the Conceptual Footprint will be subject to vegetation clearing and hence the impacts are likely to be less than discussed here. The SEB estimate for both credits and on ground offset land size is presented in Table 4-15. These numbers will be refined during 2023 prior to the submission of the PEPR.

Table 4-15 Indicative SEB calculations

Area	ID number	VA description	Area (ha)	Landscape score	Vegetation score	Conservation score	Unit biodiversity score	Total biodiversity score	SEB points of loss	Offset area required (Ha)
ML6315	2	*Acacia papyrocarpa* (Western Myall) Open Woodland +/- *Cratystylis conocephala* (Daisy Bluebush) and *Maireana sedifolia* (Bluebush)	76	1.15	68.26	1.14	89.49	6801.43	14283.01	1785.38
	8	*Eucalyptus oleosa* ssp. (Red Mallee) / *Acacia papyrocarpa* (Western Myall) +/- *Myoporum platycarpum* (False Sandalwood) Open Woodland	52	1.15	67.72	1.16	90.34	4697.57	9864.90	1233.11
Subtotal ML 6315			**128**					**11499.01**	**24147.91**	**3018.49**
MLP 111 (Expansion of camp	6	*Atriplex vesicaria* (Bladder Saltbush) Low Open Shrubland	2	1.15	68.10	1.16	90.85	181.69	381.55	47.69
Subtotal MLP 111			**2**					**181.69**	**381.55**	**47.69**
Atacama (Project Area)	1	*Eucalyptus* spp. / *Hakea francisiana* (Bottlebrush Hakea) / *Grevillea stenobotrya* (Rattle-pod Grevillea) Tall Open Shrubland	159	1.15	59.76	1.14	78.34	12456.22	26158.07	3269.76
	2	*Acacia papyrocarpa* (Western Myall) Open Woodland +/- *Cratystylis conocephala* (Daisy Bluebush) and *Maireana sedifolia* (Bluebush)	610	1.15	68.26	1.14	89.49	54590.46	114639.97	14330.00
	3	*Eucalyptus oleosa* ssp. Mixed Mallee over *Triodia* spp.	223	1.15	60.78	1.18	82.48	18392.83	38624.93	4828.12
	4	*Eucalyptus yumbarrana* (Yumbarra Mallee) Mixed Mallee	797	1.15	61.71	1.18	83.74	66743.38	140161.09	17520.14
	6	*Atriplex vesicaria* (Bladder Saltbush) Low Open Shrubland	1	1.15	68.10	1.16	90.85	90.85	190.78	23.85
	7	*Casuarina pauper* (Black Oak) +/- *Acacia papyrocarpa* (Western Myall) Woodland	69	1.15	67.62	1.14	88.64	6116.28	12844.18	1605.52
	8	*Eucalyptus oleosa* ssp. (Red Mallee) / *Acacia papyrocarpa* (Western Myall) +/- *Myoporum platycarpum* (False Sandalwood) Open Woodland	191	1.15	67.72	1.16	90.34	17254.54	36234.54	4529.32
	9	*Senna* spp. Open Shrubland	7	1.15	66.91	1.18	90.79	635.51	1334.57	166.83
Subtotal Atacama (Project Area)			**2057**					**176280.06**	**370188.13**	**46273.52**
Total			**2187**					**187960.76**	**394717.59**	**49339.70**

*This number is subject to rounding errors

Iluka has formed a working group with the Far West Coast Aboriginal Corporation (FWCAC) which has been investigating how a partnership between both groups would work to achieve an SEB for the Project. This would occur through the establishment of an on-ground offset via the purchase or leasing of land within the FWCAC's Native Title Area. To achieve the SEB, Iluka would engage the FWCAC's services to deliver on-ground management of the land for the required 10-year management period.

At this stage the concept to achieve the SEB would include:

- The establishment of a Management or Heritage Agreement to secure the land acquired by Iluka for ongoing conservation which would be approved by the South Australian Minister for Environment and Water.
- The development of a 10-year SEB Management Plan by Iluka which would be endorsed by the South Australian Minister for the Environment and Water.
- A contract between Iluka and the FWCAC for the delivery of the outcomes detailed within the SEB Management Plan.

A forward work plan has been developed between Iluka and the FWCAC which outlines the steps which will be implemented in 2023 to develop the concept. The steps are outlined in chronological order, noting that many of the steps will occur concurrently.

- **Planning, Land Identification:** Iluka will identify what is required to achieve SEB, identify suitable land in the FWCAC's Native Title Determination Area (including working with the FWCAC to prioritise land of high cultural value) to meet that requirement, and negotiate sale or long-term lease of land with the current landowner. The NVC will be engaged by Iluka throughout the land identification process to ensure the identified land will meet the SEB requirements.
- **Planning, Land Management:** Iluka will work with the FWCAC and land management experts in the region to identify the specific land management activities required to achieve and SEB on the land. Together the parties will identify who will own the land or hold the lease for the land, following the required 10-year SEB Management Plan period.
- **Planning, Resourcing:** Iluka and the FWCAC will work together to identify the resourcing required to achieve an SEB including the materials required for the land management activities, vehicles and/ or infrastructure assets, and employee positions required within the FWCAC. Consideration will be given to cultural protocols and investment in coordination, financial management, monitoring, reporting and other administrative activities to meet regulatory requirements.
- **Planning, Collaborations:** Iluka and the FWCAC will work together to identify if there is a need to work with additional parties to achieve an SEB. This will include detailing the role both parties will have in implementation, and the FWCAC identifying capacity and/ or skills they would like to develop. If additional parties are required, Iluka and the FWCAC will identify parties who have the required skills and expertise, engage with those potential parties to understand any conditions of their involvement, and agree on preferred businesses / organisations that both parties would want to work with.

- **Consolidation of Planning:** Iluka will lead bringing all of the information agreed through the planning process into a consolidated project plan document. Iluka and FWCAC will refine and agree to the project plan and undertake a costing exercise for oversight of the cost to achieve an SEB.
- **Development of the SEB Management Plan:** Iluka will lead development of the SEB Management Plan based on the agreed project plan. The draft Management Plan will be shared with the FWCAC, NVC and any identified contributing parties to incorporate feedback prior to finalisation.
- **Memorandum of Understanding/Collaboration Agreement:** Iluka and the FWCAC will work together to draft a Memorandum of Understanding (MOU), Collaboration Agreement or similar document that details the agreed arrangement including roles and responsibilities, management of additional contributing parties, funding, payment schedule, variation scope, ownership of the land beyond 10 years, and what happens if the arrangement is not working for one or both of the parties. The agreement will be approved by the Iluka executive and endorsed by the FWCAC Board prior to signature and execution.
- **Government Approval:** Iluka will submit the SEB Management Plan together with the relevant agreement between FWCAC and Iluka for the NVC's assessment through the PEPR process.

The forward plan process is outlined in Figure 4-15**. Note that** whilst the intent is to deliver SEB through the concept outlined it is not guaranteed at this time, and is subject to agreement from all parties.

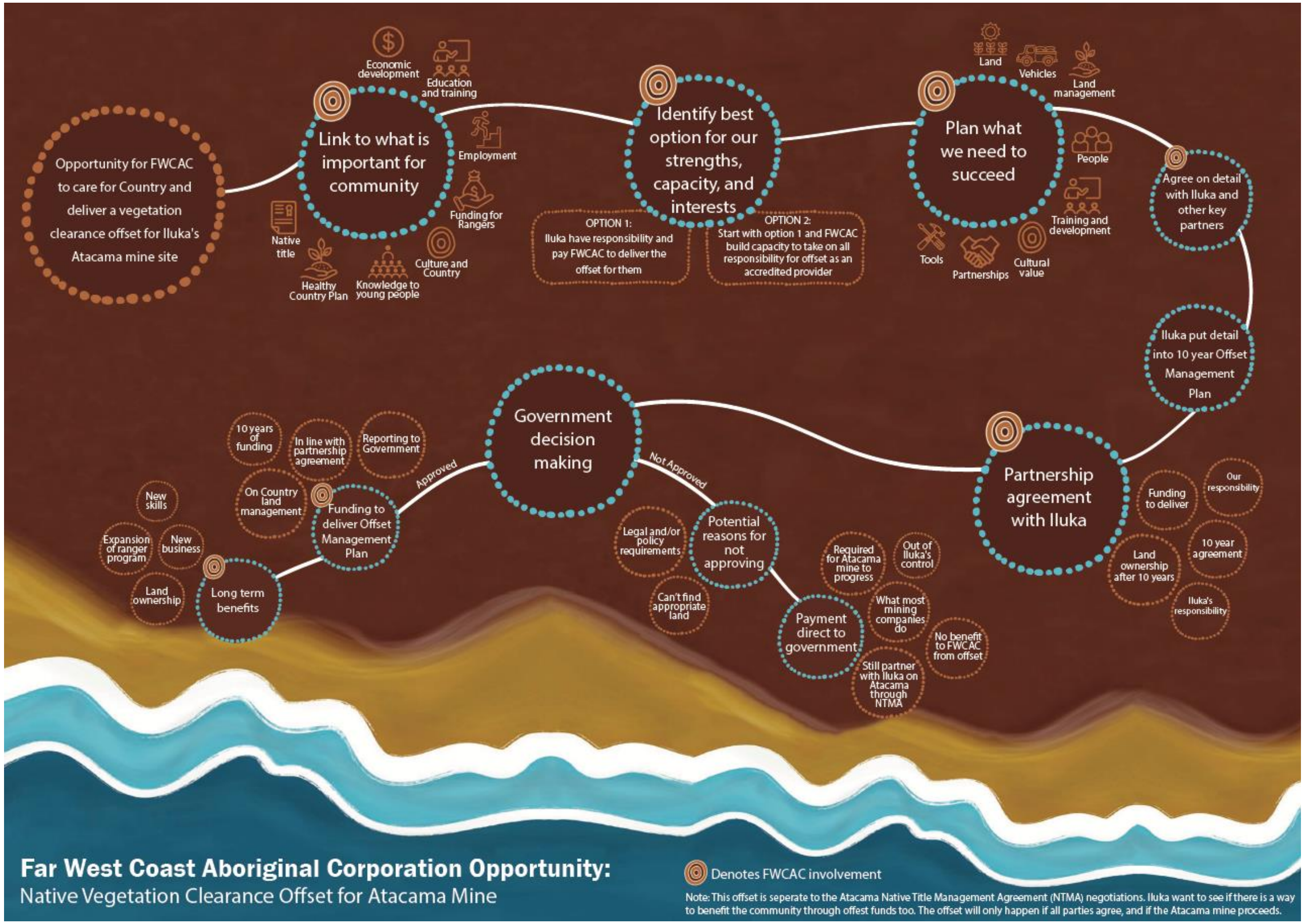

Figure 4-15 SEB offset forward plan

4.10 Description of mine site at completion

Following rehabilitation of the disturbance footprint, the final landform at Atacama will look much like the pre-mining landscape, except for areas in which the four pits and the adjacent roads cut into and removed dune crests. These dune crests will not be returned during rehabilitation. Instead, these areas will:

- have the depressions within the disturbed areas reinstated back to swale level, though in instances where additional overburden is available a 'saddle' will be made between the dunes
- comprise a 1:6 gradient at the head of the created dune slope, grading down to a less steep slope from mid-slope to the toe (1:10)
- reinstate approximately 30 cm of dune topsoil on battered dunes
- use woody debris to assist in the stabilisation of the slopes
- reinstate the swale type vegetation.

Please refer to Figure 4-16 which is an interactive PDF and presents the conceptual drawings detailing how the dunal landform system which change over time. Precise timing on when the slopes will be battered is still to be determined, conceptually this is presented as occurring during operations.

As described in previous sections all roads and infrastructure will be removed prior to closure, unless agreed with the Landholder. The land will revert back to a Regional Reserve.

The proposed rehabilitation strategies and timing (outlined in Sections 4.5.9, 4.5.10, 4.6.8, 4.7.4 and 4.8.8) will be subject to further investigation and refinement during preparation of the PEPR and operations.

Proposed contours for the final landform post-closure are shown in Figure 4-17.

A detailed Mine Closure Plan currently exists for J-A (Appendix F), this will be updated to incorporate the Atacama Project and provided as part of the PEPR in 2023.

Original land surface (dunes vertically exaggerated, soil profile not to scale)

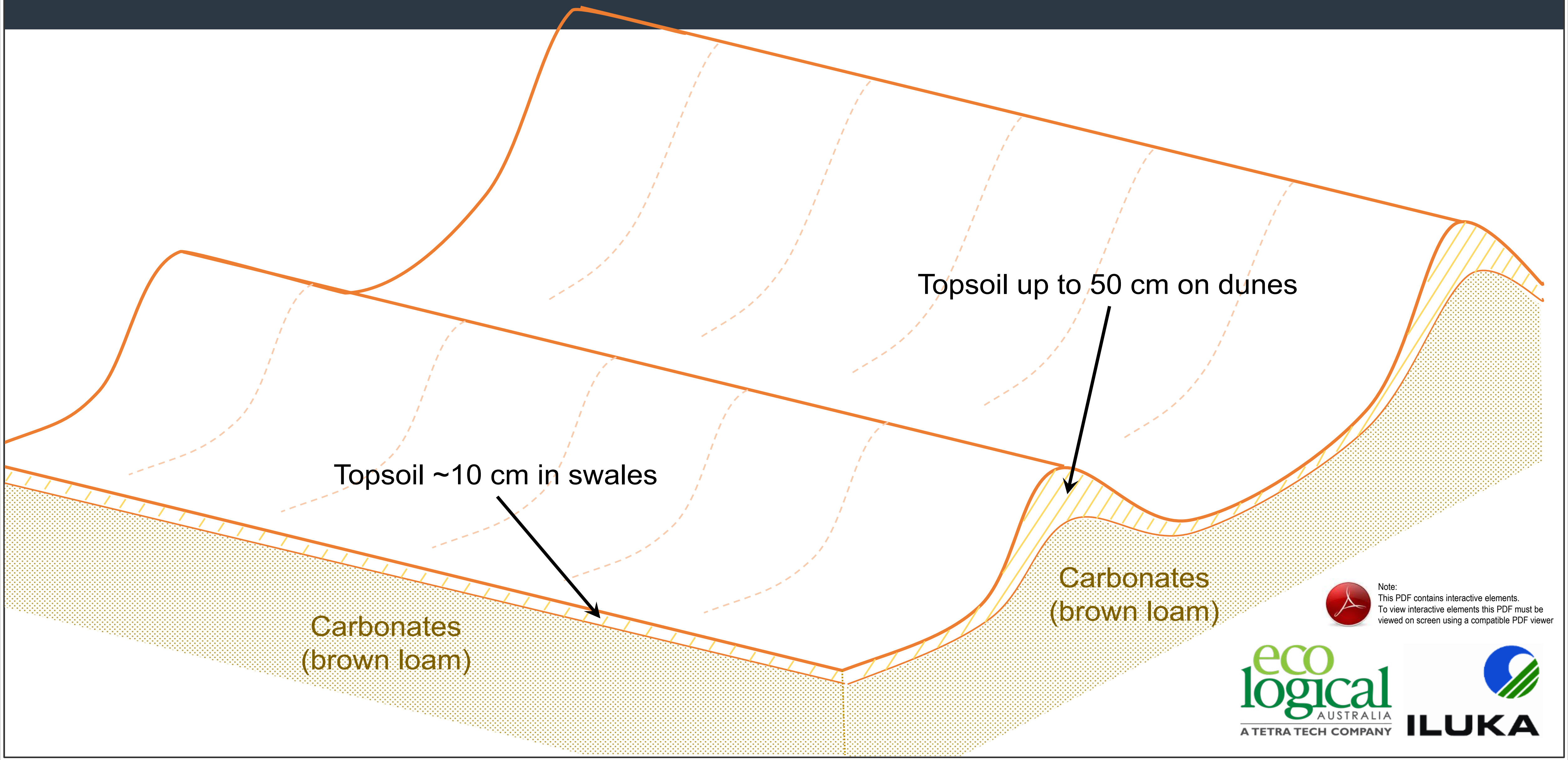

Figure 4-16 Atacama conceptual final landform surface

1 2 3 4 5 6 *Select profile number*

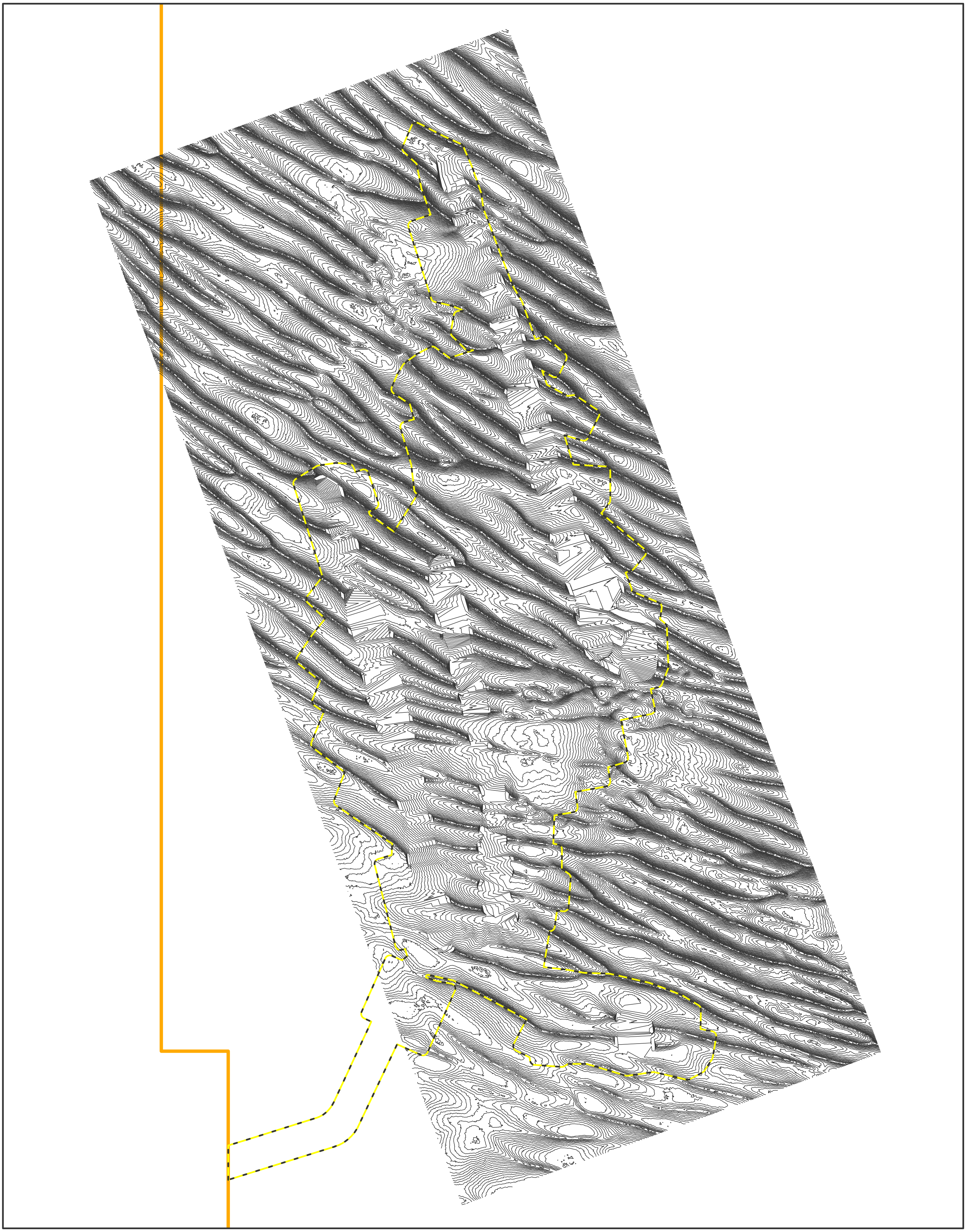

Figure 4-17 Atacama concept landform at completion (contours)

Project Area

Conceptual Footprint

Contours

N

0 1 2

Kilometres

Datum/Projection:
GDA 1994 MGA Zone 53

Project: 20409-OK Date: 2/6/2023

eco logical AUSTRALIA
A TETRA TECH COMPANY

4.11 Resource inputs

4.11.1 Workforce and local procurement

The Project will be run as an extension to the existing J-A operations. J-A will house core supporting services for the Atacama mine including the processing plant, HMC storage and major offices. Supporting ancillary infrastructure will be located at the Atacama site.

The J-A Operations Manager will be responsible for the development of the Atacama Project with existing but augmented functions, as required, across mine planning, rehabilitation, health, safety, environment and community (HSEC), maintenance etc.

The earthmoving fleet and primary contractor will be based at Atacama. The existing accommodation camp and airstrip at J-A will be augmented as required and utilised for the development of the Atacama Project.

A breakdown of the workforce across J-A and Atacama is presented in Table 4-16 below. A total of up to 350 fulltime equivalent (FTE) extra positions will be required across both projects during operations, and a further 50-90 contractors during the 12 months of construction.

Table 4-16 Additional workforce breakdown

Aspect	Construction	Operations
Contractors – Atacama	50-90	210
Contractors – J-A	0	120
Iluka staff	0	20[11]
Total	**50-90**	**350**

When filling these roles, a preference will be given to local employment providing required competencies can be met. All required positions will be for skilled and highly skilled labour. Aboriginal employment targets and programs are components of the existing Production Agreement and will continue to be part of the amended Production Agreement with the FWCAC (currently under negotiation at the time of writing). Training is provided through Iluka's Learning & Development team to ensure all workers meet minimum competency standards. Percentage complete against requisite training targets is a performance metric for all employees.

These positions will be created during Project execute phase following the Iluka Board's final investment decision (FID) on the Project. This is estimated to occur in early 2024.

[11] Iluka staff may require up to 4 further roles for rehabilitation, this will be refined for the PEPR.

A procurement plan will be developed during the Detailed Feasibility Study (DFS) (approximately Q2 2023 to Q2 2024) that will target local business participation, and procurement of local goods and services as far as practicable.

4.11.2 Energy sources

Total energy use for the Project has not considered the personnel transport to site and ore transport to point of sale (as required in TOR 006). Personnel transport and ore transport is not expected to significantly increase from the existing energy use for the J-A mine site.

The estimated electrical demand for the Project will peak during operations, with 24hrs a day, 7 days a week operation. Power loads are expected to be approximately 4.5 MW throughout the life of the Project. Table 4-17 summarises the indicative power load at Atacama during operation.

No power supply will be installed at the Project Area, with the exception of generators during construction and lighting towers during operations.

Table 4-17 Preliminary System Load for Atacama Project

Node / substation	Installed load kW
MUP	1,000
ROM booster pumping, including infrastructure	2,000
WHIMS plant[12]	1,000
RO plant[13]	500
Maximum demands	4,500

The total GHG emissions over the life of mine, including rehabilitation, are projected as 636,479 tCO_2-e, with annual emissions peaking at 66,601 t CO_2-e in 2029 (Greenbase 2022). Temporary diesel generators located at J-A will be utilised to provide power to the Project during construction and are expected to produce 155,294 tCO_2-e per annum. No carbon offsets are proposed at this time.

The solar capacity at J-A will also be upgraded to provide a portion of renewable energy to the Project. The existing solar farm located in the J-A ML will be upgraded, with an additional 1 MW generator bringing the total potential capacity of the system to 13 MW. The exiting 11 kV overhead line will be upgraded to a 33 kV overhead power line from the power station to the Ambrosia operation and extended 12 km to Atacama, adjacent to the access road to MUP 1 and MUP 2 (Figure 4-1). For more information on the power upgrades and solar farm please refer to the CiO in Appendix D.

4.11.3 Water sources

Expected annual water usage is outlined in Table 4-18 and an indicative water balance for the Atacama Project is outlined in Figure 4-9.

All water will be sourced from the existing palaeochannel aquifer borefield located on MPL 110, approximately 32 km west from the J-A mine site. The borefield has an installed capacity of

[12] Included for information though noted that the WHIMs plant is located on the J-A ML.

[13] Included for information though noted that the RO plant is located on the J-A ML.

31.1 ML/day. The combined J-A and Atacama Project will require approximately 13.2 ML/day of bore water on average, although Iluka will make use of available supply capacity, if required, albeit with management controls so as to reduce pumping and water transfer costs, and environmental impacts. There is sufficient installed capacity in the existing borefield system to provide the additional process water demand for Atacama without any major upgrades to the borefield. For more information, please refer to the CiO in Appendix D.

The arid climate means rainfall is limited and rare in the Project Area, and as such cannot be relied upon as a water source for use for the Project. Due to the limited volumes expected to occur the rain fall (when it occurs) will be channelled from the hardstand MUP pad into the stormwater runoff retention basins and allowed to evaporate (Figure 4-1). Mine dewatering is not considered as a water source for the Project as all mining operations will occur above the water table.

During the construction and closure phases of the Project, the process water consumption is expected to be 2 ML per day as outlined in Table 4-18.

As the Project will use water infrastructure which is part of J-A, a combined J-A and Atacama water balance is provided in Figure 4-9. This water balance indicates that the overall water in the system is expected to be 153.1 ML/day from the process water pond, with tailings deposition water and WCP water being returned back into the process water pond (located at J-A). Given the outflow as listed in Table 4-18 are 14.7ML/day, 91% of the water on site will be recycled.

Table 4-18 Indicative water requirements (pre-stripping vs campaign mining)

Supply / demand (ML/d)	Pre-stripping	Campaign
Inflows		
Atacama moisture in ore	-	0.6
Ambrosia moisture in ore	-	0.9
Borefield	2	13.2
Total	**2**	**14.7**
Outflows		
Ore slurry (mags and non-mags HMC)	0	0.4
Deposited tails	0	11.8
Dust suppression (evaporation)	2	1.5
RO water usage (excluding dust suppression)	Minimal	1.0
Total	**2**	**14.7**

Water outflows from the Project are estimated in Table 4-6. Process water will make up the majority of the outflows with 13.7 ML/day being used in various locations. Process water composition will be a mixture of brine from the RO plant, recovered water from tailings deposition, water recovered from the WCP and borefield water, all of which are located on the J-A ML or MPLs. The process water is considered hypersaline and will be supplied to the Atacama Project from an existing process water pond located within the J-A ML. A supply line will be constructed to connect to the existing line at Ambrosia to the Project and will be located within the haul road corridor as shown Figure 4-10. Water supply is required for the operation of the MUP and for dust suppression in the Project Area. There will be a 2.5 ML raw water pond located to the north of the MUP #1 and shown in Figure 4-1.

Deposited and evaporated process water will have an indicative salinity is in the range of 40,000 to 60,000 mg/L TDS. The composition of the groundwater used to supplement the process water is provided in Table 4-7. Brine from the RO plant is also used to supplement the process water, as such TDS concentrations within the process water circuit are likely to increase by up to 7%. Flocculants will be present in the water recovered from the tailings at concentrations of approximately 134 mg/L. An estimated 1.0 ML/day of RO water outflow will provide water supply to the Project amenities, workshop and be used for dust suppression. The RO water will be stored in a 2.5 ML storage pond located to the north of the MUP #1 and shown in Figure 4-1. The expected composition of the RO water, based on the existing RO plant at J-A, provided in Table 4-8.

There will be no water intentionally discharged to the environment.

5 CONSULTATION

This chapter provides an overview of the consultation process undertaken by Iluka with their key stakeholders as part of the development of this MLP.

5.1 Key stakeholders

Iluka already has an active presence with their stakeholders due to the development and operation of the J-A mine. Iluka aim to engage (or continue to engage with) a diverse range of stakeholders in an open, inclusive and meaningful manner. The key objectives of consultation to date for the Project were to:

- Understand the interests and potential concerns that individuals or groups had towards the Project and discuss environmental and social outcomes expected to occur in relation to the Project.
- Collect qualitative data, evidence and insights for assessing the potential impacts and benefits to match the diversity and representation of the stakeholder's viewpoint, as well as consider alternative Project design options/ alternatives.
- Create collaboration between all engagement activities to minimise potential consultation fatigue amongst key stakeholders and groups.

The following key stakeholders have been identified for the Project:

Stakeholder group	Details
State government agencies	DEM
	Department for Environment and Water (DEW)
	Alinytjara Wilurara Landscape Board (previously referred to as the Alinytjara Wilurara Natural Resources Management Board)
	Eyre Peninsula Landscape Board
	Environment Protection Authority (EPA)
	Native Vegetation Branch (NVB)
	Landscape South Australia
	Outback Communities Authority
	Drug and Alcohol Services South Australia
	Yumbarra Conservation Park Co-Management Board
Federal government agencies	DCCEEW

Stakeholder group	Details
Aboriginal groups	Far West Coast Aboriginal Corporation (FWCAC)
	Far West Coast Liaison Committee
	Ceduna Aboriginal Corporation (CAC)
	Aboriginal Lands Trust
	Yalata Anangu Aboriginal Corporation (YAAC)
Local and regional communities, groups and businesses	Ceduna Aboriginal Homelands, Yalata, Oak valley, Koonibba, Scotdesco
	Local Communities: Thevenard, Ceduna, Penong, Nundroo
	Thevenard Ratepayer's Association
	Ceduna Business and Tourism Association
	Penong Progress Association
	Thevenard and Ceduna (Businesses/ Suppliers/ Accommodation providers)
	Penong Progress Association (PBTA)
	District Council of Ceduna
	Rural Development Australia Eyre Peninsular (RDAEP)
	Ceduna Business Tourism Association (CBTA)
	Ceduna Visitor Information Centre
	Ceduna Area School/ Crossways Lutheran School
	Penong and Coorabie District School
	Yalata Anangu School
	TAFE SA
	Ceduna Youth Hub
	Flinders Port
	Viterra
	Eyre Plus

Stakeholder group	Details
	Emergency services (SA Ambulance, Country Fire Service and volunteers)
	Ceduna District Health Services
	Ceduna District Regional Hospital
	Ceduna Koonibba Aboriginal Health Services
	Yalata Maralinga Health
	Service/ Tullawon Health Services
	Oak Valley Maralinga Health Services
	Ceduna Childcare
	Mental Health Organisations
	Port Thevenard Residents Association
Media	West Coast Sentinel
Internal	Piacentini
	Iluka employees
	Kalari
Other	CASA
	Cater Care Services
	Gypsum Resources Australia (GRA)
	Eyre Futures
	Eyre Peninsular Advocate
	Royal Flying Doctor Services
	McEvoy Transport
	West Coast Welding
	Centa Care

5.1.1 Stakeholder engagement plan

Iluka have developed an Atacama Stakeholder Engagement Plan which outlines how Iluka will approach engagement for the Project. The Stakeholder Engagement Plan aims to support the management of social and technical risks to the Project by enabling external parties to influence the project development in a socially acceptable manner.

Iluka has followed their corporate framework in developing the Stakeholder Engagement Management Plan which aligns with *AS ISO 31000 Risk Management*, including the following standards and procedures as outlined in Table 5-1.

Table 5-1 Iluka standards and procedures

Document Number	Document Title
0016-185956964-1392	Integrated Project Delivery Manual
ILUKA-SUS-Standard-0109	HSEC Group Standard 02 – Social Performance
ILUKA-SUS-Procedure-0145	HSEC Group Procedure – Grievance Management
ILUKA-SUS-Procedure-0146	HSEC Group Procedure – Social Performance

5.1.2 Risk and objectives

As part of the development of the Atacama Stakeholder Engagement Plan the following factors were identified as potentially impacting the Project's social acceptability and therefore a social risk:

- Iluka's allocation and consumption of fresh water from a shared resource in competition with other users (e.g., agriculture) resulting in reduced ability to access the saline water supply
- stream flow impacts of excess water discharge
- water source impacts of sulphide in wastewater
- amenity, infrastructure and third-party safety impacts of increased truck traffic
- biophysical impacts to, or near, the edge of the Yellabinna Regional Reserve
- clearance of remnant native vegetation
- cultural heritage impact management
- sense of fairness towards Iluka's approach to engaging Traditional Owners
- unknown sentiment, issues, and expectations among Traditional Owners due to no existing relationship between them and Iluka
- limited understanding of the project, its potential impacts, benefits and management measures by local residents
- increased expectations of employment, procurement and sponsorship programs.

The following objectives were then set in relation to the above social risk:

- Assess baseline social risk early in the Project, including contextual influence of the J-A Project, to inform overall risk management approach.
- Establish respectful and constructive relationships with Traditional Owners early in the Project to enable issues identification and management.

- Meet or manage societal expectations in relation to identified social risks to establish and maintain a climate of consent towards the Project.
- Ensure stakeholders understand Project uncertainty driven by commercial and market factors, so that their expectations about risks and opportunities are realistic.

5.1.3 Timing and methods

For all identified stakeholders a priority ranking was assigned which assisted in determining the level of engagement/ method of engagement for each stakeholder. This ranking is a starting point and level of engagement and method can change over time depending on feedback from stakeholders. The indicative engagement timing and ranking for non-government stakeholders throughout the MLP process is detailed in Table 5-2.

Table 5-2 Stakeholder engagement methods and timing (non-government)

Priority	Stakeholder	Minimum engagement activities	Timing
High	District Council of Ceduna	Formal presentations Media releases and newsletter Site visits if requested	Quarterly as required
	FWCAC	Formal presentations Media releases and newsletter Site visits if requested Establishment of a deducted Working group to advance Offset project collaboration	Quarterly as required
Medium-High	Viterra	Meeting	As required
	GRA	Meeting	Quarterly contract review meetings, quarterly dust management group
	Port Thevenard Residents Association	Formal presentations Media releases and Newsletter	As required
	RDAEP Eyre Peninsula Landscape Board Alinytjara Wilurara Natural Resources Management Aboriginal Lands Trust		
	Employees Iluka Exploration	Formal presentations	Ongoing

Priority	Stakeholder	Minimum engagement activities	Timing
	Piacentini	Internal Communications - email, intranet update, operational meetings	
	Flinders Port Kalari Cater Care	Media releases and Newsletter Phone updates	Weekly with Kalari and Cater Care and quarterly with Thevenard users.
	West Coast Sentinel	Media releases and newsletter	As required for media releases and biannually for newsletters
	Far West Coast Liaison Committee	Report on compliance with NTMA	Quarterly
	Eyre Peninsular Advocate	Media releases and provision of advertorial copy	As required
	Thevenard Ratepayer's Association Ceduna Business and Tourism Association Thevenard Residents Association and Thevenard Ratepayer's Association Penong Progress Association	Phone updates Media releases and Newsletter Drop-in session	Biannual
	Ceduna Aboriginal Corporation (CAC) Eyre Plus		
	Local Communities: Thevenard, Ceduna, Penong, Nundroo		

Priority	Stakeholder	Minimum engagement activities	Timing
	Aboriginal Communities: Ceduna Aboriginal Homelands, Yalata, Maralinga (Oak Valley), Koonibba, Scotdesco	Newsletter (via FWCAC and/ or CAC)	Biannual
Low	CASA Kalari CBTA Local Communities: Thevenard, Ceduna, Penong, Nundro. Thevenard and Ceduna (Businesses/Suppliers/ Accommodation providers) Aboriginal Lands Trust Ceduna Area School Crossways Lutheran School TAFE Ceduna Youth Hub Ceduna Aboriginal Corporation Eyre Futures Centa Care Yalata Anangu Aboriginal Corporation (YAAC) Penong Progress Association (PBTA) McEvoy Transport West Coast Welding Buzzy enterprises Penong and Coorabie Districts School Yalata Anangu School	Media Releases and Biannual Newsletter - Provide local community on site activities, community investment and rehabilitation updates	Biannual

Priority	Stakeholder	Minimum engagement activities	Timing
	Ceduna Business and Tourism Association Ceduna visitor Information Center Emergency services (SA Ambulance, Country Fire Services and volunteers) Ceduna District Health Services Ceduna Regional Hospital Ceduna Koonibba Aboriginal Health Services Yalata Maralinga Health Services/ Tullawon Health Services Oak Valley Maralinga Health Services Royal Flying Doctor Services Mental Health Organisations Ceduna Childcare Drug and Alcohol Services South Australia		

The indicative timing and method of engagement for all government stakeholders through the MLP process is outlined in Table 5-3.

Table 5-3 Stakeholder engagement and timing (government)

Priority	Stakeholder	Minimum engagement activities	Timing
High	DEM	Project update meetings (face to face or via MS Teams) Pre-MLP submission engagement	Monthly
	DEW	Project update meetings (face to face or via MS Teams) Pre-MLP submission engagement	Monthly Attendance at technical meetings as required.
	NVB	As required at Project update meetings (face to face or via MS Teams)) As required for ongoing discussion on State based offsetting requirements.	As required
	DCCEEW	Pre-referral meeting(s) Engagement during referral decision Pre-MLP submission engagement	As required Attendance at monthly DEM/ DEW meetings from January 2023
Medium	EPA	As required at Project update meetings (face to face or via MS Teams)	As required
	Yumbarra Conservation Park Co-Management Board	Project briefing meetings Formal presentations Media releases and Newsletter	Annually
	Eyre Peninsula Landscape Board	Formal presentations Media releases and Newsletter	Annually

Priority	Stakeholder	Minimum engagement activities	Timing
	Landscape SA	Project briefing meetings	Annually Attendance at technical meetings as required
	Alinytjara Wilurara Landscape Board	Presentation update on operations	Annually
Low	Outback Communities Authority	Media releases and Newsletter	Biannual

5.2 Records

All records of stakeholder consultation are retained in a central database in accordance with Iluka's social performance standard.

5.3 Stakeholder grievance mechanism

Grievances raised by stakeholders are managed and recorded in accordance with Figure 5-1. Since 2009, the J-A Project has recorded seven public complaints, all of which have been addressed by Iluka and closed (WSP, 2023), the last of which was in 2021.

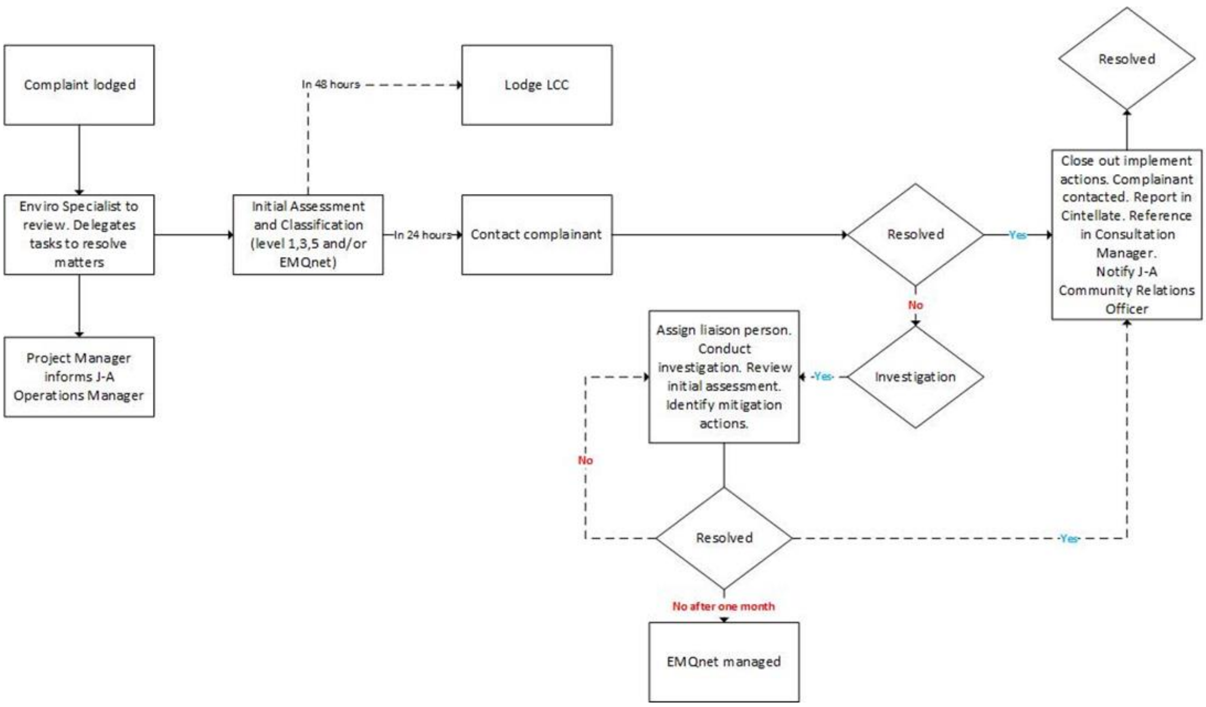

Figure 5-1 Iluka's grievance mechanism

5.4 Summary of consultation

Table 5-4 presents a summary of stakeholder consultation during the development of the MLP, the outcomes of those discussions and how those issues were resolved.

Specific consultation with stakeholders has also occurred as part of the social impact assessment which has not been included within this chapter. For more information, please refer to Appendix C2 or Appendix E.

Table 5-4 Consultation summary

Stakeholder	Date	Discussion/ issues	Outcome of discussion/ how it was resolved	How has the issue been addressed in the MLP (references)
DEM, DEW, NVB, EPA	26/10/2021	First meeting of 2021 to discuss the new Project scope and any updates since the Project was put on hold in 2020. New Project includes the mining of both zircon and ilmenite reserves. Submission of the MLP will be approximately Q3 2022, with construction to begin Q4 2023 and first production early 2025.	Agreed to set up regular monthly meetings for the Project. To arrange a further meeting with DEM to discuss the approvals schedule and obtain feedback on timing. Agreed that Iluka will provide more information on key questions raised regarding rehabilitation, soils and tailings.	NA
Yumbarra Co-Management Board	02/11/2021	Update on proposed Project including altered landform at Atacama and tailing at J-A. Iluka outlined their intent to investigate an SEB Offset Project with FWCAC. Ecological survey data will be forthcoming in a report to the Board as per the scientific permit conditions by the end of the calendar year. Confirmed sighting of Malleefowl but like all listed species was found off path. No Sandhill Dunnart captures but other native marsupials plus skinks and geckos.	Another update will occur in Q2-3 2022 as part of the MLP engagement process. Board queried fate of Tripitaka and nearby rock hole. Iluka responded that the feasibility of Tripitaka would be included in the Atacama PFS. Iluka confirmed subsequently with Exploration that Uria Rockhole is not within the Tripitaka RL.	NA
DEM, DEW, NVB	19/11/2021	This meeting was arranged to provide more information on key questions raised on the 26 October 2021, regarding rehabilitation, soils and tailings. Each topic was presented on by an Iluka specialist. Key questions raised related to whether or not erosion and wind modelling can be undertaken for the sand stack, to have consideration of what species can be returned to the landscape as part of project rehabilitation/ the fire resilience of those species, undertaking a failure modes assessment of the sand stack, can there be progressive rehabilitation of the sand stack and if a trail for dune rehabilitation is feasible.	Agreed to have a project meeting in December 2021 before the Christmas shutdown period.	Section 3 and 4
FWCAC	25/11/2021	Project briefing with final landform, cultural heritage, economic development and employment being key issues	Report back on landform design and study status. Economic and employment to be dealt largely through NTMA negotiations Q1-Q3 2022.	Section 3, 4, 7.13 and 9.1
LandscapeSA	03/12/2021	Project briefing meeting. Questions were asked about any strategies to relocate any threatened species? At present size of Project is likely to be similar to J-A total – around 1200 Ha. Strategies yet to be developed. Likely not to involve relocation. Interest in management of heritage finds percentage of profit to be returned back to the community/ community benefits and employment. Iluka responded that community benefits are important, and detail will be developed during the PFS/ DFS process	N/A	Section 3 and 8
DEM	16/12/2021	This meeting was arranged to provide more information on key questions raised on the 26 October 2021 regarding the approvals schedule. The schedule was reviewed, and feedback provided. Overall, it was agreed the approvals pathway schedule was realistic, but some edits would be made.	Agreed that DEM will provide Iluka feedback on the breakdown of tasks during government assessment to update the schedule accordingly.	Entire document

Stakeholder	Date	Discussion/ issues	Outcome of discussion/ how it was resolved	How has the issue been addressed in the MLP (references)
FWCAC	16/12/2021	Invitation to be involved in a collaborative offset project to meet Iluka Offset requirements under the SA NV Act and FWCAC Caring for Country Objectives	Establishment of a dedicated Working Group to progress collaboration. Preferred involvement to manage and own land.	Section 4.9
DAWE (now DCCEEW)	17/12/2021	Project update was provided to DAWE on new Project scope and any updates since the Project was put on hold in 2020, after a EPBC Act referral decision. The two options for the Project to progress, given the changes to project size, were discussed - that being a variation or a re-referral.	Pathway still to be determined, but likely that Iluka will submit a request for a variation under Section 156B of the Act.	Section 2.2
DEM	21/12/2021	Monthly project update Meeting for December. An update on the PFS was provided. Key areas of discussion included EPBC update, approval schedule, stakeholder engagement, the upcoming field programs, the SEB project and the potential for a EPEPR relating to a test pit.	Confirmed interest for DEM to be part of meetings with DAWE in early 2022.	Entire document
NVB	13/01/2022	Discuss progress of the Offset project and estimation of land management costs to support Iluka's current investigation of viability	NA	Section 4.9
DAWE (now DCCEEW)	19/01/2022	Discussed the potential of submitting a variation and potential implications of this approach.	Feedback was provided by DAWE. Agreed Iluka to discuss feedback internally and inform DAWE of the confirmed approach.	NA
LandscapeSA	21/01/2022	Discuss progress of the Offset project and estimation of land management costs to support Iluka's current investigation of viability	NA	Section 4.9
DEM	28/01/2022	Review of the Project schedule provided by Iluka and commentary provided by DEM.	Updated schedule to be reviewed and finalised.	NA
DEM, DEW	03/02/2022	Monthly Project Update Meeting for January. An update on the PFS was provided. Key areas of discussion included EPBC update, approval schedule, stakeholder engagement, the upcoming field programs, the SEB project and the potential for a EPEPR relating to a test pit.	Next meeting to be held in late February which will include a presentation on the recent threatened species survey results	Entire document
DEM, DAWE (now DCCEEW)	04/02/2022	Follow up from Iluka to DAWE after January meeting to confirm that the approach Iluka will take for the Project change is to re-refer it. Key points were to get confirmation on how to officially withdraw the previous referral and confirming if DAWE would want a pre-lodgement meeting to discuss content.	Email (same day) confirmed that a letter from the Signatory of the referral is required and confirmation of acceptance of a pre-lodgement meeting	NA
FWCAC	08/03/2022	First Working Group meeting to advance Offset Project collaboration. Investigation of support or capacity building needed and interest in working independently or partnering with others. Development of a one-page visual communication tool	Follow up discussion with FWCAC and NVB required. Following this FWCAC to endorse a short-listed approach. Draft one page diagram to be produced.	Section 4.9

Stakeholder	Date	Discussion/ issues	Outcome of discussion/ how it was resolved	How has the issue been addressed in the MLP (references)
DEM, DEW	11/03/2022	Monthly Project Update Meeting for February. An update on the PFS was provided. Key areas of discussion included EPBC update, approval schedule, stakeholder engagement, the upcoming field programs, the SEB project and the potential for a EPEPR relating to a test pit. A presentation was also provided on the threatened species survey work undertaken in October 2021.	Next meeting to be held in late March (2 weeks) and will discuss the test pit. Schedule to be provided on timing for key engagement with the regulators for the Project.	Entire document
DEM, DEW	25/03/2022	Monthly Project Update Meeting for March. Discussion focused on the potential need for a test pit on the EL for the Atacama Project.	They need for a test pit is unlikely to be determined until at least mid-year, however it was agreed to progress work on the test pit to aid the approvals process including (providing draft EPEPR material, developing a schedule for approval and engaging with Safework SA and the EPA). Next monthly meeting will be held in April.	Entire document
DEM, DEW	29/04/2022	Monthly Project Update Meeting for April. An update was provided on the test pit, PFS, field program for Tripitaka, approvals schedule, stakeholder engagement, the Atacama field program and SEB project. A draft EPBC referral has been written and is undergoing review. Project footprint has increased, and referral submission is planned for the following week.	Agreed for a EPBC update to be presented to DEM and DAWE pre-referral. Next monthly meeting will be held in May.	Entire document
DEM, DEW	27/05/2022	Monthly Project Update Meeting for May. An update was provided on the test pit, PFS, field program for Tripitaka, approvals schedule, stakeholder engagement, the Atacama field program and SEB project. The delay to the EPBC referral was also discussed to accommodate an increase to the project footprint. Delay in EPBC referral outlined.	A new joint meeting with DEM and DAWE will occur in the next few weeks for the updated referral. Next monthly meeting will be held in June.	Entire document
DC Ceduna	16/08/2022	Questions about FWCAC representation at working group meetings. Working group updated on the upcoming business and economic development work proposed between Iluka and FWCAC (SEB).	Amendment to the TOR to add the FWCAC Chairperson as a member. Key representatives to meet a fortnight before the scheduled monthly working group meetings for half an hour to determine whether the meeting should go ahead. The business and economic development work will explore other opportunities that FWCAC have an interest in which will be identified in a workshop in Adelaide in November.	Section 4.9
DCCEEW	17/06/2022	EPBC referral submitted via the online portal.	NA	Section 2.2
DCCEW	13/07/2022	Iluka received a response from DCCEEW that further information was required to be considered a valid referral under the EPBC Act.	This information was provided by the 26 July 2022.	Section 2.2

Stakeholder	Date	Discussion/ issues	Outcome of discussion/ how it was resolved	How has the issue been addressed in the MLP (references)
DEM, DEW	22/07/2022	Monthly Project Update Meeting for July. Update provided on design work for PFS, test pit contingency, Tripitaka, EPBC resubmission, EPEPR, SEB project status.	Next monthly meeting will be held in August.	Entire document
Local Businesses	17/08/2022-12/09/2022	Discussions on rehabilitation, Social Impact Assessment processes and objectives. Identification of impacts related to employment, community investment, programs and initiatives, public safety, communications and engagement, housing, environmental conservation, closure.	The social impacts identified will be taken into consideration during the project construction, operation and closure to increase the positive impacts on the local community.	Section 7.13
Local community organisations	17/08/2022-12/09/2022	Discussions on rehabilitation, Social Impact Assessment processes and objectives. Identification of impacts related to employment, community investment, programs and initiatives, public safety, communications and engagement, housing, environmental conservation, closure.	The social impacts identified will be taken into consideration during the project construction, operation and closure to increase the positive impacts on the local community.	Section 7.13
Local social services	17/08/2022-12/09/2022	Identification of impacts related to employment, community investment, public safety, communications and engagement, housing, environmental conservation, closure.	The social impacts identified will be taken into consideration during the project construction, operation and closure to increase the positive impacts on the local community.	Section 7.13
Aboriginal organisations	17/08/2022-12/09/2022	Native Title Agreement taken into consideration. Identification of Aboriginal employment targets, community investment, public safety, communications and engagement housing, environmental conservation, closure.	The social impacts identified will be taken into consideration during the project construction, operation and closure to increase the positive impacts on the Aboriginal community.	Section 1.7 and 7.13
DEM	26/08/2022	Monthly Project Update Meeting for August. Update provided on design work for PFS, test pit contingency, Tripitaka, EPBC resubmission, EPEPR, SEB project status.	Radiation baseline and impact assessment will be presented early September 2022. Dates to be locked in for further baseline and impact assessment presentations. Agreed to set up a sub-meeting to discuss requirements of a change in operations document for the J-A tenement to be submitted with the MLP. Next monthly meeting will be held in early October.	Entire document
FWCAC	29/08/2022	SEB Working Group meeting - status on workplan noting that land purchase will take longer than scheduled. Iluka edits to proposal tabled. Draft TOR for working group discussed.	Updated workplan proposal. Draft TOR to be produced for ratification at the next meeting.	Section 4.9
DCCEEW	30/08/2022	Iluka received a request from DCCEEW to suspend the referral decision timeframe for 20 business days.	Iluka accepted this in writing the following day.	Section 2.2
DEM, EPA, DEW	01/09/2022	Radiation Consulting Australian presented the results of the ERICA and RESRAD assessments for the Project.	General acceptance of the methods used and presented.	NA
DCCEW	01/09/2022	Iluka received a letter from DCCEEW confirming all parties had agreed to a 'Suspension of Referral Decision Timeframe"	NA	Section 2.2

Stakeholder	Date	Discussion/ issues	Outcome of discussion/ how it was resolved	How has the issue been addressed in the MLP (references)
DEM, DEW	07/09/2022	Meeting for J-A and Atacama to discuss the requirement for a change in operations and the content of that document.	It was agreed that a change in operations should be submitted as an appendix to the MLP. A screening assessment is required to be undertaken to confirm the scope of the change in operations	Appendix D
DCCEEW	27/09/2022	DCCEEW requested further information from Iluka regarding the location of the HMC stockpile, whether the stockpile will be on J-A or Atacama and the level of disturbance required for the stockpile. DCCEEW also advised Iluka that due to an extended wait time for internal advice the Department will not be able to meet the 20 day extension due date.	Iluka responded on the 10 October 2022.	Section 2.2
DEM, DEW	04/10/2022	Monthly Project Update Meeting for September. Update provided on design work for PFS, test pit contingency, Tripitaka, EPBC resubmission, EPEPR, SEB project status. No decision has been made on the EPBC decision from DCCEEW.	Agreed to submit the screening assessment for change in operations scope to DEM for comment and the draft impact assessment framework for the Project incorporating significance (if required for EPBC). Agreed that all parties will touch base in a week regarding the lack of a decision from DCCEEW (so far) on the EPBC referral. Next monthly meeting will be held in late October	Entire document
DCCEEW	17/10/2022	Iluka emailed DCCEEW to get a status update on the referral assessment	DCCEEW responded same day that the team was working as quickly as possible to reach a decision.	Section 2.2
DCCEEW	21/10/2022	DCCEEW emailed Iluka requesting further information regarding groundwater levels at J-A, further information on HMC stockpile management and the solubility of the HMC.	Iluka responded to DCCEEW's request for further information regarding the referral on the 28/10/2022.	Section 2.2
FWCAC, DEW	02/11/2022	Discussion around what is possible for the land beyond the 10-year SEB management period.	Details provided on what DEW considered when reviewing applications.	Section 4.9
DEM, DEW, EPA, DCCEEW	03/11/2022	CDM Smith presented a summary of their findings for the J-A groundwater drilling program, the two model assessments, geochemical assessment, groundwater impact assessment and how these findings relate to Atacama.	General acceptance from attendees on presentation methodology and findings. Draft report provided to regulators and comments are welcome to incorporate into the Change in Operation Application documentation. CDM Smith incorporated feedback from regulators into their final version of their reports.	Section 7 and Appendix D
DCCEEW	04/11/2022	Iluka requested advice on the status of the referral assessment	DCCEEW confirmed on the 7 November 2022 that the information had been received and that their assessment was occurring as quickly as possible.	NA
DEM, EPA	10/11/2022	Jacobs presented a summary of their findings for the Atacama air quality impact modelling and how it relates to J-A.	General acceptance from attendees on presentation methodology and findings. Comment provided from EPA to ensure new NEPM standards have been adopted. Jacobs incorporated feedback from the regulators into their final version of the report.	Section 7

Stakeholder	Date	Discussion/ issues	Outcome of discussion/ how it was resolved	How has the issue been addressed in the MLP (references)
DCCEEW	10/11/2022	Letter received from DCCEEW confirming that the Project will be a Controlled Action.	NA	Section 2.2 and 8
DEM, DEW	11/11/2022	Monthly Project Update Meeting for October. Update provided on design work for PFS, test pit contingency, Tripitaka, EPBC resubmission and EPEPR. DCCEEW have determined the Project to be a Controlled Action. There will be an increase in the camp size at J-A.	Test pit layout to be confirmed and DEM to resolve TOR requirements due to Controlled Action	Entire document
DEM, DEW	25/11/2022	Monthly Project Update Meeting for November Update provided on design work for PFS, test pit contingency, Tripitaka, EPBC, approvals schedule, change in operations, stakeholder engagement, field programs, SEB project and EPEPR.	Agreed to set up a meeting with tenements to start the administrative process. Set up placeholder for ecology presentation and meeting with DCCEEW. December meeting will be cancelled due to close timing to the holiday period.	Entire document
FWCAC	30/11/2022	Out of session catch-up to determine need for December SEB working group meeting.	No December working group meeting. Out of session catch up, January to confirm formal working group meeting on February 8, 2023.	Section 4.9
FWCAC	01/12/2022	SEB update - Board informed of the working group progress and its workplan.	NA	Section 4.9
DEM, DEW, Landscape SA	08/12/2022	ELA presented a summary of their findings for the Atacama ecology impact assessment with particular reference to State and Federally listed species.	General acceptance from attendees on presentation methodology and findings. Questions asked by LandscapeSA as to whether or not data from all surveys is now in BDBSA. ELA confirmed after the meeting that it was via email. LandscapeSA confirmed findings are aligned with their own survey results in the broader Yellabinna region. ELA incorporated feedback from the regulators into their final version of the report.	Section 7 and 8
DEM, DEW, DCCEEW	14/12/2022	Meeting set up to confirm project specific TOR details, in particular with specific information required for MNES under the Accredited Assessment. Discussion was also had regarding addressing significance and residual impacts for MNES within the MLP.	TOR was provided to Iluka, with Iluka to provide any critical feedback on new additions to DEM and DCCCEEW. Intent will be to publish this document online in January 2023. DCCEEW confirmed acceptance of the use of the Significance Impact Guidelines 1.1 for assessing impacts to MNES in the MLP. Agree to move the December monthly meeting to mid-January 2023 due to the Holiday Period and for Iluka to arrange a meeting with DCCEEW mid-January to present the findings of the ecology studies and assessments prior to the MLP submission.	Section 8 and 13
ALT	19/12/2022	Introduction to the Project and offer of face-to-face briefing	NA	NA
Anangu Yalata Aboriginal Corporation	19/12/2022	Introduction to the Project and offer of face-to-face briefing	NA	NA

Stakeholder	Date	Discussion/ issues	Outcome of discussion/ how it was resolved	How has the issue been addressed in the MLP (references)
DCCEEW	22/12/2022	Points of clarification on draft TOR s.11-14 and discussion on how to incorporate required information into the MLP.	NA	Section 13
DEM, DEW, DCCEEW	13/01/2023	Monthly Project Update Meeting for January. Update provided on design work for PFS, test pit contingency, Tripitaka, EPBC, approvals schedule, change in operations, stakeholder engagement, field programs, SEB project and EPEPR. First monthly meeting attended by DCCEEW.	Project specific TOR to be finalised and gazetted. Confirmed MLP submitted will occur in February 2023, DEM and DCCEEW to finalise administrative requirements for the accredited processes.	Section 13
DCCEEW, DEM, Landscape SA and DEW	16/01/2023	ELA presented an overview of the technical study's undertaken to date for ecology an in particular MNES and a high-level summary of the Section 8 assessment and findings of no residual significant impact to MNES.	Positive feedback was received on the methodology and survey work undertaken to date for MNES. There was general agreement on the conclusions though noted that DCCEEW would read provided memo information and confirm if they had any clarifying questions.	Section 8
DEM	01/02/2023	Discussion with DEM team on the process for tenement application.	Further information provided to Iluka on the tenement application process. DEM to confirm when the Project specific TOR will be gazette.	NA

6 IMPACT ASSESSMENT FRAMEWORK

TOR Atacama and MG2a requires a mining proponent to assess the impacts (environmental) of a proposal and subsequently develop outcomes, outcome measurement criteria and leading indicators to manage potential impacts. This chapter describes the impact assessment framework which has been utilised throughout the assessment of the Atacama Project.

Please note that TOR Atacama and MG2a do not explicitly require the social impacts to be addressed, social impacts have been included within their own section (Section 7.13), separate to the State's assessment framework.

All ecology is considered within the State's assessment framework, however as the Federal government requires more detail to be provided on MNES (in particular an assessment of the residual significant impact to these species) a different assessment methodology has been applied for MNES and this can be found in Section 8.

6.1 Determining project elements

Proponents are required to describe the specific elements of the environment that may reasonably be expected to be impacted by the proposed operation during the whole life cycle of the Project (i.e., construction, operation and closure).

The elements which have been identified for the Project include:

- heritage (Aboriginal, European and geological)
- flora, fauna and native vegetation
- soil and land quality
- public health and safety
- waste
- groundwater, including quality and quantity
- surface water, including quality and quantity
- noise and vibration
- air quality
- visual amenity
- traffic
- social
- radiation.

6.2 Potential impact events

Potential impact events are then considered for each of the identified elements. Potential impact events are the elements of the environment that may be impacted directly or indirectly by the proposed operation. **Direct impacts** are caused directly by the proposed operations (e.g., clearing of vegetation). **Indirect impacts** are secondary events that occur and are substantially caused by the operations and have an impact on the environment (e.g., dust generation might impact the flora and fauna).

Where stakeholder consultation identified perceived potential impacts, these impacts were also assessed.

6.3 Sources, pathways and receptors

For every potential impact event the source-pathway-receptor of that event is then considered, defined as the following:

- **Source:** a project element that can affect and interact with the environment.
- **Pathway:** a medium by which the effect reaches a receptor from a project source for example air or water.
- **Receptor:** a discrete, identifiable attribute or associated value that can be impacted by from a project source via a pathway.

Impact events for which there is a confirmed source-pathway-receptor (S-P-R) linkage are the only events considered as able to occur and therefore are subjected to further assessment (impact assessment). This decision is based on available scientific information and considering all phases of the Project.

Consideration is also given to potential impact events for which there is uncertainty in the data used to determine a S-P-R linkage and how sensitive that information is to change. Impact events were not considered further if they were found to have no S-P-R linkage and/ or a high degree of confidence in the data used in making that determination (i.e., low uncertainty and low sensitivity to change), however they were considered further in instances where the S-P-R linkage is uncertain or where there was no S-P-R linkage but the uncertainty in the data was high.

6.4 Impact assessment

An environmental impact is a change to an environmental, social or economic value which will occur as part of the construction, operation and closure of the Project.

An assessment of impact occurred for confirmed impact events (i.e., those with a confirmed S-P-R linkage, an uncertain linkage or those with no linkage but high uncertainty) taking into account control measures and management strategies, uncertainty and sensitivity. Each of these factors is described further within this chapter.

6.4.1 Control measures and management strategies

Adverse environmental impacts can be minimised or avoided using control and management strategies. These measures/ strategies should be proportionate to the consequence of the impact, comply with the other applicable statutory requirements, and be technically and economically achievable.

Control measures use the **'hierarchy of controls' approach** where they are applied in the following order:

- **Design –** elimination or prevention of impact through design and/or redesign. For example:
    - Remove the hazard (source).
    - Alternate processes that do not result in the impact.
    - Replace the material or process with a less hazardous one (substitution).
- **Control -** design/engineering; usually physical controls that can be incorporated into the mine and infrastructure. For example:
    - Location of plant and equipment.
    - Mining method.
    - Encapsulate or contain hazardous materials, pollutants and emissions.
    - Change height or location of major structures.
    - Install engineered barriers to control access by receptors.
    - Treat/ destroy the pollutant/emission.
    - Control release to a level the environment can absorb (e.g., dilute the pollutant/emission).
- **Management** – management system, identification of management approaches, procedures and plans to be implemented to manage the risk and the way the activity is conducted by personnel, for example:
    - Trigger and response plan for managing dust emissions.
    - Clearance permit system for ensuring native vegetation clearance is in accordance with approved clearance.
    - Induction and training of new employees to ensure awareness of Aboriginal heritage and to avoid unauthorised disturbance.

6.4.2 Uncertainty

The Mining Regulation 46 (7) (c) and (d) requires the proponent to identify any matter where there is a significant lack of information or degree of uncertainty. The uncertainties could derive from factors such as lack of information, limitations on modelling or quality of data. Any significant uncertainties and assumptions regarding the likely effectiveness of proposed control measures or management strategies in managing and mitigating impacts and achieving environmental outcomes for mine operations and post-mine completion must be described. Including any assumptions used in modelling helps assessing the effectiveness of the proposed control strategies.

6.4.3 Sensitivity

The Mining Regulation 46(7)(c) and (d) requires the applicant to provide an assessment of a change in any assumption related to any significant uncertainty concerning proposed control strategies and management measures. It is important to perform a sensitivity analysis to see if the sensitivity to change in an assumption relating to a significant uncertainty can result in significant changes to the predicted potential impact event.

The sensitivity analysis should be performed so far as is relevant, meaning when a change in an assumption relating to a significant uncertainty result in an outcome is not being achieved.

6.5 Proposed outcomes

Proposed (draft) outcomes are then developed for the Project based on the outcomes of the impact assessment. Outcomes are finalised as part of the submission of the PEPR.

The outcomes must be relevant to all stages of the operation (construction, operation and closure). An outcome is a statement which reflects the acceptable impact on the environment (and may be no impact) resulting from the proposed mining and processing activities.

6.6 Proposed leading indicator criteria

Draft leading indicator criteria were developed for all impact events that were significantly reliant on a management and/ or control strategies to reduce the potential impact on the environment. The intent of a leading indicator is to provide an early warning to the Proponent and to the Government that a control measure or management strategy may fail or is failing and therefore the environmental outcome is potentially at risk of not being achieved, giving time to respond appropriately. Leading indicator criteria will be finalised in the PEPR submission.

6.7 Proposed outcome measurement criteria

Draft outcome measurement criteria have been developed for all outcomes. The intent of the measurement criteria is to demonstrate the achievement of an outcome. Where possible, quantitative criteria have been developed. Following the approval of the PEPR (should the Project be granted a ML), criteria will be used as the key indicators of compliance with the Mining Act. These will be finalised in the PEPR submission.

7 ASSESSMENT OF ENVIRONMENTAL AND SOCIAL EFFECTS AND IMPACT

This chapter considers potential changes to the baseline environment due to the Project works. Pathways and linkages are determined for each potential source and assessed for significance and impacts on the identified receptors.

A consolidated impact assessment covering all of this Section (except for Section 7.13 – social assessment) can be found in Appendix C8 and a summary of all outcomes is presented in Table 7-32.

7.1 Views of affected parties

As outlined in Section 5 Iluka have been undertaking engagement with their stakeholders for over a year in regard to the Project. A summary of their views in relation to each environmental and social element is provided in Table 7-1.

Table 7-1 Context and views of affected parties

Environmental element	Views of affected parties	Applicable government standards and non-legislated standards	Environmental receptor
Heritage (Aboriginal, European and geological)	Concern regarding potential impacts to Country and associated cultural values due to Project construction and operations. Minimisation of footprint post closure is important. Recognition that Iluka have a good track record with rehabilitation and the environment.	• *Native Title Act 1993* (Cth) • *Aboriginal Heritage Act 1988* (SA) • *Native Title Act 1994* (SA) and *Native Title (South Australia) Regulations 2016* • *Environment Protection and Biodiversity Conservation Act 1999* (Cth) • *Heritage Places Act 1993* (SA).	Cultural heritage sites (Aboriginal, European or geological)
Flora, fauna and native vegetation.	Concern that Project will not be rehabilitated back to an acceptable state and to minimise cultural significance impacts. Concerns over potential impacts to State and Federally listed species through direct clearance and altered landform.	• *Environment Protection and Biodiversity Conservation Act 1999* (Cth) • *Native Vegetation Act 1991* and *Native Vegetation Regulations 2017* • *National Parks and Wildlife Act 1972* (SA) • *Public and Environmental Health Act 1987* (SA) • *Landscape South Australia Act 2019* (SA). • State and Commonwealth declared species lists.	Fauna and flora/ vegetation

Environmental element	Views of affected parties	Applicable government standards and non-legislated standards	Environmental receptor
Soil and land quality	Nil views.	• *Environment Protection Act 1993* (SA) • *Mining Act 1971* (SA) • *Landscape South Australia Act 2019* (SA). • Australian standards relating to storage of flammable and combustible liquids • EPA Bunding and spill management 2016.	Flora
Public health and safety	As per traffic.	• *Road Traffic Act 1961* (SA) • *Crown Land Management Act 2009* (SA) • *Work Health and Safety Act 2012* (SA). • Australian Standards for security fences and gates.	Local communities, members of the public and fauna
Waste	Nil views	• *Environment Protection Act 1993* (SA) • *Public Health Act 2011* (SA) • *Public and Environmental Health (Waste Control) Regulations 1995.* • *Environment Protection (Waste to Resources) Policy 2010.*	Local communities, soil, fauna and flora

Environmental element	Views of affected parties	Applicable government standards and non-legislated standards	Environmental receptor
Groundwater (including quality and quantity)	Intertest in off-Project Area seepage impacts from tailings - DEM & DEW Uncertainty from some community members regarding impact(s) of water supply on the Great Artesian Basin and cumulative impacts on water supply.	• *Landscape South Australia Act 2019* (SA) • *The Environment Protection Act 1993* (SA) • *Mining Act 1971* (SA). • *Environment Protection (Water Quality) Policy 2015* • EPA Bunding and spill management 2016 • Australian and New Zealand Guidelines for Fresh and Marine Water Quality ANZECC/ARMCANZ 2000 • Australian Standards Water Quality Sampling.	Third party users, GDE's, Lake Ifould
Surface water (including quality and quantity)	Routine inclusion of assessment of potential impact to Lake Ifould. Recognition of low risk for Atacama deposit.	• *Mining Act 1971* (SA) • *Environment Protection Act 1993* (SA) • *Aboriginal Heritage Act 1988* (SA). . • EPA Bunding and spill management 2016 • Australian and New Zealand Guidelines for Fresh and Marine Water Quality • *Environment Protection (Water Quality) Policy 2015* • Australian and New Zealand Guidelines for Fresh and Marine Water Quality.	Fauna, flora and Lake Ifould

Environmental element	Views of affected parties	Applicable government standards and non-legislated standards	Environmental receptor
Noise and vibration	Nil views	• Australian standards for acoustics, description and measurement of environmental noise • *Environment Protection (Noise) Policy 2007* (SA).	Fauna
Air quality	Possible indirect ecological impact requiring inclusion regulatory assessment process – DEW. Wind erosion impacts due to altered final landform – DEW. Nil non regulatory views.	• *Mining Act 1971* (SA) • *Native Vegetation Act 1991* and *Native Vegetation Regulations 2017* • *The Environment Protection Act 1993* (SA) (EP Act) • *Climate Change and Greenhouse Emissions Reduction Act 2007* (SA) • *Environment Protection (Air Quality) Policy 2016* • *Civil Aviation Act 1988* (Cth) • *National Greenhouse and Energy Reporting Act 2007* (Cth). • Australian Standards relating to air quality	Local communities, fauna and flora
Visual amenity	No concern regarding anthropocentric receptors. Concerns over how the successful the rehabilitation will be and how the landform will look over time.	• *Mining Act 1971* • *Environment Protection Act 1993* (SA). • Australian standards for the control of obtrusive effects of outdoor lighting.	Local communities

Environmental element	Views of affected parties	Applicable government standards and non-legislated standards	Environmental receptor
Traffic	Road traffic is accepted along the existing haulage route. Potential safety concerns associated with heavy vehicles and children crossing the road (particularly near the school) at Penong. Since the use of longer trucks there has been fewer trucks per day, reducing this safety concern.	• *Road Traffic Act 1961*.	Local communities and member of the public
Social	Potential inequity of sponsorship distribution for communities outside of Ceduna. Interest in maximising employment and business benefits to the local community, partially targeting Aboriginal and youth employment and training opportunities. Community benefits from existing J-A operation are recognized.	• *Mining Act 1971* (SA).	Local communities
Radiation	DCCEEW required assessments for Referral - deemed not a nuclear action. Not raised as an issue by any consulted parties.	• *Radiation Protection and Control Act 2021* and *Radiation Protection and Control Regulations 2022* • *Australian Radiation Protection and Nuclear Safety Act 1998* (Cth) • *Work Health and Safety Act 2012* (SA) •*Environment Protection and Biodiversity Conservation Act 1999* (Cth)	Local communities, fauna and flora

7.2 Heritage (Aboriginal, European and geological)

This section describes how the Project may impact on heritage items, including Aboriginal, European and geological heritage and sets out the measures that will be implemented to minimize those impacts.

Section 3.20 provides detail on the existing Aboriginal, European and geological heritage of the site and its surrounds. Section 4 provides details of the proposed mining activity.

7.2.1 Context

The Project is within the Yellabinna Regional Reserve, which is managed by the Yumbarra Co-management Board – a partnership between the FWCAC and DEW. The Atacama site is recognised as belonging to the Far West Coast Aboriginal Peoples in the Federal Court Determination for Native Title on the 5 December 2013. The FWCAC represents the Aboriginal peoples who are common law holders of Native Tiles (IHC, 2020).

A number of heritage surveys of the Atacama Project Area have been undertaken between 2004-2019. There are no Aboriginal or European heritage sites listed on any available registers within the Atacama Project Area. Large areas of the Atacama Project Area have been surveyed however these have been broad overview surveys with a small number of targeted inspections in areas of interest for exploration purposes. The south – western corner of the Atacama Project Area is located within 8 km of an area of high Aboriginal significance. An Aboriginal cultural heritage survey of the site is planned with the FWCAC for 2023 after the NTMA is signed between both parties.

Many known places relating to European heritage and settlement of the region are related to the early industries in the region including sealing, whaling and other maritime industries. The closest known European heritage sites to the Project are located in Ooldea and are associated with Daisy Bates' camp and an Aboriginal camp site. Due to the arid environment, European sites and items are often commonly found near Aboriginal sites. Any European heritage remaining in the region or Project Area is likely to be of significance, as defined by the *Heritage Places Act 1993* and tied to themes of exploration and early movement across Australia (G. Cincunegui, personal communication, 1 February 2023).

The nearest geological heritage area identified is located within Cook in the Nullarbor plain, approximately 190 km to the west of the Project. No survey efforts have been undertaken to survey geological heritage on site, this is deemed appropriate due to the separation distances between the nearest known geological heritage item and the Project.

7.2.2 Potential impact events

Potential impact events are detailed in Table 7-2.

7.2.3 Design, control and management strategies

Design, control and management strategies for the identified impact events are detailed in Table 7-3.

7.2.4 Impact assessment

The heritage impact assessment is presented in Table 7-2.

7.2.5 Draft outcomes, measurement criteria and leading indicators

The draft heritage control measures, outcomes and measurement criteria are presented in Table 7-3.

Table 7-2 Potential impact events: Heritage

Environmental element	Phase	Impact ID	Potential impact event	Source	Pathway	Receptor	Uncertainties and assumptions	Sensitivity to change (in assumptions)	S-P-R linkage? (Yes, No or Uncertain)	Justification for the confirmation/ non-confirmation of an S-P-R linkage?	Description of the likely impact event
Heritage	Construction Operation, Closure	H1	Unauthorised access to Aboriginal heritage sites, objects and/ or remains by mining personnel	Site personnel	Unauthorised access, damage	Aboriginal heritage Item(s)	Minimal site-specific data is available at the time of writing. High reliance on exploration and desktop studies, for this S-P-R, that may not accurately reflect site conditions. Low level of confidence in the impact assessment (due to use of desktop and exploration-based data) and high uncertainty around impacts to Aboriginal heritage items Aboriginal cultural heritage survey to be conducted with the FWCAC in early 2023. Unrecorded Aboriginal heritage items may be found during this survey.	High	Uncertain	S-P-R is not confirmed. No identified restricted areas have as yet been identified. Currently locations and potential impacts of Project related activities of Aboriginal Items within the Project Area are unknown. (IHC,2020)	Unauthorised access with potential for damage or inappropriate handling of by mining personnel to Aboriginal heritage sites, objects and/ or remains.
Heritage	Construction Operation, Closure	H2	Damage or disturbance to previously unrecorded Aboriginal heritage sites, object or remains	Site Personnel Machinery	Excavations and earthworks- manual and machinery for the following activities: • vegetation clearance • removal of overburden • drill and blast operations • establishment of site infrastructure – buildings • road constructions • deposition of stockpiles	Aboriginal heritage Item(s)	Minimal site-specific data is available at the time of writing. High reliance on exploration and desktop studies, for this S-P-R, that may not accurately reflect site conditions. Low level of confidence in the impact assessment (due to use of desktop and exploration-based data) and high uncertainty around impacts to Aboriginal Heritage Items Aboriginal Cultural Heritage survey to be conducted with the FWCAC in early 2023. Unrecorded Aboriginal heritage items may be found during this survey.	High.	Uncertain	S-P-R is not confirmed. Currently locations and potential impacts of activities associated with the Project on Aboriginal Items within the Project Area are unknown.	Damage through mechanical methods used in mining process with potential for damage or destruction to Aboriginal heritage sites, objects and/ or remains.

Environmental element	Phase	Impact ID	Potential impact event	Source	Pathway	Receptor	Uncertainties and assumptions	Sensitivity to change (in assumptions)	S-P-R linkage? (Yes, No or Uncertain)	Justification for the confirmation/ non-confirmation of an S-P-R linkage?	Description of the likely impact event
Heritage	Construction Operation, Closure	H3	Access by mining personnel to unknown European heritage places and objects	Site Personnel	Unauthorised access, damage	European heritage item(s)	No site-specific data available. Reliance on desktop studies and database searches. High uncertainty, with low confidence in impact uncertainty around impacts to European heritage Items. No known heritage items within the Project Area.	Medium	Uncertain	The closest known European Heritage site to the Project Area is located in Ooldea, approximately 28 km to the northwest of the Project. Historic heritage survey has not been undertaken and therefore there remains the possibility that European heritage may exist in the Project Area and unauthorised damage may occur. Any European heritage remaining in the region or Project Area is likely to be of significance, as defined by the *Heritage Places Act 1993* and tied to themes of exploration and early movement across Australia (G. Cincunegui, personal communication, 1 February 2023). S-P-R is not confirmed. Possible receptors not identified in the Project Area at this stage but remain possible. Impacts may range from minimal to major depending on access.	Unauthorised access with potential for damage or inappropriate handling of items by mining personnel to European heritage places and objects.
Heritage	Construction Operation, Closure	H4	Damage or disturbance to excavations to previously unrecorded European heritage places and objects	Site Personnel Machinery	Excavations and earthworks- manual and machinery for the following activities: • Vegetation clearance • Removal of overburden • Drill and blast operations • Establishment of site infrastructure – buildings • Road constructions • Deposition of stockpiles	European heritage Item(s)	No site-specific data available. Reliance on desktop studies and database searches. High uncertainty, with low confidence in impact uncertainty around impacts to European heritage items. No known heritage items within the Project Area.	Medium	Uncertain	As above for H3.	Damage through mechanical methods used in mining process with potential for damage or destruction to European heritage places and objects

Environmental element	Phase	Impact ID	Potential impact event	Source	Pathway	Receptor	Uncertainties and assumptions	Sensitivity to change (in assumptions)	S-P-R linkage? (Yes, No or Uncertain)	Justification for the confirmation/ non-confirmation of an S-P-R linkage?	Description of the likely impact event
Heritage	Construction Operation, Closure	H5	Heavy machinery use and blasting resulting in vibration impact to geological heritage.	Machinery and blasting	Vibrations	Geological heritage Item(s)	Assumes that vibrations will be minimal at the identified geological heritage Items, with the closest identified geological heritage Item approximately 190 km away. Blasting is not currently likely to occur within the scope of Project operations.	Low	No	The closest identified geological heritage item is approximately 190 km from the Project Area. Based on the nature of the operations blasting activities are not usually employed. In the event that blasting is required, it is likely to be occasional and with vibrations unlikely to reach the offsite heritage item. S-P-R not confirmed.	No predicted impact due to distances involved.

Table 7-3 Control measures and proposed outcomes: Heritage

Impact ID	Impact event	Control measures	Uncertainties and assumptions	Sensitivity to change in assumptions	Proposed outcome	Draft outcome measurement criteria	Draft leading indicator
H1	Unauthorised access with potential for damage or inappropriate handling of by mining personnel to Aboriginal heritage sites, objects and/ or remains.	**Control** No – go areas clearly marked in consultation with Traditional Owners. **Design** A clearance survey is to be undertaken across the proposed ML with the FWCAC and a heritage consultant for Aboriginal heritage. **Management** Induction to include the requirements of the *Aboriginal Heritage Act 1988* and the importance of maintaining no-go areas. Workforce cultural awareness training. A Cultural Heritage Management Plan will be developed and implemented and will include: • discovery protocol for potential heritage items • notification protocols • general information about the Aboriginal heritage exclusion areas (within confidentially requirements)	N/A	N/A	The tenement holder must during construction, operation and closure ensure there is no damage, disturbance, or interference to Aboriginal heritage items, objects and/or remains as a result of the Project activities, unless it is authorised under relevant legislation.	**Construction and operation** No unapproved disturbance to Aboriginal heritage sites, objects and/or remains. Mine records demonstrate that if an Aboriginal site, object or remain was discovered/ disturbed during operations, works ceased and the native title claimants and the Aboriginal Affairs and Reconciliation Division were notified. Works re-commenced only after notification and consultation over the appropriate actions. Compliance with agreed disturbance and heritage protection requirements, as defined in the *Aboriginal Heritage Act 1988*, and as agreed with the FWCAC. **Closure** All Aboriginal heritage sites are restored as agreed to with FWCAC.	None proposed
H2	Damage through mechanical methods used in mining process with potential for damage or destruction to Aboriginal heritage sites, objects and/ or remains.	As above for H1	As above for H1				

Impact ID	Impact event	Control measures	Uncertainties and assumptions	Sensitivity to change in assumptions	Proposed outcome	Draft outcome measurement criteria	Draft leading indicator
H3	Unauthorised access with potential for damage or inappropriate handling by mining personnel to European heritage objects and/or places.	**Control** No – go areas clearly marked. **Design** A clearance survey is to be undertaken across the proposed ML with a heritage consultant (for European heritage). Based on observations during the Aboriginal heritage survey the need for a targeted European survey can be assessed near key areas (such as water courses) by a Heritage Consultant. Any remaining areas not surveyed can be managed seeing a site discovery processes to be included within the Cultural Heritage Management Plan. **Management** Induction to include the requirements of the *Heritage Places Act 1993* and the importance of maintaining no-go areas. A Cultural Heritage Management Plan will be developed and implemented and will include: • Discovery protocol for potential heritage items • Notification protocols • General information about the European heritage exclusion zones (within confidentially requirements).	N/A	N/A	The tenement holder must during construction, operation and closure ensure there is no damage, disturbance, or interference to European heritage objects and/or places as a result of the Project activities, unless it is authorised under relevant legislation.	**Construction and operation** No unapproved disturbance to European objects and/or places. Mine records demonstrate that if a European object or places is discovered/ disturbed during operations, works ceased and a European Heritage Consultant was engaged to assess significance and advice of future actions and requirements to meet the *Heritage Places Act 1993*. Compliance with agreed disturbance and heritage protection requirements, as defined in the *Heritage Places Act 1993*. **Closure** If applicable all European heritage objects to be returned to their original position or relocated and managed in accordance with the relevant approval.	None proposed
H4	Damage through mechanical methods used in mining process with potential for damage or destruction to European heritage objects and /or places.	As above for H3	As above for H3				

7.3 Flora, fauna and native vegetation

This section describes how the Project may impact on flora, fauna and native vegetation values and sets out the measures that will be implemented to minimise those impacts.

Sections 3.9 to 3.10 provide details on the existing ecological environment and Section 4 provides details of the proposed mining activity. Section 4.9 describes the proposed vegetation clearance including detail on the estimated quantum of SEB required under South Australian legislation to offset the proposed clearance and how the SEB will be provided.

Eco Logical Australia completed an Ecological Impact Assessment for Atacama (ELA, 2022) and it is attached as Appendix C3. This assessment was used as the basis for the following impact assessment for flora, fauna and native vegetation.

7.3.1 Context

As discussed in Section 3.9 to 3.10 , there have been several targeted flora and fauna assessments in and around the Project Area, including:

- Targeted threatened species survey (ELA, 2022a)
- Baseline Environmental Investigations Atacama Project (EBS 2019a)
- Atacama Project EPBC assessment report (EBS 2019b)
- Targeted Malleefowl Survey – Atacama (EBS 2019c)
- Atacama Baseline Flora and Fauna Assessment – 2014 (EBS 2015a).

In addition, flora and surveys have been undertaken at the adjacent J-A mine since 2005. Monitoring at J-A was established by EBS in 2008 and ongoing monitoring has been undertaken in autumn and spring in 2009, and then annual spring surveys from 2010 to 2015, with surveys undertaken every two years from 2017 onwards. (EBS 2009a, 2009b, 2010, 2011, 2012, 2013, 2014, 2015, 2016, 2018; Jacobs 2021 and 2022).

The combined results of these surveys provide a wealth of site-specific data that covers over 17 years and includes data collected through a variety of weather conditions including drought years, across all seasons, and covers multiple generations for each species of concern.

In addition, monitoring during operation at the adjacent J-A mine provides information on the potential impacts on flora and fauna, the reaction of key species, and the potential for rehabilitation.

Hence there is a high degree of confidence in the information presented below, with a low level of uncertainty.

7.3.1.1 Threatened species (EPBC Act)

The Project was referred to DCCEEW under the EPBC Act and the Minister for the Environment and Water determined the Proposed Action to be a Controlled Action under Section 75 of the EPBC Act on 9 November 2022 [ref. EPBC 2022/09289]. DCCEEW's decision on referral determined that the

Proposed Action may have or is likely to result in a significant impact to two fauna species and one flora species.

- Malleefowl (Vulnerable EPBC Act and Vulnerable NPW Act)
- Sandhill Dunnart (Endangered EPBC Act and Vulnerable NPW Act)
- Ooldea Guinea-flower (Vulnerable EPBC Act and Vulnerable NPW Act).

A detailed assessment of potential impacts to these species under the EPBC Act is shown in Section 8. As such, these species will not be specifically assessed under the NPW Act within this Chapter, however they will be considered as part of the fauna and flora assemblages within the Project Area when assessing impacts to ecology.

7.3.1.2 Threatened Species (NPW Act)

As outlined in the baseline section, five NPW Act birds and two NPW Act flora have been observed to occur in the Project Area. A further seven NPW Act listed species are considered likely/ possible to occur through the available suitable habitat as shown in Table 7-4, and as such all 14 species have been considered within the impact assessment for State listed species.

Table 7-4 Likelihood assessment for NPW Act species

Name	Common name	NPW Act status	Likelihood of occurrence
Fauna			
Acanthiza iredalei ssp. *iredalei*	Slender-billed Thornbill (western)	Rare	Likely
Ardeotis australis	Australian Bustard	Vulnerable	Known
Cinclosoma castanotus	Chestnut Quail-thrush	Rare	Known
Falco peregrinus	Peregrine Falcon	Rare	Known
Hieraaetus morphnoides	Little Eagle	Vulnerable	Likely
Lophochroa leadbeateri	Major Mitchell's Cockatoo	Vulnerable	Likely
Myiagra inquieta	Restless Flycatcher	Rare	Known
Neophema splendida	Scarlet-chested parrot	Rare	Known
Pachycephala inornata	Gilbert's Whistler	Rare	Likely
Neelaps bimaculatus	Western Black-naped Snake	Rare	Possible
Flora			
Corynotheca licrota	Sand Lily	Rare	Possible
Gratwickia monochaeta	-	Rare	Known
Melaleuca leiocarpa	Pungent Honey-myrtle	Rare	Known
Santalum spicatum	Sandalwood	Vulnerable	Possible

7.3.1.3 Native vegetation

Ecological field surveys have mapped nine VA's present within the Project Area (Figure 3 31). Across all associations, vegetation was generally described as being diverse, intact native vegetation largely in pre-European condition, with little weed infestation (EBS 2019a). The Project Area covers an ecotone between two biological communities with the Yellabinna dunes with associated mallee woodland to the north-east and the Acacia shrublands of the Nullarbor subregion to the south-west.

None of the VAs observed are listed as TEC under the EPBC Act, or State threatened ecological communities under the Provisional list of threatened ecosystems of South Australia (EBS 2019a).

The bulk of vegetation clearing will be undertaken during the construction phase, the areas cleared will be utilised for mine infrastructure, transport routes and mining pits. Using the Precautionary Principle, the Conceptual Footprint consists of the maximum area that may be cleared including a 50 m buffer. Table 4-14 quantifies the area of each VA within the Conceptual Footprint (and hence the maximum area of each VA that may be cleared).

7.3.2 Potential impact events

Potential impact events are detailed in Table 7-5.

7.3.3 Design, control and management strategies

Design, control and management strategies for the identified impact events are detailed in Table 7-6.

7.3.4 Impact assessment

The ecology impact assessment is presented in Table 7-5.

A NPW Act species impact assessment was undertaken as part of Appendix C3. For more information on specific impact events which have the potential to impact upon those species refer to the Appendix.

7.3.5 Draft outcomes, measurement criteria and leading indicators

The ecological control measures, outcomes and measurement criteria are presented in Table 7-6.

Table 7-5 Potential impact events: Flora, fauna and native vegetation

Environmental element	Phase	Impact ID	Potential impact event	Source	Pathway	Receptor	Uncertainties and assumptions	Sensitivity to change (in assumptions)	S-P-R linkage? (Yes, No or Uncertain)	Justification for the confirmation/ non-confirmation of an S-P-R linkage?	Description of the likely impact event
Flora, fauna and native vegetation	Construction Operation Closure	FFNV1	**Habitat loss and direct loss of flora.** Land clearance for construction of project infrastructure and/or rehabilitation causes a reduction of abundance and diversity of native flora.	Vegetation clearance	Land - Mechanical and earthmoving equipment / loss of habitat	Native vegetation	Plant growth response to edge effects / reconstructed topsoil profiles Seed bank response to disturbance and stockpiling	Low	Yes	To enable the construction of the Project approximately 2,057 ha of native vegetation is proposed to be cleared within the Project Area. The clearing of vegetation will result in a reduction in the availability of suitable habitat for flora species which are known or likely to occur within the Project area. The habitat within the Conceptual Footprint is in good condition and is used by a variety of species as detailed in the baseline (Section 3). All vegetation types (and hence habitat types) within the Project Area are found in abundance within the surrounding area, either within the Yellabinna Regional Reserve, or the Nullarbor Regional Reserve. A side effect of habitat loss is habitat fragmentation. The proposed mining operations consist of open-cut pits (largest being approximately 5,800 m long, 470 m wide) within the linear dune system. This size is likely to cause a local scale barrier effect with associated fragmentation. Flora and some fauna species which are found within arid and semi-arid ecosystems have evolved to traverse or disperse over large distances, and fragmented distribution is common. The scale of habitat fragmentation associated with the proposed mining operations is unlikely to result in a local extinction or decrease in population size of species with large home ranges. Habitat fragmentation can also result in an increase of ratio of the 'edge' of a habitat. The 'edge effect' associated with vegetation clearing and site disturbance can lead to increased opportunities for weeds and pest species to invade a native vegetation community, as well as changes to habitat such as increased light and wind which may affect the native flora assemblages. This may result in a decrease of abundance and/ or diversity of native non-threatened flora and threatened flora species. An S-P-R linkage is therefore confirmed.	Adverse effect on species abundance (including threatened species) both locally and regionally due to planned clearance activities.

Environmental element	Phase	Impact ID	Potential impact event	Source	Pathway	Receptor	Uncertainties and assumptions	Sensitivity to change (in assumptions)	S-P-R linkage? (Yes, No or Uncertain)	Justification for the confirmation/ non-confirmation of an S-P-R linkage?	Description of the likely impact event
Flora, fauna and native vegetation	Construction Operation	FFNV2	**Direct Loss – fauna** Use of machinery and vehicles during construction of project infrastructure, transport of mineral extracts and personnel during mining activity, and during rehabilitation works causes direct impacts to native fauna. Fauna mortality through accidental capture in trenches or fencing required through construction and operation.	Mining operations Rehabilitation Moving vehicles / open trenches / fences	Land – mechanical and earthmoving equipment Accidental capture of, or vehicle strike of fauna.	Fauna	Sensitivity and aversion to disturbance of fauna species varies.	Low	Yes	Throughout the mine life there will be an increase of human activity and the use of vehicles and machinery. During the construction and vegetation clearance stage individual animals have the potential to be injured or killed through interactions with machinery. Fauna species which are at the greatest risk during this stage are species which burrow into the soil, nest amongst shrubs/ grasses, and are slow moving. The transportation of personnel between J-A site and Atacama also increases the potential for vehicle strike of fauna. During the night when visibility is at the lowest there is an increased risk of collision as many arid species forage during the cooler hours. There may be an increase in fauna interactions with infrastructure such as fence entanglements, and individuals falling into trenches. An S-P-R linkage is therefore confirmed.	Fauna fatalities due to machinery / traffic interactions or entrapment / drowning resulting in decreased diversity and/ or abundance of native fauna.
Flora, fauna and native vegetation	Construction Operation Closure	FFNV3	**Habitat Loss – fauna** Land clearance for construction of project infrastructure and/ or rehabilitation causes a loss of habitat and reduction of abundance and diversity of native fauna	Mine footprint areas requiring clearance	Land – mechanical and earthmoving equipment / loss of habitat	Fauna	Species may move to and from disturbance area during fluctuations in environmental conditions.	Low	Yes	As per FFNV1	Reduction in habitat and resources resulting in decreased diversity and/ or abundance of native fauna

Environmental element	Phase	Impact ID	Potential impact event	Source	Pathway	Receptor	Uncertainties and assumptions	Sensitivity to change (in assumptions)	S-P-R linkage? (Yes, No or Uncertain)	Justification for the confirmation/ non-confirmation of an S-P-R linkage?	Description of the likely impact event
Flora, fauna and native vegetation	Construction Operation Closure	FFNV4	**Weeds** The Project increases weed density, causing a reduction in the abundance and diversity of native flora and hence impacting native fauna indirectly.	Existing weeds within or external to Project	Introduced from offsite via contaminated soil or direct movement.	Native flora, fauna and vegetation	Surrounding area is largely a reserve assessed to be in high condition. Species, extent and density of weeds in surrounding areas is relatively unknown (due to limited surveys over the large area) and subject to change	Low	Yes	The disturbance of land through throughout the LOM creates habitats that are favourable for weed species to become established and grow. Weeds can lead to a decrease in the habitat quality and out-compete native species. There are a variety of different distribution vectors for weeds, including: • wind • vehicles and earthmoving equipment • animals (native and introduced) • surface water flows. Weeds have the potential to degrade or replace native vegetation which results in loss of habitat for native fauna and flora species. Three introduced flora species have been observed within the Project Area: Rosy Dock, Wild turnip and Ward's weed. Each was present in low densities, including Wild Turnip which although found often, was recorded as sparse in each location. These species are not listed as Weeds of National Significance or Priority weeds under the Landscape SA Act for the Alinytjara Wilurara Landscape Management Region. Buffel Grass has been recorded in low density at J-A and is the subject of monitoring and treatment in conjunction with Landscape SA. The most likely mechanism for weeds to be transported is via vehicles and equipment moving into the Project Area. If not controlled, it is likely there will be an increase in diversity or abundance of weeds within the new ML. Appendix C3 shows the weeds which have been recorded at the J-A mine and/ or within the Reserve and therefore have a potential for spread and establishment within the Project Area. An S-P-R linkage is therefore confirmed.	Increased diversity and/ or abundance of weed species in the Project Area causing a decrease in habitat quantity and quality.

Flora, fauna and native vegetation	Construction Operation Closure	FFNV5	**Pests - Fauna** Direct impacts on fauna through predation by carnivorous pest species and indirect impact through changes in habitat.	Mining operations Rehabilitation	Pest animals attracted to waste materials and increased activity	Native fauna	Monitoring has confirmed the presence of cats, foxes and rabbits. Species, extent and density of weeds in surrounding areas is relatively unknown (due to limited surveys over the large area) and subject to change	Low	Yes	The introduction of fauna pest species can result in the decline of some species through predation or competition. Small mammals, reptiles and ground-nesting birds are particularly at risk from predator pests such as foxes and cats. Other vertebrate pests can impact both native fauna and flora (e.g., rabbits) through resource competition, weed spread, over-grazing of flora species and habitat degradation. Pest species have been recorded within the Project Area. The introduction of the European rabbit inflicts damage on a variety of ecological assets, native flora and fauna, vegetation communities, and landforms. Due to the rabbit's high reproductive rates and ability to survive in a variety of habitats they become established in areas rapidly (CoA, 2016). The Domestic cat is a threat to native fauna through predation and competition and disease transmission. Cats in Australia have contributed to the extinction of many small to medium-sized mammals and ground nesting birds in the arid zone previously (CoA, 2015). The European fox is another introduced predator which poses a major threat to many native Australia animals. They are listed on the Worlds Conservation Union's list of the 100 worst invasive species (DEWHA, 2008). Due to their rapid reproduction rate and high survival rate of cubs they colonise areas rapidly within a short period of time. The cat and fox have potential to decrease species populations significantly within the Project Area through increased predation. There is an increased risk of this occurring from the construction to operation phase due to human activity. Areas which have undergone vegetation clearance are known to attract predators as it exposes prey when they are traversing open areas. They have also been observed roaming along roads which provide them with easy access corridors. Activities that may result in the increase in pest fauna include unmanaged waste collection areas, increase in roadkill, increase in human activity and accidental transport with machinery, equipment or supplies. These pest species are known to be established in the area and no new species have been recorded as being introduced to the area since the inception of the J-A mine's	Increased diversity and/ or abundance of pest animal species resulting in predation on native fauna or competition for native vegetation. This may decrease the diversity and/ or abundance of native fauna and native vegetation.

Environmental element	Phase	Impact ID	Potential impact event	Source	Pathway	Receptor	Uncertainties and assumptions	Sensitivity to change (in assumptions)	S-P-R linkage? (Yes, No or Uncertain)	Justification for the confirmation/ non-confirmation of an S-P-R linkage?	Description of the likely impact event
										fauna monitoring program. An S-P-R linkage is therefore confirmed.	
Flora, fauna and native vegetation	Construction Operation Closure	FFNV6	**Pests – Fauna** Altered landscapes allow for migration of herbivore pest species which may consume native flora reducing the abundance and diversity of native flora species.	Mining operations Rehabilitation	Land – pest animals attracted to waste materials and increased activity	Native flora and vegetation	Monitoring has confirmed the presence of cats, foxes and rabbits. Species, extent and density of weeds in surrounding areas is relatively unknown (due to limited surveys over the large area) and subject to change	Low	Yes	See above. Project-related activities could result in an increase in abundance and/ or diversity of pest species in the area. These pest species would impact on a range of flora species (including listed species) due to increased grazing pressure. An S-P-R linkage is therefore confirmed.	Increased diversity and/ or abundance of pest species in Project Area which would decrease the habitat quantity and quality of native flora and fauna.
Flora, fauna and native vegetation	Construction Operation Closure	FFNV7	**Pathogens** Human activity and/or increased pest species introduce pathogens or diseases leading to a reduction in the abundance and diversity of native flora and/or native fauna	Mine operations Workforce	Vehicles, people movements and machinery	Fauna	The prevalence of pathogens in the surrounding areas (i.e., outside of J-A and the Project Area) is unknown. No records of pathogens during Project surveys.	Low	Uncertain	Pathogens are biological agents which can cause disease or illness to the host, including reducing their ability to reproduce. Within South Australia three species (Mundulla Yellow, *Austropuccinia psidii* (Myrtle rust) and *Phytophthora cinnamomi* (Phythophora) are known to have the potential to impact native flora. However, there was no evidence of plant pathogens in the Project Area during field investigations at J-A or Atacama and the Project Area is not located in a high-risk *Phytophthora cinnamomi* (root-rot fungus), or Mundulla Yellows area due to the low average annual rainfall of 180 mm/ year (root-rot fungus occurs in areas where average annual rainfall is greater than 400 mm) and minimal human disturbance. Given the suboptimal conditions for pathogens, and the lack of records in the surrounding area, the source for this potential impact is uncertain, and hence the S-P-R linkage is uncertain.	New or increased abundance of pathogens may impact on the diversity and/ or abundance of native fauna and flora species.
Flora, fauna and native vegetation	Construction Operation Closure	FFNV8	**Toxins / poison** The use of toxins as a method of pest control results in a reduction in the abundance and diversity of native flora and/or native fauna.	Hazardous materials	Direct contact or indirect contact (bioaccumulation)	Flora and Fauna	Likely ingestion by and bioaccumulation in fauna species is unknown.	Low	Yes	Weed spraying has the potential to kill native flora species within the area. It may also secondarily poison native herbivores and lead to soil contamination. If soil contamination does occur, it can have localised impacts to the affected area. The impact of toxins/ poisons on most native flora and fauna species is unknown.	Fauna and/ or flora fatalities due to interaction with toxins resulting in decreased diversity and/ or abundance of native fauna and/ or flora.

Environmental element	Phase	Impact ID	Potential impact event	Source	Pathway	Receptor	Uncertainties and assumptions	Sensitivity to change (in assumptions)	S-P-R linkage? (Yes, No or Uncertain)	Justification for the confirmation/ non-confirmation of an S-P-R linkage?	Description of the likely impact event
Flora, fauna and native vegetation	Construction Operation	FFNV9	**Fire** Project related ignition sources result in accidental fires and in a reduction in the abundance and diversity of native flora and/or native fauna. Project construction results in changed fire regime leading to a reduction in the abundance and diversity of native flora and/or native fauna.	Fire ignition sources Unplanned events	Land - Vegetation Other flammable items on the mine site that could act as fuel	Native vegetation Flora Fauna	Link between fire and persistence of some species is unknown or not well documented. Presence of fauna species known to be significantly affected by fire frequency (such as Malleefowl).	Low	Yes	Increased human activity into an area can cause change in the natural fire regime. It may decrease the frequency and intensity of fires via control measures and/ or increase accidental fires caused through the introduction of ignition points (i.e., vehicles and machinery). Species that are sensitive to fire may be impacted through Project-related activities if they lead to an increase in frequency. This process could lead to disturbance outside of the Project Conceptual Footprint involving repetitive loss of the dense shrub layer that forms critical habitat for species. If this were to occur, it has potential to: • reduce the area of occupancy the species can inhabit in the region • fragment populations as fire isolates remaining suitable habitat and • if a sufficiently large scale could: – disrupt the breeding cycle – impact habitat to the extent that the species is likely to decline and subsequently reduce the population size of the species. An S-P-R linkage is therefore confirmed.	Adverse effect on species abundance (including threatened species) both locally and regionally due to uncontrolled fire as a result of mining operations.

Environmental element	Phase	Impact ID	Potential impact event	Source	Pathway	Receptor	Uncertainties and assumptions	Sensitivity to change (in assumptions)	S-P-R linkage? (Yes, No or Uncertain)	Justification for the confirmation/ non-confirmation of an S-P-R linkage?	Description of the likely impact event
Flora, fauna and native vegetation	Closure	FFNV10	**Final landform** Final landforms do not support rehabilitation of pre-mining flora and fauna habitat, causing a permanent and on-going change to abundance and diversity of native flora and fauna.	Construction of final landform.	Land	Flora and fauna	Changes in vegetation communities as result of change in landform (loss of dune crests) is unknown.	High	Uncertain	Rehabilitation activities at Atacama are expected to be undertaken progressively, in conjunction with mining activities. The rehabilitation activities and final landforms are as discussed in Section 4. The net extraction of material and soil movements will result in changes to the topography, compared to pre-mining conditions and surrounding dunes. The pits cut across the existing regional dunes. The rehabilitated landforms will be shaped to blend with the surrounding landforms, but the dune crests are unlikely to be continuous in height. While care is expected to be taken to replicate soil profiles, the changes to landforms can be expected to result in impacts or changes to vegetation associations that regenerate within the rehabilitated footprint areas in comparison to those present in pre-mining conditions. This is a permanent but relatively small-scale impact. The dune crest habitats that will be removed are available over greater extent in the adjacent Yellabinna Regional Reserve. The ecology and detailed requirements for communities that use the small dune crest are unknown, hence the recreation of this habitat type to offset the permanent loss of the dune crests has some associated uncertainty. Given the uncertainty an S-P-R linkage has been confirmed.	Changes in final landforms and soils result in unsuccessful re-establishment of vegetation and fauna habitat.

Environmental element	Phase	Impact ID	Potential impact event	Source	Pathway	Receptor	Uncertainties and assumptions	Sensitivity to change (in assumptions)	S-P-R linkage? (Yes, No or Uncertain)	Justification for the confirmation/ non-confirmation of an S-P-R linkage?	Description of the likely impact event
Flora, fauna and native vegetation	Construction Operation	FFNV11	**Light** Anthropogenic sources of light at night due to 24 hr operation causing interruption to foraging and circadian rhythms of native fauna.	Artificial lighting	Phototrophic behaviours / attraction of insectivorous species	Native fauna	Unknown sensitivity of local species and populations to light sources	Moderate	Yes	During the operational phase at Atacama, operation will be 24 hours per day, seven days a week. Operation will require constant light sources. This may have impact on native fauna species through increased risk of predation, disruption of circadian rhythms, disorientation, attraction to light sources increasing injury and mortality risk and may have negative impacts on breeding and migration. There is also the potential for changes to vegetation growth and flowering patterns. There are no regulatory limits for lighting impacts to fauna. No noticeable impact as a result of light increase recorded at J-A. An S-P-R linkage has been confirmed.	Interruption of native fauna behaviour as a result of increased lighting which may cause a decrease in the abundance and/or diversity of fauna species within and adjacent to the Project Area

Environmental element	Phase	Impact ID	Potential impact event	Source	Pathway	Receptor	Uncertainties and assumptions	Sensitivity to change (in assumptions)	S-P-R linkage? (Yes, No or Uncertain)	Justification for the confirmation/ non-confirmation of an S-P-R linkage?	Description of the likely impact event
Flora, fauna and native vegetation	Construction Operation	FFNV12	**Noise and vibration** Anthropogenic sources of noise and vibration due to 24 hr operation. Interruption of foraging and circadian rhythms of native fauna. Avoidance behaviour particularly by burrowing species.	Mine operation	Noise carried via wind	Fauna	Unknown sensitivity of local species and populations to noise and vibration	Low	Uncertain	Noise at Atacama is expected to increase from current ambient noise levels during the construction and operation phases of the mine. During these phases, increased noise is likely to occur in short, intense pulses from mobile plant equipment as well as in the form of more prolonged noises with consistent vibration, pitch and volume due to generators, excavators, pumps and vehicles. During operation mining activities will occur 24/7, which may cause avoidance of adjacent areas in the wider Reserve, interference with species' calls, increased risk of predation and interference with circadian rhythms which can ultimately result in decreased fecundity of individuals. The animal's initial reaction to a new noise source is fright and avoidance, but if other sensory systems are not stimulated, the animal learns quite quickly to ignore the noise source. Whilst some mobile species may choose to relocate to the adjacent habitat within the Yellabinna Regional Reserve, others may remain and acclimatize to the increased noise levels. The noise impacts to local fauna populations are likely to be below the level to produce detectable changes, and the impacts are expected to be low depending on the distance from the mine and the individual tolerances of the specific fauna species.	Fauna exhibiting avoidance behaviour may decrease the abundance and /or diversity of fauna species within the Project Area.
Radiation	Operation	R3	Excavation and storage of ore generates naturally occurring radioactive materials in dust emissions that reduce vegetation health, impacting on the abundance and/ or diversity of native flora and fauna.	Refer to Section 7.14.							
Air quality	Construction Operation Closure	AQ3	Mining activities cause a decrease in air quality due to nuisance dust emissions impacting native flora.	Refer to Section 7.10.							

Environmental element	Phase	Impact ID	Potential impact event	Source	Pathway	Receptor	Uncertainties and assumptions	Sensitivity to change (in assumptions)	S-P-R linkage? (Yes, No or Uncertain)	Justification for the confirmation/ non-confirmation of an S-P-R linkage?	Description of the likely impact event
Air quality	Construction Operation	AQ4	Increase in emissions due to vehicle and machinery use cause reduction in the abundance and diversity of native flora and/or native fauna.	Refer to Section 7.10.							
Surface water	Construction Operation Closure	SW3	Alteration of surface water flow regime resulting in impacts to vegetation	Refer to Section 7.8.							
Groundwater	Construction Operation	GW3	Changes / reduction in groundwater availability impacting on groundwater dependent ecosystems.	Refer to Section 7.7.							
Groundwater	Construction Operation	GW4	Hypersaline groundwater rise impacting soils and vegetation within and beyond the extent of the mine disturbance area.	Refer to Section 7.7.							
Groundwater	Construction Operation	GW5	Groundwater contamination associated with accidental spills.	Refer to Section 7.7.							
Groundwater	Operation	GW6	Contamination of groundwater with hypersaline process water	Refer to Section 7.7.							

Table 7-6 Control measures and proposed outcomes: Flora, fauna and native vegetation

Impact ID	Impact event	Control measures	Uncertainties and assumptions	Sensitivity to change in assumptions	Proposed outcome	Draft outcome measurement criteria	Draft leading indicator
FFNV1	**Habitat loss and direct loss of flora.** Land clearance for construction of project infrastructure and/ or rehabilitation causes a reduction of abundance and diversity of native flora.	**Design** All vegetation clearance restricted to approved footprint. Undertake a Landscape Function Analysis. **Control** Progressive rehabilitation of disturbed area, commencing as soon as practical Comparison of annual aerial photography to ensure vegetation clearance is within approved limits. Use of ground disturbance permit system. Restricting access to undisturbed areas not required during operations. **Management** Implementation of a Native Vegetation Management Plan. Implementation of a Rehabilitation Management Plan. Provision of a SEB.	Plant growth response to reconstructed soil profiles Soil seed bank response to disturbance and stockpiling Change in vegetation communities due to changed final landform. Ability to regenerate key species (e.g., Spinifex).	Low	The Tenement Holder must ensure that all clearance of native vegetation is authorised under appropriate legislation. The Tenement Holder 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.	**Construction and operation** Annual GIS comparison of approved clearance boundary and actual clearance boundary to show all vegetation is within authorised clearance boundaries (annual SEB reconciliation report). Annual vegetation health survey to be undertaken to measure: • plant mortality • new growth • evidence of flowering and fruiting • extent of smothering • evidence of saline stress. **Closure** Landscape Function Analysis (over a minimum of five years after the completion of rehabilitation) to show rehabilitated areas are trending towards pre-disturbance landscape function based on comparison with control site. The following will be collected: • Soil cover • basal cover of vegetation • litter cover • BSC • crust entirety • erosion type and severity • deposited materials • surface roughness • surface resistance to disturbance • slake testing • soil texture • vegetation diversity and abundance.	None proposed

Impact ID	Impact event	Control measures	Uncertainties and assumptions	Sensitivity to change in assumptions	Proposed outcome	Draft outcome measurement criteria	Draft leading indicator
FFNV2	**Direct loss - fauna** Use of machinery and vehicles during construction of project infrastructure, transport of mineral extracts and personnel during mining activity, and during rehabilitation works causes direct impacts to native fauna. Fauna mortality through accidental capture in trenches or fencing required through construction and operation.	**Control** Personnel forbidden from feeding or harassing wildlife. Fauna caution signage on haul road. Speed limits on roads used for Project activities. **Management** Implementation of a Fauna Management Plan. Maintenance of a fauna sightings and deaths register. Fauna handling and euthanasia procedures.	Sensitivity and aversion to disturbance of fauna species varies	Low	The Tenement Holder must ensure that there are no net adverse impacts from site operations on native fauna abundance or diversity within the lease area and adjacent areas.	**Construction and operation** Opportunistic visual observations and incident investigation (report stored in Iluka Incident Management System) demonstrates that the Mine Operator did not cause or could not have reasonably prevented fauna deaths or injuries from occurring. A review of mine records demonstrates that where an animal was found to be sick or injured as a result of mining operations Iluka complied with the *Animal Welfare Act 1985.*	**Construction and operation** Quarterly review of the incident register for the management of sick or injured fauna, including the identification of any procedural changes required
FFNV3	**Habitat Loss – fauna** Land clearance for construction of project infrastructure and/ or rehabilitation causes a loss of habitat and reduction of abundance and diversity of native fauna	As per FFNV1	Fluctuation in population of mobile fauna species in response to temporal influences.	Low	The Tenement Holder must ensure that there are no net adverse impacts from site operations on native fauna abundance or diversity within the lease area and adjacent areas.	**Construction and operation** As per FFNV1 Biennial Fauna survey of the diversity and abundance of native fauna species in project (impact) areas and control sites **Closure** As per FFNV1.	**Construction and operation** Quarterly review of the incident register for the occurrence of injured or deceased fauna, including the identification of any procedural changes required.

Impact ID	Impact event	Control measures	Uncertainties and assumptions	Sensitivity to change in assumptions	Proposed outcome	Draft outcome measurement criteria	Draft leading indicator
FFNV4	**Weeds** The project increases weed density, causing a reduction in the abundance and diversity of native flora and hence impacting native fauna indirectly.	**Design** Minimisation of disturbance areas. **Control** Ensure road building material is not brought in from an area where weeds may be present. Implementation of vehicle and equipment hygiene / wash down procedure. Inspect and if identified, treat weeds ahead of vegetation clearance to prevent transfer of pest plants to stockpiles. **Management** Regularly monitor disturbance areas for presence of weeds. Reporting of weed sightings via internal reporting system and reporting requirements highlighted in site induction program. Implement targeted weed management of observed significant increases in distribution or abundance or presence of new weed. Implementation of Pest Species Management Plan.	Intensity of weed management in the greater Yellabinna Reserve area (outside of the tenement boundaries). Weed introduction via uncontrolled public vehicles using haul road (public access area)	Moderate	The Tenement Holder must ensure there is no introduction of new weeds or plant pathogens nor an increase in abundance of existing weed or pest animal species in the lease area and adjacent areas caused by mining operations.	**Construction and operations** Annual weed survey to measure the diversity and abundance of weed species. Monthly field monitoring for the presence of weed species in disturbance areas (including soil stockpiles, road edges and mining infrastructure) to demonstrate no introduction of new weeds of plant pathogens nor an increase in abundance due to mining operations. Opportunistic visual observations of weed species demonstrates no introduction of new weeds or plant pathogens. **Closure** Following completion of active rehabilitation, and annually for a minimum of five years, a weed survey demonstrates that weed species diversity and abundance at closure is consistent with control sites.	**Construction and operation** Annual review of the weed survey and weed management register (comprising results of field monitoring and visual observations) considering trends that could indicate population increase or introduction of new weed species

Impact ID	Impact event	Control measures	Uncertainties and assumptions	Sensitivity to change in assumptions	Proposed outcome	Draft outcome measurement criteria	Draft leading indicator
FFNV5	**Pests - Fauna** Direct impacts on fauna through predation by carnivorous pest species and indirect impact through changes in habitat.	**Design** Waste storage infrastructure is designed and maintained to prevent access by pest animal species Ensure all waste and food storage containers are adequately sealed **Control** Domestic animals prohibited on-site Prohibit feeding of wildlife Reporting of pest plant sightings via internal reporting system and reporting requirements highlighted in site induction program **Management** Implementation of Pest Species Management Plan Implement targeted pest species management for observed significant increases in distribution or abundance or presence of new pest species. Methods will be those used at J-A and align with regional practises.	Intensity of pest animal management in the greater Yellabinna Reserve area (outside of the tenement boundaries)	Low	The Tenement Holder must ensure there is no introduction of new weeds or plant pathogens nor an increase in abundance of existing weed or pest animal species in the lease area and adjacent areas caused by mining operations.	**Construction and operation** Biennial fauna survey demonstrates that there is no significant increase in abundance of pest animal species in the lease and adjacent areas. Monthly field monitoring of the presence of pest animal species including warrens and tracks in disturbance areas (including soil stockpiles, road edges and mining infrastructure) to demonstrate no increase in abundance and diversity due to mining operations. Opportunistic field observations for the presence of pest animal species demonstrates no increase in abundance in the lease area and adjacent areas. **Closure** Following completion of active rehabilitation, and annually for a minimum of five years, a fauna survey demonstrates pest animal abundance at closure to be consistent with control sites.	**Construction and operation** Annual review of register of pest animal sightings considering trends that could indicate population increase.
FFNV6	**Pests – Fauna** Altered landscapes allow for migration of herbivore pest species which may consume native flora reducing the abundance and diversity of native flora species.	As FFNV5	As FFNV5	Low	The Tenement Holder must ensure there is no introduction of new weeds or plant pathogens nor an increase in abundance of existing weed or pest animal species in the lease area and adjacent areas caused by mining operations.	As FFNV5	As FFNV5

Impact ID	Impact event	Control measures	Uncertainties and assumptions	Sensitivity to change in assumptions	Proposed outcome	Draft outcome measurement criteria	Draft leading indicator
FFNV7	**Pathogens** Human activity and/or increased pest species introduce pathogens or diseases leading to a reduction in the abundance and diversity of native flora and/or native fauna	**Management** Implementation of Pest and Weed Management Plan.	Presence of pathogens in the greater Yellabinna Reserve area is unknown.	Low	The Tenement Holder must ensure there is no introduction of new weeds or plant pathogens nor an increase in abundance of existing weed or pest animal species in the lease area and adjacent areas caused by mining operations.	As per FNNV4	As per FNNV4
FFNV8	**Toxins / poison** The use of toxins as a method of pest control results in a reduction in the abundance and diversity of native flora and/or native fauna.	**Control** Regular checks of baiting stations.	N/A	Low	The Tenement Holder must ensure that there are no net adverse impacts from site operations on native fauna abundance or diversity within the lease are and adjacent areas.	As per FFNV2	As per FFNV2
FFNV9	**Fire** Project related ignition sources result in accidental fires and in a reduction in the abundance and diversity of native flora and/or native fauna. Project construction results in changed fire regime leading to a reduction in the abundance and diversity of native flora and/or native fauna.	**Design** Fire suppression systems installed. **Control** Hot works permitting system. Site based emergency response team and firefighting equipment. **Management** Implementation of a Native Vegetation Management Plan. Implementation of a Fire Risk Management Plan.	Bushfires in surrounding region impacting on lease area	Low	The Tenement Holder will ensure there are no uncontrolled fires that could have been reasonably prevented as a result of mining activities.	**Construction and operation** Fire incidents caused by mine operations recorded (incident type, description, classification and action taken) in Iluka incident management system reviewed annually to demonstrate outcome achievement (Does not apply to natural bushfires recorded for purposes of internal hazard reporting).	None proposed.

Impact ID	Impact event	Control measures	Uncertainties and assumptions	Sensitivity to change in assumptions	Proposed outcome	Draft outcome measurement criteria	Draft leading indicator
FFNV10	**Final landform** Final landforms do not support rehabilitation of pre-mining flora and fauna habitat, causing a permanent and on-going change to abundance and diversity of native flora and fauna.	**Management** Implementation of a Native Vegetation Management Plan. Implementation of a Rehabilitation Management Plan.	Rooting depth requirements for deep rooted plant species Viability of seeds for specific species within stockpiles Artificial germination success for specific species	Low	The Tenement Holder 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.	**Closure** Landscape Function Analysis to show rehabilitated areas are trending towards pre-disturbance landscape function based on comparison with control site. The following will be collected: • Soil cover • basal cover of vegetation • litter cover • BSC • crust entirety • erosion type and severity • deposited materials • surface roughness • surface resistance to disturbance • slake testing • soil texture • vegetation diversity and abundance.	Assessment of early rehab success.
FFNV11	**Light** Anthropogenic sources of light at night due to 24 hr operation causing interruption to foraging and circadian rhythms of native fauna.	Light only the object areas intended- keep lights as close to the ground as practicable to avoid light spill. Use the lowest intensity lighting appropriate for the task. **Control** Use adaptive light controls to manage light timing.	Sensitivity of specific fauna species to lighting is unknown.	Low	The Tenement Holder will ensure that there are no net adverse impacts from the site operations on native fauna abundance or diversity in the lease area and in adjacent areas.	As per FFNV3 (for construction and operation)	As per FFNV3 (for construction and operation)
FFNV12	**Noise and vibration** Anthropogenic sources of noise due to 24 hr operation. Interruption of foraging and circadian rhythms of native fauna	**Control** Equipment, machinery and vehicles should be regularly maintained (documented). All machinery and equipment to be used will comply with the relevant Australian standard for noise attenuation (e.g., have noise mufflers and be well maintained). Vehicles and machinery should not be left idling when not in use.	No noise studies have been completed as there are no anthropogenic noise receptors	Low	The Tenement Holder will ensure that there are no net adverse impacts from the site operations on native fauna abundance or diversity in the lease area and in adjacent areas.	As per FFNV3 (for construction and operation)	As per FFNV3 (for construction and operation)

7.4 Soil and land quality

This section describes how the Project may impact on soil and land quality values and sets out the measures that will be implemented to minimise those impacts.

7.4.1 Context

7.4.1.1 Soil Context

A key management issue at Atacama will be the preservation of valuable topsoil resource (CDM Smith,2022a).

Five soil landscapes were identified over the Atacama Project area:

- parallel dunes with spinifex swales
- parallel dunes with bluebush swales
- gently undulating rises with bluebush and saltbush
- gently undulating plains with bluebush and saltbush and
- flat swale depressions.

All soil material types and depths are listed in Table 7-7.

Table 7-7 Soil material types and depths (Source: CDM Smith, 2022a)

Profile[14]	Depth BGL (cm)	Thickness range (cm)	Description
Dune A11	10-20	10-20	Up to 80 cm over soil carbonate layers, occurring in dune landscapes
Dune A12	20-80	40-60	
Spinifex A11	10-15	10-30	10-30 cm depth over soil carbonate layers occurring between dune crests where spinifex occurs
Spinifex A12	30-40	20-25	
Bluebush A11	10-15	10-20	10-30 cm depth over soil carbonate layers occurring between dune crests where bluebush occurs
Bluebush A12	20-40	15-20	
Carbonate	25-40	60+	Between 25 and 40 cm depth. Analogous to the "Brown loam" terminology used at J-A. Very high fine-earth concentrations and audible and visible reaction to 1M HCl.
Pedogenic Clay	500-600	100-500	Between 500 and 600 cm depth. Analogous to the "red loam" terminology used at J-A. A discontinuous, horizonal clay lens.
Pidinga Loams	1400	800	Yellow, yellow-brown, pale grey and grey sandy clay loam to clay loam found 1,400 cm below surface.

[14] Soil horizons can be classified as A,B, C etc. Where an A horizon represents soils which have an accumulation of organic matter and are usually darker than the below layers. An A11 and A12 layer represents a sub-class of the A1 horizon (with A11 at the surface). It denotes a subtle difference in soil material when compared to A12.

Profile[14]	Depth BGL (cm)	Thickness range (cm)	Description
Pidinga Sands	1700	2000-3000	Grey and dark grey sands, fine sands and loamy sand above and within the heavy mineral ore body found 1,700 cm below surface.

Dune A horizons, Spinifex swale A horizons and Bluebush swale A horizons are considered topsoil material and should be stored separately from the lower soil materials. The topsoil nutrient status is low with low ability to store and retain nutrients. It is likely that organic matter held in topsoil play a key role in supporting the nutritional needs of the existing vegetation cover. Retaining organic material in the topsoils should be a priority.

Management recommendations for soil include:

- Topsoil materials shall not be mixed with soil carbonate materials. Topsoil materials shall be placed on the surface of rehabilitated soil profiles.
- Fine earth carbonate materials shall not be placed at the surface
- Each identified soil landscape shall be stockpiled separately and preserved to be placed at the surface of the soil profile.
- Dunes can be stripped to 50cm and all other areas strip to 10cm to enable segregation of topsoil from carbonate materials
- All areas with gently undulating plains and rises should only be stripped to 10cm.
- Topsoil will need to be stockpiled to ensure soil organic matter and seedbank is maintained. The seedbank can be maintained by stockpiling for as short a time as possible and keeping the stockpiles as dry as possible.
- calcareous layers to be placed below the topsoil layers in a similar sequence to the original profile when replaced
- Overburden shall be placed under the soil carbonate layer
- Pidinga sands and Ooldea sand contact may be acidic and requires further assessment of the potential Acid Sulphate Soil risks
- Revegetation of Atacama will require neutral to alkaline conditions in the root zone.

ASS assessments were undertaken by EMM (2022a) and are discussed in Section 3.6.2 in detail. The assessment found that PASS is generally present below the ore body though some samples showed the presence of AASS within the Marine Sands lithology just before it transitions into the next lithology. Noting that AASS is material which has already undergone some level of oxidation of RIS. EMM (2022a) also undertook further test work on samples which found the only lithology which was PAF to be the lignite layer. The Marine sands were found to be potentially non-acid forming.

7.4.1.2 Land quality

Land quality is typically considered to be the condition, state or "health" of the land relative to human requirements, including agricultural production, forestry, conservation, and environmental management (Pieri, Dumanski, Hamblin, & Young, 1995).

The land is arid and not generally suitable for agricultural production or forestry. Rather, the land quality of the Project Area is related to its conservation value and ecosystem support which is related to the relatively undisturbed native arid habitat and sparse vegetation. A key factor in the revegetation of Atacama will be the pH of the root zones. The topsoil typically has a range of pH neutral to alkaline conditions. The management of acidic soil materials should be replaced at depth within the restored soil profile.

7.4.2 Potential impact events

Potential impact events are detailed in Table 7-8.

7.4.3 Design, control and management strategies

Design, control and management strategies for the identified impact event are detailed Table 7-9**.**

7.4.4 Impact assessment

The soil and landscape quality environmental impact assessment is presented in Table 7-8.

7.4.5 Draft outcomes, measurement criteria and leading indicators

The soils and land quality control measures, outcomes and measurement criteria are presented in Table 7-9.

Table 7-8 Potential impact events: Soil and land quality

Environmental element	Phase	Impact ID	Potential impact event	Source	Pathway	Receptor	Uncertainties and assumptions	Sensitivity to change (in assumptions)	S-P-R linkage? (Yes, No or Uncertain)	Justification for the confirmation/ non-confirmation of an S-P-R linkage?	Description of the likely impact event
Soils and land quality	Construction Operation	SL1	Land clearance results in loss of topsoil and subsoil, impacting on quantity available for rehabilitation.	Earthmoving equipment and plant	Excavation – stripping topsoil and vegetation clearing	Soils Final landform/ rehabilitation	It is assumed that staged clearing and excavation will occur. It is assumed that some topsoil will be lost during land clearance.	Low	Yes	To enable the construction of the Project approximately 2,057 ha of native vegetation is proposed to be cleared within the Project Area. The clearing of vegetation will result in the stripping of topsoil and subsoil and there is the potential for loss of topsoil during stripping in the absence of controls and management strategies, resulting in reduced topsoil and subsoil stockpiles. An S-P-R linkage is confirmed.	Excavation and clearing results in loss of topsoil and subsoil, impacting soils available for rehabilitation and quality of final landform.

Environmental element	Phase	Impact ID	Potential impact event	Source	Pathway	Receptor	Uncertainties and assumptions	Sensitivity to change (in assumptions)	S-P-R linkage? (Yes, No or Uncertain)	Justification for the confirmation/ non-confirmation of an S-P-R linkage?	Description of the likely impact event
Soils and land quality	Construction Operation Closure	SL2	Inappropriate management of excavated topsoil, subsoil and overburden results in unsuitable reconstructed soil profile that impacts rehabilitation vegetation growth and survival.	Excavation, stockpiling and reinstatement of topsoil, subsoil and overburden	Changes in soil chemistry and composition	Soils Final landform/ rehabilitation	Uncertainty around reactivity of soils and permeability of stockpiles.	Low	Yes	The excavation of soils will occur as part of the Project. These soils will be stored in separate stockpiles. Incorrect stockpile management practices may impact soil and land and consequently rehabilitation success. **Soil chemistry** CDM Smith (2022b) identify that the pH of the root zone of vegetation must be neutral or alkaline. The lower soil profiles may be acidic, and topsoils are neutral to alkaline. The placement of hard setting dispersive red loams at the surface may affect water infiltration in the root zone and negatively impact success of rehabilitation. Incorrect soil storage may impact the soil function. **Increased weeds in viable soil** Stockpiling and mixing of soils have the potential to affect viable native vegetation seed stocks through introduction of weed seeds, which typically grow faster and larger than native vegetation, reducing soil capacity. The removal, storage and replacement of soil layers will have to be managed appropriately to ensure that upon rehabilitation and successful plant growth is not adversely impacted. This linkage is heavily reliant on the implementation of mitigation measures and controls and as such an S-P-R linkage is confirmed.	Inappropriate soil management results in unsuitable reconstructed soil profile that impacts successful reestablishment of native vegetation.

Environmental element	Phase	Impact ID	Potential impact event	Source	Pathway	Receptor	Uncertainties and assumptions	Sensitivity to change (in assumptions)	S-P-R linkage? (Yes, No or Uncertain)	Justification for the confirmation/ non-confirmation of an S-P-R linkage?	Description of the likely impact event
Soils and land quality	Operation Closure	SL3	Erosion and loss of stockpiled topsoil, subsoil and overburden from fluvial and aeolian transport, results in loss of available material for rehabilitation and impacts water quality.	Soil stockpiling	Fluvial – rainfall runoff and mobilisation of soil Aeolian migration of small particles from stockpiles and deposition elsewhere	Soils Watercourses	N/A	Low	Yes	Soil stockpiled across the Project Area has the potential for water and wind erosion. Soil analysis undertaken by CDM Smith (2022b) shows the pedogenic clay and loams to be highly sodic and most samples analysed were dispersive. These materials will slake upon exposure to water and raindrop impact. Slaking is the process of soil collapse caused by the escape of entrapped air within the soil on immersion in water, which is similar to raindrop impact. Dispersion is the separation of soil aggregates and the movement of the clay fraction into suspension in water. Without the implementation of controls there is likely to be a significant loss of soil resources. As such an S-P-R linkage is confirmed.	Fluvial and aeolian erosion of stockpiles results in loss of available material for rehabilitation and land degradation.

Environmental element	Phase	Impact ID	Potential impact event	Source	Pathway	Receptor	Uncertainties and assumptions	Sensitivity to change (in assumptions)	S-P-R linkage? (Yes, No or Uncertain)	Justification for the confirmation/ non-confirmation of an S-P-R linkage?	Description of the likely impact event
Soils and land quality	Operation	SL4	Erosion of, and mismanagement of stockpiled acidic material, results in contamination of soils and reduction inf soil quality.	Excavation, stockpiling and reinstatement of overburden	Changes in soil chemistry. Pyrite in soil oxidizes on exposure to Oxygen. Sulphuric acid generated	Soils Native flora and fauna	While there is evidence of AASS within two of the three boreholes tested in the Marine Sands, further testing including acid-base accounting (acid neutralisation capacity to maximum potential acidity ratio (ANC: MPA) which defines the net acid production potential (NAPP)) found the Marine sands to be potentially non-acid forming. As such further test work is required to understand the potential for further acid generation of this material, and how widespread it is within the sands. The Acid base accounting result (ANC: MPA) for Marine sands is limited to one borehole sample. The current conceptualisation is that PAF material for high acid forming potential are located below the ore body and will not be mined. The AASS encountered within the Marine sands is not widespread and does not have high acid forming potential. This will be confirmed via further test work.	High	Uncertain	EMM (2022b) undertook a geochemical assessment of the lithologies in the Project Area based on the three boreholes drilled for groundwater baseline. They found that in all three boreholes the lignite and saprolite layers (i.e., those underneath the orebody) were either PASS or AASS, so a type of ASS. In ATMW02 and ATMW03 near the bottom of the Marine sands layer some samples were found to be AASS, meaning that some level of oxidisation has occurred on these samples, but that does not preclude their ability to generate further acidity. Acid-base accounting of the samples was also undertaken by EMM (2022b), which estimates the potential for the material to produce and also neutralise acid. The sands tested were from ATMW01 and found to be potentially non-acid forming. Whereas the lignite tested from ATMW01 and ATMW03 were found to be PAF. Noting that the PAF material is below the orebody and will not be mined. Whilst the above information seems to infer that the Marine sands are unlikely to generate acid, this result is limited to one borehole and therefore there is uncertainty around the S-P-R linkage.	Erosion of, and mismanagement of stockpiled acidic material, results in contamination of soils and loss of soil quality impacting on restoration outcomes and native flora and fauna.

Environmental element	Phase	Impact ID	Potential impact event	Source	Pathway	Receptor	Uncertainties and assumptions	Sensitivity to change (in assumptions)	S-P-R linkage? (Yes, No or Uncertain)	Justification for the confirmation/ non-confirmation of an S-P-R linkage?	Description of the likely impact event
Soils and land quality	Construction Operation Closure	SL5	Long term stockpiling results in a loss of seedstock reducing ecological viability of top and subsoils impacting on rehabilitation	Soil stockpiling (Wet topsoil stockpiles and long topsoil stockpile time)	Changes in soil composition - Seeds rotting, aging	Final landform / rehabilitation	Time is a factor in the viability of the seedbank in the stockpiles; the length of time to seed degradation is an uncertainty. Moisture levels in the soil is a factor in the viability of the seedbank in the stockpiles. The impact of a changing climate on the seedbank, e.g., to a more wet or more arid environment, is an uncertainty.	Medium	Yes	When not directly returned, soil that is stripped as part of mining activities will be stockpiled during operations for later use in rehabilitation activities. The length of time between soil stockpiling and final reinstatement of the topsoil and subsoil profile will vary. Rehabilitation will take over 10 years to complete, and as such there is the potential that some of the soil stockpiles could remain in place in excess of 10 years. It is possible that the ecological viability of seed and microorganisms present within the topsoil and subsoil profiles may be diminished by the stockpiling process, or if stored for long periods of time, this could consequently impact on rehabilitation success (Golos and Dixon 2014). Current soil nutrient status is low and the ability of topsoil to store and retain nutrients is also low, with the organic matter held in the topsoil likely playing a key role in supporting the nutritional needs of the existing vegetation cover. Maintenance of this organic matter within the stockpiled topsoil's should be a priority for the rehabilitation program (CDM Smith, 2022b). Without the implementation of control and management strategies, it is possible there will be an impact on the ecological viability of soils that are stockpiled which could have a significant effect on ecosystem function of rehabilitated areas within the disturbance footprint. An S-P-R linkage is confirmed.	Long term stockpiling results in a loss of seedstock reducing ecological viability of top and subsoils.

Environmental element	Phase	Impact ID	Potential impact event	Source	Pathway	Receptor	Uncertainties and assumptions	Sensitivity to change (in assumptions)	S-P-R linkage? (Yes, No or Uncertain)	Justification for the confirmation/ non-confirmation of an S-P-R linkage?	Description of the likely impact event
Soils and land quality	Closure	SL6	Hypersaline water use (dust suppression) results in contamination of soil materials	Mine operations – dust suppression	Hypersaline water seepage into soils	Soils Native vegetation	The response of dunal vegetation in the Project Area to increased salinity is uncertain.	Medium	Yes	Surface soils have a low salinity (ECe < 2,000 µS/cm). Moderate salinities (2,000–4,000 µS/cm) are encountered within the carbonates and pedogenic clays. Salinities then decline with depth within the Pidinga loams and sands. This trend matches soil texture (CDM Smith, 2022b). Hypersaline water will be stored onsite for use in dust suppression management methods for the Project (as already occurs at J-A). It is possible that soils with the Project Area could become salinized through uncontrolled releases or inappropriate/ excessive application of hypersaline water. This could impact plant growth. An S-P-R linkage is confirmed.	Hypersaline water use (dust suppression) results in contamination of soil materials which makes the soil unsuitable for rehabilitation.
Soils and land quality	Closure	SL7	Final rehabilitated landform(s) has high levels of erosion resulting in soil loss	Final landform	Fluvial and aeolian	Soils Native vegetation	It is expected that lessons learnt from over 10 years of operation at nearby J-A can assist with management methods.	Low	Yes	The characteristics of the soils indicate that they can be erosive when the surface crust is disturbed. After rehabilitation replaced topsoil will not have a strong surface crust initially without the implementation of control and management strategies this could result in a significant loss of soil resources while the crust is forming. In term this erosion could lead to unsuccessful rehabilitation outcomes for the final landform(s). An S-P-R linkage is therefore confirmed.	Final rehabilitated landform(s) has high levels of erosion resulting in soil loss

Table 7-9 Impact assessment: Soil and land quality

Impact ID	Impact event	Control measures	Uncertainties and assumptions	Sensitivity to change in assumptions	Proposed outcome	Draft outcome measurement criteria	Draft leading indicator
SL1	Land clearance for mine site construction and operation results in loss of topsoil and subsoil, impacting on quantity available for rehabilitation.	**Design** All vegetation clearance restricted to approved footprint. **Control** Prohibiting topsoil and subsoil (if other than brown loam) stripping when winds exceed 20 km/h. Vegetation clearance will be staged, and progressive rehabilitation will be undertaken. Restricting access to stockpiles. **Management** Implementation of a Dust & Air Quality Management Plan. Implementation of a Minerals Stockpile Management Plan. Implementation of a Native Vegetation Management Plan. Implementation of a Rehabilitation Management Plan. Land clearance undertaken in accordance with Approvals.	N/A	Low	The Tenement Holder must ensure that the soil function is capable of supporting the agreed land use.	**Construction and operation** Annual soil balance completed from year 1 of vegetation clearance / stockpiling and a soils balance and inventory is subject to annual documented reconciliation and audit.	None proposed

Impact ID	Impact event	Control measures	Uncertainties and assumptions	Sensitivity to change in assumptions	Proposed outcome	Draft outcome measurement criteria	Draft leading indicator
SL2	Inappropriate management of excavated topsoil, subsoil and overburden results in unsuitable reconstructed soil profile that impacts vegetation growth and survival.	**Design** Sequencing of overburden replacement to support selected landscape function and use. Topsoil types will be mapped and categorised for future use and mine closure planning. Topsoil and subsoil will be stockpiled separately to avoid working areas, areas of natural drainage and access tracks. If practical, topsoil will be directly returned to site rehabilitation works. **Control** Natural regeneration of vegetation cover on topsoil/subsoil stockpiles. Restricting access to stockpiles. **Management** Implementation of a Native Vegetation Management Plan. Implementation of a Dust & Air Quality Management Plan. Implementation of a Minerals Stockpile Management Plan. Implementation of a Rehabilitation Management Plan. Soil water and salt movement modelling undertaken in reconstructed soil profiles. Document the location and type of soils in each stockpile. Undertake survey scanning monitoring of topsoil and subsoil stockpiles for erosion, vegetation cover, weeds. Loams, soils and timber stockpiles to be included in annual soil balance and overburden inventories. Research program to clarify unknown characteristics of soils and vegetation.	N/A	Low	The Tenement Holder must ensure that the soil function is capable of supporting the agreed land use.	**Construction and operation** Annual soil balance completed from year 1 of vegetation clearance / stockpiling and a soils balance and inventory is subject to annual documented reconciliation and audit. **Closure** Landscape Function Analysis (over a minimum of five years after the completion of rehabilitation) to show that the BSC profile (minimum age class 2) and function has been restored. As described in *Field guide for landscape function analysis for environmental monitoring and assessment, Minerals Regulatory Guideline 21 (MG 21)* (DMITRE 2013).	None proposed

Impact ID	Impact event	Control measures	Uncertainties and assumptions	Sensitivity to change in assumptions	Proposed outcome	Draft outcome measurement criteria	Draft leading indicator
SL3	Erosion and loss of stockpiled topsoil, subsoil and overburden from fluvial and aeolian transport, results in loss of available material for rehabilitation and impacts water quality.	**Design** Minimise potential erosion impacts through staged clearing and progressive rehabilitation where possible **Control** Restricting access to stockpiles Prohibiting topsoil and subsoil stripping when winds exceed a defined threshold a Surface water management infrastructure is designed to reduce loss of topsoil and subsoil through erosion and sedimentation for mine operational stockpiles and borrow pit stockpiles. Erosion and sediment control measures including vegetation cover or chemical application to minimise erosion Bunding around stockpiles to contain sediment migration from rain events Regular inspections and maintenance of sediment and erosion control devices during operations Natural regeneration of vegetation cover on topsoil/subsoil stockpiles **Management** Implementation of Erosion and Sediment Control Plan Implementation of Native Vegetation Management Plan, Rehabilitation Management Plan, Dust and Air Quality Management Plan, Surface Water Management Plan and stockpile monitoring program.	N/A	Low	The Tenement Holder must ensure that the soil function is capable of supporting the agreed land use.	**Operation** Annual soil balance completed from year 1 of vegetation clearance / stockpiling and a soils balance and inventory is subject to annual documented reconciliation and audit. **Closure** Landscape Function Analysis (over a minimum of five years after the completion of rehabilitation) to show that the BSC profile (minimum age class 2) and function has been restored. As described in *Field guide for landscape function analysis for environmental monitoring and assessment, Minerals Regulatory Guideline 21 (MG 21)* (DMITRE 2013).	Regular erosion and sediment controls inspection records indicate that surface water management infrastructure has been implemented and maintained for topsoil, subsoil and overburden stockpiles. Inspection within 24 hours of >10mm/12hr rainfall events as recorded in onsite rainfall gauge, indicate no additional evidence of increased erosion or sedimentation

Impact ID	Impact event	Control measures	Uncertainties and assumptions	Sensitivity to change in assumptions	Proposed outcome	Draft outcome measurement criteria	Draft leading indicator
SL4	Erosion of, and mismanagement of stockpiled acidic material, results in contamination of soils and loss of soil quality.	**Management** Amend the current J-A Soil Management Plan Undertake further geochemical analysis of Marine sands to quantify ASS risk.	AASS present in Marine sands in testing of two of three boreholes. Marine sands are potentially non-acid forming. PAF is evident in the Lignite layer which will not be mined.	High	The Tenement Holder must ensure that the soil function is capable of supporting the agreed land use.	**Operation** Annual mine records demonstrate all areas of acid sulphate encountered were appropriately managed.	None proposed

Impact ID	Impact event	Control measures	Uncertainties and assumptions	Sensitivity to change in assumptions	Proposed outcome	Draft outcome measurement criteria	Draft leading indicator
SL5	Long term stockpiling results in a loss of seedstock reducing ecological viability of top and subsoils impacting on rehabilitation	**Design** Progressive rehabilitation of disturbed area, commencing within first few years of operations, where possible Operate stockpile returns in a first out – first replaced system wherever possible **Control** Ensure, when establishing stockpiles that just enough moisture for erosion and sediment control processes- not excessive moisture added Collect seedstock from alternate locations over the life of the mine Topsoil and subsoil stockpiled to a maximum of 2 m and 4 m in height respectively, to preserve seed stock and micro-organism function Use of temporary sediment and erosion controls (e.g., mobile booms) if required Implement procedures for stockpiling and stockpile maintenance Direct return of topsoil and subsoil where possible Restricting access to stockpiles Direct seeding of rehabilitated areas Undertake survey scanning monitoring of topsoil and subsoil stockpiles for erosion, vegetation cover, weeds Undertake weed management on stockpiles **Management** Implementation of a rehabilitation management plan Implementation of the Stockpile Management Plan (currently used at J-A)	Stability of topsoil and subsoil stockpiles. Stability of rehabilitated soil surface. Seed longevity beyond previously examined 17 months. Microorganism availability in long-term (> 5 years) stockpiles"	Medium	The Tenement Holder must ensure that the soil function is capable of supporting the agreed land use.	**Construction and Operation** Annual soil balance completed from year 1 of vegetation clearance / stockpiling and a soils balance and inventory is subject to annual documented reconciliation and audit. **Closure** Landscape Function Analysis (over a minimum of five years after the completion of rehabilitation) to show that the BSC profile (minimum age class 2) and function has been restored. As described in *Field guide for landscape function analysis for environmental monitoring and assessment, Minerals Regulatory Guideline 21 (MG 21)* (DMITRE 2013).	None proposed.

Impact ID	Impact event	Control measures	Uncertainties and assumptions	Sensitivity to change in assumptions	Proposed outcome	Draft outcome measurement criteria	Draft leading indicator
SL6	Hypersaline water use (dust suppression) results in contamination of soil materials	**Management** Sample soil salt concentrations in areas required for dust suppression and remove salt contaminated soils prior to rehabilitation Implementation of a Rehabilitation Management Plan. Implementation of Surface Water Management Plan which includes regular inspections of surface water drainage systems.	Depth of salinity in soils where hypersaline water used for dust suppression.	Medium	The Tenement Holder must ensure that the soil function is capable of supporting the agreed land use.	**Closure** Analysis of soil salinity (ECe) at soil test hole drilling within in-pit rehabilitated areas demonstrates no salinisation of rehabilitated soil profile compared to baseline.	None proposed
SL7	Final rehabilitated landform(s) has high levels of erosion resulting in soil loss	**Design** Staging of pit excavation and clearing of vegetation to minimise the disturbed area at any time during the operation phase. Progressive rehabilitation of the site will be undertaken during the life of the mine in accordance with rehabilitation plan. **Control** Ongoing dust control during construction, operation and rehabilitation, implemented as discussed in Section 7.10. Rehabilitated areas ripped on the contour to increase surface roughness and slow wind speed at ground level. Replacement of vegetation debris to reduce wind and water erosion **Management** Implementation of a Native Vegetation Management Plan. Implementation of a Minerals Stockpile Management Plan. Implementation of a Rehabilitation Management Plan. Implementation of Erosion and Sediment Control Plan. Erosion modelling of final landform design.	Rehabilitation activities are effective and in accordance with the rehabilitation plan	Low	The Tenement Holder must ensure that the soil function is capable of supporting the agreed land use.	**Closure** Landscape Function Analysis (over a minimum of five years after the completion of rehabilitation) to show that the BSC profile (minimum age class 2) and function has been restored. As described in *Field guide for landscape function analysis for environmental monitoring and assessment, Minerals Regulatory Guideline 21 (MG 21)* (DMITRE 2013).	**Closure** Prior to closure dust deposition monitoring for 12 months demonstrates that fugitive dust emissions from the rehabilitated landscape is consistent with control sites. *[Prior to closure dust gauge sites will be established at agreed locations with DEM].*

7.5 Public health and safety

This section describes how the Project may impact public health and safety and sets out the measures that will be implemented to minimise those impacts.

Sections 3.4, 3.15, and 3.16 provide detail on the existing topography and landscape, local community and landowners and land use. Sections 7.6, 7.10 and 7.13 provide detail on impacts related to waste, air quality and traffic; all of which are relevant in the context of public health and safety.

7.5.1 Context

The Project Area is isolated from town and population centres and the current adjacent land use includes the mining of heavy mineral sands at J-A. There are no residents or communities in the vicinity of the Project Area, with the nearest population area being the Yalata Aboriginal community approximately 75 km to the south, whilst Ceduna is the nearest largest population centre, approximately 290 km to the southeast. Similarly, there are no public roads adjacent to, or in the vicinity of the Project Area and all transport and traffic associated with the Project will enter through the neighbouring J-A haul road (from Ambrosia) which will be extended to service the Project.

Tourists and visitors can be present within the Reserve. The Yellabinna Regional Reserve is remote and at present, the main visitor facilities and walking tracks are located at Mt Finke Campground, approximately 168 km east of the Project Area. 4WD visitors have the potential to access the Project Area through existing tracks nearby, though any visitor to the area is required to inform Park Rangers prior to entry who in turn would advise Iluka of visitors in the region. It is unlikely that visitors will be walking or driving in proximity to the Project Area, however the possibility remains given that the post closure landform will return to pre mine land use as a Regional Reserve. Figure 7-14 presents the Project Area in the context of the Reserve, the campground and public access from Googs Track, highlighting that it is unlikely that visitors will be walking in proximity to the Project Area however the possibility remains given that the post closure landform will return to pre mine land use as a regional reserve.

Local Aboriginal groups, as well as staff visiting the Reserve may also be present in the wider region. Members of the FWCAC are permitted to access areas on Iluka's tenements for cultural purposes, including hunting and gathering and the use of Atacama is likely to be limited to occasional passing through as there are currently no known significant cultural or hunting sites close by and greater than 24-hour residency by Aboriginal groups would be unusual (Joanne Lee, personal communication, 20 July 2022)).

7.5.2 Potential impact events

Potential impact events are detailed in Table 7-10.

7.5.3 Design, control and management strategies

Design, control and management strategies for the identified impact event are detailed Table 7-11.

7.5.4 Impact assessment

The public health and safety impact assessment is presented in Table 7-10.

7.5.5 Draft outcomes, measurement criteria and leading indicators

The public health and safety control measures, outcomes and measurement criteria are presented in Table 7-11.

.

Table 7-10 Potential impact events: Public health and safety

Environmental element	Phase	Impact ID	Potential impact event	Source	Pathway	Receptor	Uncertainty, sensitivity and assumptions	Sensitivity to change (in assumptions)	S-P-R linkage? (Yes, No or Uncertain)	Justification for the confirmation/ non-confirmation of an S-P-R linkage?	Description of the likely impact event
Public health and safety	Construction Operation	PHS1	Unauthorized access to the active mining area (Atacama) by members of the public results in injury or death	Mining and rehabilitation activities	Unintentional site access through bushland track, or site security failures	Public Local community Visitors and staff of Yellabinna Regional Reserve Aboriginal people – members of FWCAC	There are no private landholders/ residents in 80 km radius or in Yellabinna Regional Reserve. The numbers of potential people on foot in near the Project Area during construction and operations is unknown, though based on experience at nearby J-A it is considered to be low.	Low	Yes	Unauthorised access to the Project Area during construction and operation is considered as unlikely to occur, though not impossible and cannot be discounted. To enter the Project Area, a person(s) would have to first enter the J-A area and security., or there is 4WD access through already establish tracks in the Reserve. Members of the FWCAC can access areas on the tenement for cultural purposes, including hunting and gathering and the use of Atacama both during Operation and Post Closure may include occasional passing through. Due to the remoteness of the Project Area (in its proximity to camping grounds, public roads and towns), it is unlikely that visitors, residents, local community members and Reserve staff will be walking in proximity to the Project Area, however the possibility of the members of the public, local community Reserve staff or FWCAC members unintentionally accessing site cannot be discounted. Therefore, a S-P-R linkage is confirmed.	Injury or death to members of the public due to unauthorised access to the mine site during construction and operation

Environmental element	Phase	Impact ID	Potential impact event	Source	Pathway	Receptor	Uncertainty, sensitivity and assumptions	Sensitivity to change (in assumptions)	S-P-R linkage? (Yes, No or Uncertain)	Justification for the confirmation/ non-confirmation of an S-P-R linkage?	Description of the likely impact event
Public health and safety	Closure	PHS2	Access to the rehabilitated landform (Atacama) post-closure by members of the public causes injury or death.	Rehabilitated landform	Intentional or nonintentional access to the area	Public Local community Visitors and staff of Yellabinna Regional Reserve Aboriginal people – members of FWCAC	There are no private landholders/ residents in 80 km radius or in Yellabinna Regional Reserve. The numbers of potential people on foot in near the Project Area post-closure is unknown, though it is considered to be low.	Low	Yes	All Project related infrastructure will be removed at the end of operations, unless otherwise agreed to with the Landholder. It is possible that if not adequately designed and successfully implemented the post-mining landform and vegetation could have an impact on public health and safety. The Project Area is in a Regional Reserve, managed by the Yumbarra Co-Management Board, a partnership between the FWCAC and the DEW. Members of the FWCAC can access areas on the tenement for cultural purposes, including hunting and gathering and the use of Atacama both during Operation and Post Closure may include occasional passing through. Although the area is remote from the existing Yellabinna Regional Reserve visitor facilities located at Mount Finke Campground, the Project Area is located within a regional reserve which is considered to have high natural and wilderness values. Access to the public will be allowed when rehabilitation is completed, and the lease is relinquished. The post mine land use will revert to Regional Reserve and therefore it is possible that people could be in the vicinity of the Project Area post-closure.	Injury or death to members of the public due to access to the rehabilitated landform post-closure
Traffic	Operation	T1	Increased traffic accidents involving mining traffic due to an increase in duration (not vehicle movements) of the use of the existing traffic route for HMC transport.	Vehicle Movements	Transport of HMC along Eyre Highway and other publicly accessible roads	Other vehicles, members of the public, livestock	Refer to section 7.12				
Traffic	Operation	T2	Increased traffic accidents involving mining traffic (persons) driving to the Project from the Far West Coast region.	Vehicle Movements	Transport (persons) along Eyre Highway and other publicly accessible roads.	Other vehicles, members of the public, livestock	Refer to section 7.12				

Environmental element	Phase	Impact ID	Potential impact event	Source	Pathway	Receptor	Uncertainty, sensitivity and assumptions	Sensitivity to change (in assumptions)	S-P-R linkage? (Yes, No or Uncertain)	Justification for the confirmation/ non-confirmation of an S-P-R linkage?	Description of the likely impact event
Traffic	Construction	T6	Increased traffic accidents involving mining traffic due to an increase in vehicle movements and change in type and size of vehicle during the construction phase of the Project.	Vehicle Movements	Transport along Eyre Highway and other publicly accessible roads. Transport along haul road/s.	Other vehicles, members of the public	Refer to section 7.12				
Public health and safety	Construction Operation	PHS3	Uncontrolled fires causing injury or death to members of the public	Mining and rehabilitation activities	Hot works/ignition sources. use/storage of flammable materials. Accident/ rollover of mobile plant. Change in natural fire regimes for the localised Project Area due to mining operation and or closure final landform	Public Flora and fauna	It is assumed the perceived risk of fire due to Project-related ignition sources is low due to the predominant use of diesel on the Project area which has a higher threshold for ignition than other combustible materials.	Low	Yes	The Yellabinna Reserve is susceptible to fires during periods of high winds, high temperatures and dry conditions. The introduction of human activity into an area often leads to a change in the natural fire regime. Either it can decrease the frequency and intensity of fires due to control measures or increase through accidental fires caused through ignition points (i.e., vehicles, machinery, lightning strikes, arson, hot works/ on-site ignition sources or storage of flammable materials). The actual risk of fires due to Project-related ignition sources is expected to be low, if at all. The adjacent J-A mine has a positive track record in regard to mitigating the risk of ignition-based fires. However, the possibility of fires cannot be discounted.	Injury or death caused by mining operations would cause injury and death.
Air quality	Construction Operation Closure	AQ1	Mining activities cause a decrease in air quality due to nuisance dust emissions impacting health of the public.	Dust quantity - wheel generated from mine truck and plant operation Wind generated dust – stockpiles and disturbed open pit areas.	Aeolian/ wind	Public	Refer to Section 7.10.				
Air quality	Construction Operation Closure	AQ2	Mining activities cause a decrease in air quality due to fuel combustion contaminant emissions impacting health of the public.	Mine construction and operations Vehicle and machinery operation and idling.	Aeolian	Public	Refer to Section 7.10.				

Table 7-11 Control measures and proposed outcomes: Public health and safety

Impact ID	Impact event	Control measures	Uncertainties and assumptions	Sensitivity to change in assumptions	Proposed outcome	Draft outcome measurement criteria	Draft leading indicator
PHS1	Unauthorized access to the active mining area (Atacama) by members of the public results in injury or death.	**Design** Access to Atacama through single point access from the J-A mine site entrance. Signage erected and maintained to deter unauthorised access Mine plan designed to ensure the village is the first point of contact on the access road. **Control** Pre-mobilisation-site Access Request (SAR) process. Authorised public visits are managed through SAR process. Implementation of a travellers' drop-in procedure. **Management** Personnel educated to direct any unauthorised visitors to the village office at J-A. Maintain site-based Emergency Response Team and Ambulance Officers including assets and equipment. Implementation of an Emergency Crisis System and Iluka Group Standard. Incident reports concerning unauthorised site access, operational fires and traffic/ haulage events recorded in Iluka's Incident Management System.	Due to the remote location of the Project unauthorised access is unlikely but still possible.	Low	The Tenement Holder must during construction and operation ensure that unauthorised entry to the land does not result in public injuries or deaths that could have been reasonably prevented.	**Construction and operation** Unauthorised access incident recorded (incident type, description, classification and action taken) in Iluka's Incident Management System. Investigation completed in 14 days, or as agreed with the Director of Mines (or other authorised officer).	None proposed
PHS2	Access to the rehabilitated landform (Atacama) post-closure by members of the	**Design** Final landform design reviewed against approved design. **Management**	Final landform design will be refined through mine life. It is currently unknown what if any infrastructure will be useful to	Medium	The Tenement Holder must demonstrate that at closure the risks to the health and	**Closure** Topographic survey of rehabilitated site compared with approved design (comparison of RLs).	None proposed

Impact ID	Impact event	Control measures	Uncertainties and assumptions	Sensitivity to change in assumptions	Proposed outcome	Draft outcome measurement criteria	Draft leading indicator
	public causes injury or death.	Implementation of a Rehabilitation Management Plan. Implementation of a Mine Closure Plan.	the Landholder post-closure (DEW and FWCAC). It is assumed that all infrastructure will be removed.		safety of the public so far as they may be affected by the final landforms are as low as reasonably practical.	**Closure** Site audit of infrastructure type, disposal location and record of infrastructure having been removed offsite. Site audit of safety and compliance certificates (or similar records) for any retained infrastructure. Negotiation and sign off from Landowners (DEW and FWCAC) on relinquishment/ handover of any retained infrastructure.	None proposed
PHS3	Injury or death caused by uncontrolled fire caused by mine operations	**Control** Maintenance of fire breaks. Vehicles and equipment carry fire suppressant equipment. Emergency evacuation procedures established and communicated. **Management** Implementation of Fire Risk Management Plan, and the J-A Emergency Response Plan which will be extended to Atacama. Observation of fire ban rules. Fire truck, suppression equipment and trained emergency response team on call 24/7. Consultation with CFS, DEW, Ceduna Council and emergency service providers prior and during fire danger periods.	It is assumed the perceived risk of fire due to Project-related ignition sources is low due to the predominant use of diesel on the Project area which has a higher threshold for ignition than other combustible materials. It is uncertain what species within and surrounding the Project Area require fire regimes for succession (e.g., flora, colonising species of native fauna).	Low	The Tenement Holder must during construction and operation ensure that uncontrolled fires due to the mining operation does not result in public injuries or deaths that could have been reasonably prevented.	**Construction and operation** Fire incidents caused by mine operations recorded (incident type, description, classification and action taken) in Iluka Incident Management System Incident investigations completed within 14 days or other time period as agreed with the Director of Mines. Incident trends reviewed annually. *(Does not apply to natural bushfires recorded for purposes of internal hazard reporting)*	**Construction and operation** Quarterly review of incidents, audits and hazards relating to fire.

7.6 Waste and hazardous materials

This section describes how the Project, through its use of waste and storage of hazardous materials may impact the environment and sets out the measures that will be implemented to minimise those impacts.

7.6.1 Context

All tailings and reverse osmosis reject water (brine) and will be disposed of and stored on the adjacent J-A site where processing will occur. As outlined in Section 4.9 (waste section) it is expected that the waste types and volumes produced will be similar to the existing J-A project. Waste generated is expected to fall into three categories – general waste (including putrescible waste, insert solid waste and recyclables), hazardous waste (including waste chemicals and hydrocarbons) and listed wastes (sewage and clinical waste). Priority will be given to reuse and recycling pathways in preference to disposal where applicable. Waste disposal methods and volumes are outlined in Section 4.9. Details of the tailings and process waste are not detailed within this document as they are out of scope (i.e., activities which will occur on ML 6315).

All sewage generated at Atacama will be treated through a SA Health approved on-site wastewater system. The Atacama on-site wastewater system will be fed from site ablutions and crib facilities. The on-site wastewater system will comprise a treatment unit and discharge of treated effluent. The treated effluent will be discharged to soakage. Biosolids will be retained in the primary settling tanks with periodic removal and disposal.

Any waste rock produced, will be limited to the oversize material which is rejected from the MUP after primary screening (refer to Section 4.6 for more information). Rejected waste rock will be placed in the void(s) and buried at depth during rehabilitation.

Hydrocarbon contaminated soils may be generated as part of the Project. Sources include leaks, spills and washdown pads, refuelling areas, bunds and interceptor pits. These soils will be assessed and then remediated onsite using bioremediation as appropriate (Bioremediation Management Plan) on the existing bioremediation site located in the J-A ML. These areas will be assessed in accordance with the ASC NEPM 1999(2013) and South Australian EPA guidelines.

Hazardous materials are substances that, because of their chemical, physical or biological properties, can cause harm to people, property or the environment. These include hazardous substances (classified on the basis of their health effects), dangerous goods (classified based on their immediate physical or chemical effects such as fire, explosion, and corrosion and poisoning) and hazardous wastes which may possess one or both characteristics. Hazardous materials are a necessary element of mining operations. Examples include hydrocarbons (fuels and grease), process chemicals, paints and solvents, liquid petroleum gas (LPG), pesticides and herbicides, resins/adhesives and other materials.

Environmental impacts can occur both in the course of their normal use and as a result of inappropriate/uncontrolled storage, segregation, handling and disposal. During operations hazardous materials will be managed in accordance legislation, codes, standards and guidelines relevant to the materials used on-site.

7.6.2 Potential impact events

Potential impact events are detailed in Table 7-12.

7.6.3 Design, control and management strategies

Design, control and management strategies for the identified impact events are detailed in Table 7-13.

7.6.4 Impact assessment

The waste impact assessment is presented in Table 7-12.

7.6.5 Draft outcomes, measurement criteria and leading indicators

The waste impact control measures, outcomes and measurement criteria are presented in Table 7-13.

Table 7-12 Potential impact events: Waste

Environmental element	Phase	Impact ID	Potential impact event	Source	Pathway	Receptor	Uncertainties and assumptions	Sensitivity to change (in assumptions)	S-P-R linkage? (Yes, No or Uncertain)	Justification for the confirmation/ non-confirmation of an S-P-R linkage?	Description of the likely impact event
Waste	Construction Operation Closure	W1	Loss of amenity (odour, litter) results in increased abundance of pest species.	Open waste containers	Aeolian – windblown litter	Visual Amenity Native flora and fauna	Pest species are already known to occur in the region.	Low	Yes	Industrial and commercial wastes will be collected at the Atacama Project Area and transferred to J-A for main storage as per J-A's current management practices. Some interim lay down areas for inert wastes and materials may be established at Atacama. Treated sewage from office/ crib room ablutions may be disposed at Atacama in accordance with relevant regulatory requirements. Without mitigation measures it is possible that inappropriate waste storage and disposal could lead to an increased abundance of pest species (i.e., weeds and fauna), opportunistic access by native fauna and amenity issues with odour and litter. An S-P-R linkage is confirmed.	Storage of waste may result in the increase in weed germination across site, increases in pest animals and scavenging as well as visual amenity impacts.

Environmental element	Phase	Impact ID	Potential impact event	Source	Pathway	Receptor	Uncertainties and assumptions	Sensitivity to change (in assumptions)	S-P-R linkage? (Yes, No or Uncertain)	Justification for the confirmation/ non-confirmation of an S-P-R linkage?	Description of the likely impact event
Waste	Construction Operation Closure	W2	Soil contamination through inappropriate storage and handling hazardous materials and/ or through uncontrolled release of hazardous materials	Inappropriate storage Uncontrolled release	Spill or leak - direct application to soils	Soils	Lower volumes of stored diesel compared to J-A. No bulk flocculent storage, RO reagents, lab or warehouse hazmat storage compared to J-A. More SME movements compared to J-A so potential for small oil and field re-fuelling leaks etc. Location, volume and type of contamination Volume and frequency of spills is unknown, though based on experience at J-A they will be low.	High	Yes	Hazardous materials will be used for the Project as currently occurs at J-A. Inappropriate storage and handling of hazardous materials may include the co-storage of incompatible dangerous goods classes, storage without bunding or containment, poor management inventory and unsafe handling practices. Without preventative measures in place there is risk that contamination of soils could occur. An S-P-R linkage is confirmed. Multiple legislative instruments (acts, regulations, measures, policies, codes and guidelines) exist which govern the storage, handling, treatment and disposal of commercial and industrial wastes. A lack of adherence to these instruments and proper waste management processes could result in possible contamination of soils. The management of hydrocarbons Hydrocarbon spills and leaks expected to have to occur during the Project life. An S-P-R linkage is confirmed.	Inappropriate storage and handling of hazardous materials results in spills or leaks contaminating the soil profile. Hydrocarbon and chemical spillages and leaks may result in soil contamination. Soil contamination has the potential to migrate through the soil profile to groundwater. Rainfall may result in surface water contamination through run off into watercourses
Groundwater	Construction Operation	GW5	Groundwater contamination associated with accidental spills.	Exploration / infill drilling, Mine operations Fuel or chemical spills	Seepage of pollutants, chemicals, waste to groundwater from accidental spills and waste mismanagement.	Groundwater Ecological receptors at discharge points	Please refer to Section 7.7.				

Table 7-13 Impact assessment: Waste

Impact ID	Impact event	Control measures	Uncertainties and assumptions	Sensitivity to change in assumptions	Proposed outcome	Draft outcome measurement criteria	Draft leading indicator
W1	Loss of amenity (odour, litter) increased abundance of pest species.	**Control** Waste Transfer Station for segregation of wastes. Waste facility fencing for exclusion of fauna/ containment of litter located at J-A. Receptacles for general wastes and recyclables installed throughout Project Area. Approved Wastewater Treatment Plants for treatment of greywater and sewage. Waste collection by EPA-licensed transporters and treatment/ disposal to EPA-approved facilities (where applicable). **Management** Preventive baiting programs for vermin (house mouse) Monitoring and housekeeping inspections. Site induction inclusive details onsite waste management procedures. Waste management awareness training. Implementation of a Waste Management Plan. Implementation of a Pest Species Management Plan.	NA	Low	The Tenement Holder must ensure that no demolition, industrial or solid domestic waste (other than treated sewage) is disposed of on site.	**Construction and operation** Visual monitoring and recording in the site waste register demonstrates appropriate waste treatment, segregation and disposal demonstrates that appropriate waste treatment, segregation and disposal has occurred. Audit of waste disposal records for all waste types (general waste, recyclables, hazardous and listed wastes) demonstrates that waste has been stored and managed in accordance with the Waste Management Plan. **Closure** Audit report demonstrates that no demolition, industrial or solid domestic wastes (except biosolids and residual infrastructure detailed in the Mine Closure Plan) have been left onsite.	**Construction and operation** Quarterly review of site waste register containing records of all waste movements from site.

Impact ID	Impact event	Control measures	Uncertainties and assumptions	Sensitivity to change in assumptions	Proposed outcome	Draft outcome measurement criteria	Draft leading indicator
W2	Soil contamination through inappropriate storage and handling hazardous materials and/ or through uncontrolled release of hazardous materials	**Design** Bunding and containment of dangerous goods and hazardous substances per relevant legislation, guidelines and Australian/New Zealand standards. **Management** Implementation of a Hazardous Materials Management Plan. Implementation of a Waste Management Plan that covers management of hazardous wastes Hazardous Materials Approval procedure Inventory management, monitoring and inspection requirements. Spill response/ clean-up procedures. Emergency Response Team trained in fire and hazmat emergency response, including spill response trailer. Site induction inclusive details on-site hazardous materials management. Hazardous materials management training awareness program. Planned workplace inspections. Loss Control reporting system. Vehicle, plant and infrastructure preventative maintenance programs. Vehicle and equipment pre-start checks.	Location, volume and type of contamination Potential for legacy soil contamination in areas of storage and handling of Hazardous materials	Low	The Tenement Holder must ensure that fuel and liquid chemicals (hazardous materials) are managed in accordance with relevant EPA guidelines to prevent spillage and leakage to the environment.	**Construction and operation** Visual monitoring and recording of the appropriate clean up and disposal of contaminated material demonstrates that all spills were managed in accordance with Spill Response/ Clean Up Procedure and Iluka HSEC Group Standard – Hazard, Incident and Emergency Classification. Annual reporting to DEM (via the Annual Compliance Report) provides a summary of all Level 2 or higher hazardous material spill events, response clean up (as ranked according to the Iluka HSEC Group Standard – Hazard, Incident and Emergency Classification). Visual observations and incident investigation (report stored in Iluka Incident Management System demonstrates that all hazardous materials storage facilities comply with SA EPA Bunding Guidelines, or to a design agreed to with the SA EPA to prevent spillage and leakage to the environment. Visual monitoring and recording of the appropriate clean up and disposal of contaminated material demonstrates that all spills were managed in accordance with Spill Response/ Clean Up Procedure and Iluka HSEC Group Standard – Hazard, Incident and Emergency Classification. Annual reporting to DEM (via the Annual Compliance Report) provides a summary of all Level 2 or higher hazardous material spill events, response clean up (as ranked according to the Iluka HSEC Group Standard – Hazard, Incident and Emergency Classification). **Closure** Audit report demonstrates: • that soil sampling of target sites and management of any impacted soils has occurred in accordance with the *National Environment Protection (Assessment of Site Contamination) Measure 1999* (ASC NEPM) and • that classification for off-site disposal of material has occurred as per SA EPA information sheet (March 2010) *Current criteria for the classification of waste – including industrial and Commercial Waste (Listed) and Waste Soil.*	**Construction and operation** Quarterly review of incident register for spillages and leaks and the clean-up and disposal of contaminated material, including the identification of any procedural changes required. Quarterly review of incident register for spillages and leaks and the results of visual observations of hazardous materials storage facilities, including identification of any procedural changes required

7.7 Groundwater, including quality and quantity

This section describes how the Project may impact on groundwater values, including quality and quantity and sets out the measures that will be implemented to minimise those impacts.

Section 3.5 provides details on the existing hydrogeological environment and Section 4.5 provides details of the proposed mining activity.

7.7.1 Context

The Project is within the Alinytjara Wilurara Landscape Region, which is a non-prescribed groundwater resource. Previous groundwater studies (Iluka, 2015; and LWC 2018a) have identified an average pre-mining groundwater elevation at J-A of approximately 100 m with respect to Australian Height Datum (m AHD). Recent data collected from monitoring wells suggests groundwater at Atacama may be found at elevations ranging between 95 and 106 m AHD (greater than 60 m below ground level (mBGL)). Groundwater in the Eucla Basin is generally saline (Total Dissolved Solids (TDS) >10,000 mg/L). At J-A, TDS concentrations typically range from 21,900 to 36,000 mg/L.

Groundwater in the Project Area is found to naturally exist only in the Gawler Craton basement rock and have a flow to the west from Atacama, towards J-A and then onwards towards playa lakes such as Lake Ifould and Lake Tallacootra. Discharge is expressed as evaporation at these termini, without discharging at surface. High groundwater salinity preventing the use of groundwater by vegetation. The low yields and high salinity also restrict any groundwater use by third-party users. In summary, there are no direct groundwater receptors, and groundwater-related risks are linked to mounding occurring to an extent whereby it would intercept surface environments (vegetation and soils).

Recharge to the fractured rock aquifer is inferred to be minimal (<1 mm/year) due to low rainfall in the area, high evapotranspiration rates and the large depth to groundwater. Flow may continue towards the palaeochannel, where the J-A Mine's water is sourced from the Pidinga Formation (approximate groundwater elevation of 20 m AHD). Based on historical regional groundwater flow modelling, the groundwater system at Atacama is considered to be similar to that observed across the regional area (EMMA, 2020a). However, groundwater levels and flows locally may be influenced by regional fractures, faults and palaeochannel drainage.

Dry mining of the four open pits will occur with the average pit dimensions presented in Table 4-1. The eastern pit is the deepest, with its base at approximately 125 m AHD. The local groundwater elevation is observed to range between 95 m and 106 m AHD, indicating proposed mining will occur above the water table. Figure 7-1 depicts a cross section of the eastern pit showing the average depth of pit disturbance in relation to the range of groundwater table elevations, demonstrating the likely separation to the groundwater table; of approximately 30 m (95 m AHD) and 19 m (106 m AHD). Figure 7-2 presents the conceptual hydrogeological model for the Project, with indication of depth to groundwater, and hydrostratigraphic formations.

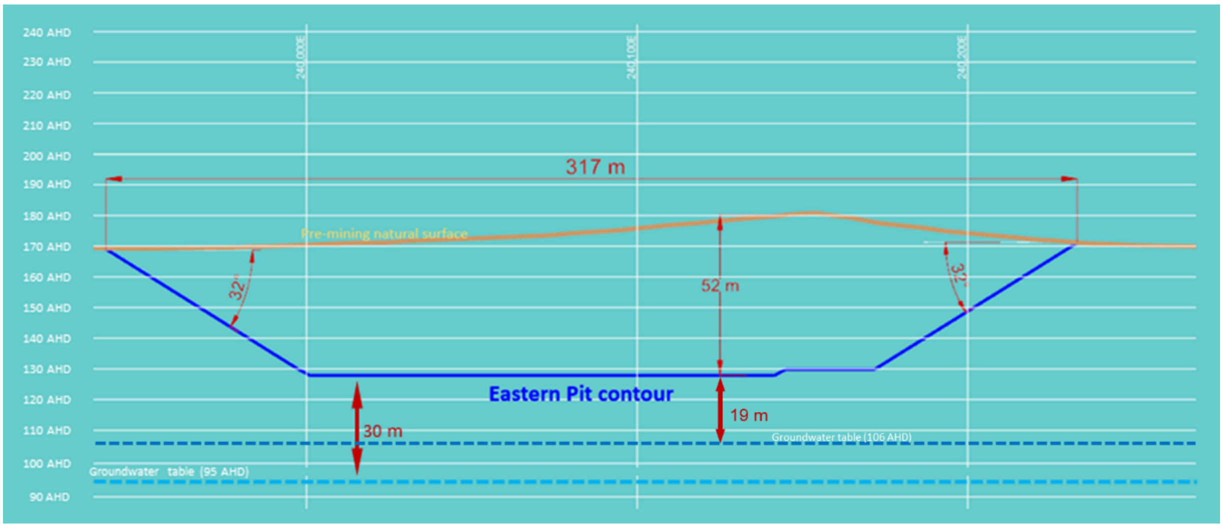

Figure 7-1 Eastern pit cross section in relation to groundwater table elevation range

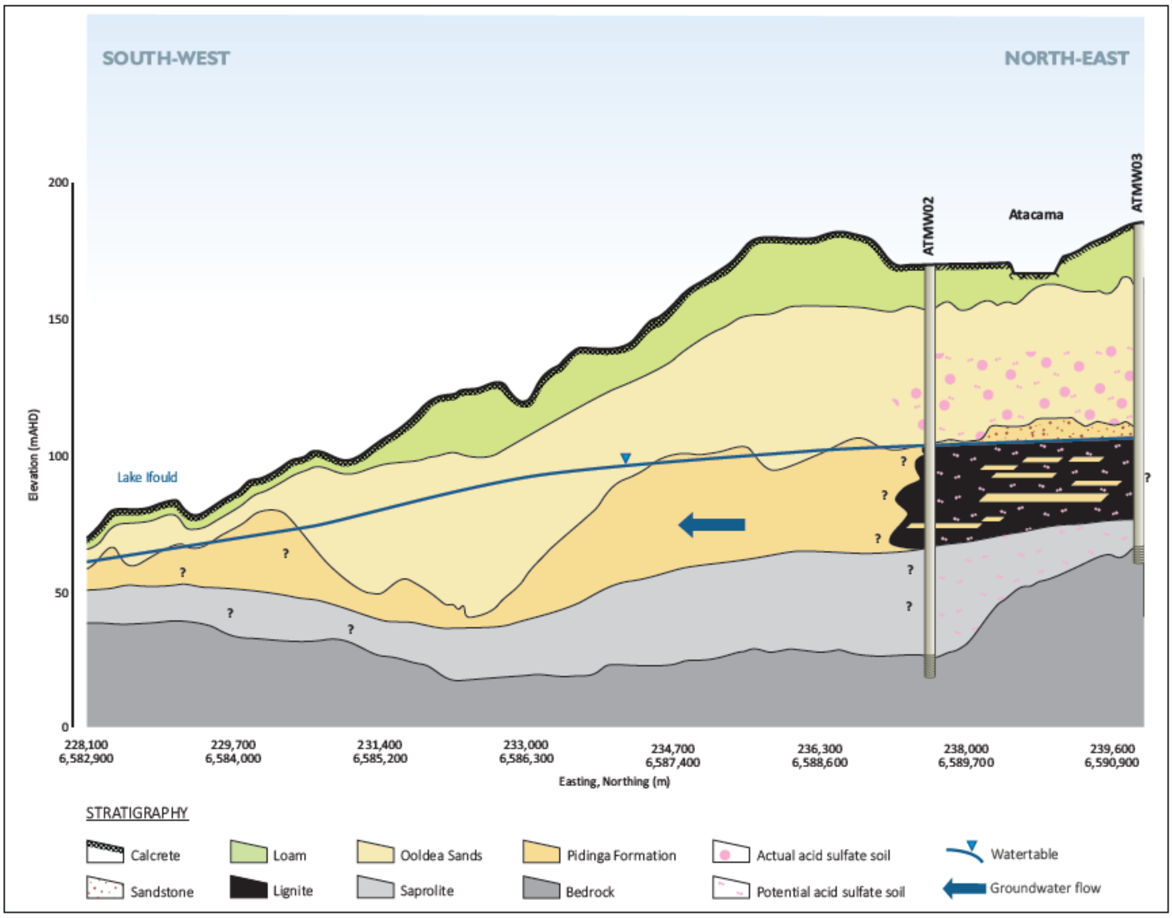

Figure 7-2 Conceptual hydrogeochemical conceptual model for Project depicting water table (EMM, 2022a)

Tailings deposition will not occur in the Project Area and will only occur at J-A, using the existing processing and storage facilities and expanding the existing in-pit tailings facilities on already disturbed areas. Process water will not be discharged to the pits in the Project Area however some process water will be used for dust suppression.

Groundwater will not be abstracted within the Project Area. Water will be instead supplied from the J-A Borefield located within MPL 110, approximately 40 km from the Project Area. This existing J-A Borefield will provide water for mine operations, including processing, dust suppression and watering of rehabilitation areas.

The potential impacts to groundwater quantity and availability related to the extended demand on groundwater abstraction from the palaeochannel aquifer and extended tailings seepage at J-A may have a cumulative effect on the existing potential impacts which concern groundwater at J-A. An assessment of these impacts will be addressed in the CiO for J-A, attached as Appendix D.

7.7.2 Potential impact events

Potential impact events are detailed in Table 7-14.

7.7.3 Design, control and management strategies

Design, control and management strategies for the identified impact events are detailed in Table 7-15.

7.7.4 Impact assessment

The groundwater environmental impact assessment is presented in Table 7-14.

7.7.5 Draft outcomes, measurement criteria and leading indicators

The groundwater control measures, outcomes and measurement criteria are presented in Table 7-15.

Table 7-14 Potential impact events: Groundwater

Environmental element	Phase	Impact ID	Potential impact event	Source	Pathway	Receptor	Uncertainties and assumptions	Sensitivity to change (in assumptions)	S-P-R linkage? (Yes, No or Uncertain)	Justification for the confirmation/ non-confirmation of an S-P-R linkage?	Description of the likely impact event
Groundwater	Construction Operation	GW1	Reduction in groundwater levels within the fractured rock lithology	Mine operations – pit trenching	Dewatering /evaporation of intercepted groundwater during mining	Reduced access to groundwater resources by third parties	Pit depth will not exceed 125 m AHD average depth, groundwater levels observed between 95 and 106 m AHD. Hydrogeology is inferred from J-A model, groundwater wells at Sonoran and Typhoon (Iluka exploration areas), and an Atacama specific drilling program that installed three wells.	Low	No	Groundwater levels at Atacama were measured at elevations between 95 and 106 m AHD (EMM, 2022a). Four pits will be constructed, to average depths of up to 125 m AHD. As such groundwater will not be intercepted and mine dewatering will not be required.	No predicted impact
Groundwater	Construction Operation Closure	GW2	Reduction in groundwater levels in the palaeochannel preventing beneficial use of the palaeochannel groundwater by other parties.	Groundwater abstraction for mining operations (processing, rehabilitation, dust suppression).	Groundwater	Reduced access to groundwater resources by third parties	Refer to CiO Application, attached as Appendix D.				

Environmental element	Phase	Impact ID	Potential impact event	Source	Pathway	Receptor	Uncertainties and assumptions	Sensitivity to change (in assumptions)	S-P-R linkage? (Yes, No or Uncertain)	Justification for the confirmation/ non-confirmation of an S-P-R linkage?	Description of the likely impact event
Groundwater	Construction Operation	GW3	Changes / reduction in groundwater availability impacting on groundwater dependent ecosystems.	Groundwater abstraction for mine operations (processing, rehabilitation, dust suppression).	Groundwater	Subterranean GDEs Terrestrial GDEs	Pit depth will not exceed 125 m AHD average depth, groundwater levels observed between 95 and 106 m AHD. Hydrogeology is inferred from J-A model, groundwater wells at Sonoran and Typhoon (Iluka exploration areas), and an Atacama specific drilling program that installed three wells. Groundwater will not be abstracted in the Project Area. Water will be supplied by J-A existing groundwater wells. Subterranean GDEs were not analysed in proximity to the Project Area. The conceptual hydrogeological model assumes that terrestrial GDEs source water from episodic rainfall events and soil moisture rather than regional groundwater resources. Salinity of the regional groundwater is too high for terrestrial GDEs to use >10,000 mg/L (Total Dissolved Solids (TDS)).	Low	No	It was considered by EMM (2022a) that there was a low likelihood of stygofauna presence in the Project Area due to the depth of the fractured rock aquifer and the highly saline nature of the groundwater environment. The closest stygofauna assessment near the Project Area was undertaken approximately 400 km away in Streaky Bay. Terrestrial GDEs exist in the Project Area. However, due to the depth of the groundwater and considering the shallowest groundwater encountered in the Project Area is 75 m BGL, it is considered that the terrestrial species are likely to rely on episodic rainfall and soil moisture rather than groundwater. Although subterranean GDEs were not analysed for the Project, there is no change in sensitivity. The ore at Atacama is located well above local groundwater elevation, groundwater will not be intercepted, and groundwater abstraction will not be required in the lease area. There will be no changes in groundwater availability for stygofauna and terrestrial vegetation GDEs as a result of the Project. Impacts related to groundwater abstraction will be assessed as part of the J-A Change to Operations.	No predicted impact

Environmental element	Phase	Impact ID	Potential impact event	Source	Pathway	Receptor	Uncertainties and assumptions	Sensitivity to change (in assumptions)	S-P-R linkage? (Yes, No or Uncertain)	Justification for the confirmation/ non-confirmation of an S-P-R linkage?	Description of the likely impact event
Groundwater	Construction Operation	GW4	Hypersaline groundwater rise impacting soils and vegetation within and beyond the extent of the mine disturbance area.	Tailings disposal	Tailings seepage to groundwater and subsequent rise of saline water table (mounding)	Native vegetation Soils Lake Ifould	All tailings from the Project will be transported and stored at J-A, off site. Impacts related to this will be assessed as part of the J-A CiO. Future seepage rates, hydro stratigraphic mapping, vegetation sensitivity.	Low	No	The Project will make best use of the disturbance area and infrastructure already approved at nearby J-A by using the existing processing and storage facilities and expanding the existing in pit tailings facilities on already disturbed areas. Tailings will be split into two components at the concentrator stage, a benign coarse sand component and a fine clay component <53micron in size. The coarse sand fraction of the tailings will be stored in a sand cap located at Jacinth North. The slime component will be deposited in the Ambrosia void as part of the remediation. Potential cumulative impacts to mounding outside of the Project Area resulting from the Project tailings seepage in the J-A lease will be assessed as part of the J-A CiO. Potential mounding within the Atacama Project Area as a result of the additional tailings seepage in the J- A lease will also be addressed as part of the J-A CiO; however it noted that impacts to vegetation and soils in the Atacama Project Area are unlikely. East of J-A, the groundwater elevation drops by approximately 15 m. This is interpreted as a fault potentially restricting groundwater flow and compartmentalising the groundwater system.	No predicted impact.
Groundwater	Construction Operation	GW5	Groundwater contamination associated with accidental spills.	Exploration / infill drilling, Mine operations Fuel or chemical spills	Seepage of pollutants, chemicals, waste to groundwater from accidental spills and waste mismanagement.	Groundwater Ecological receptors at discharge points	The volumes of spills that may occur is unknown, however it is unlikely to be at large quantities	Low	No	Groundwater at Atacama has been found at elevations ranging between 95 and 106 m AHD (approximately 30 m below average pit base depth). And no significant receptors were identified in the area. The overburden within the Project Area is unsaturated and the region water table is located in the basement. Any spill at Atacama (either at natural surface or within the pits) is unlikely to be of a volume required to reach groundwater within the basement. Therefore, it is considered that there is no S-P-R linkage.	No predicted impact

Environmental element	Phase	Impact ID	Potential impact event	Source	Pathway	Receptor	Uncertainties and assumptions	Sensitivity to change (in assumptions)	S-P-R linkage? (Yes, No or Uncertain)	Justification for the confirmation/ non-confirmation of an S-P-R linkage?	Description of the likely impact event
Groundwater	Operation	GW6	Contamination of groundwater with hypersaline process water	Mine operations – dust suppression Storage of process water on site	Process water seepage into groundwater	Groundwater Ecological receptors at discharge points	Distribution of soluble forms of aluminium minerals, neutralizing capacity of native groundwater	Low	Yes	Two 2.5 ML ponds will be established to the north of MUP 1. One pond will store process water and one pond will be RO water. The process water pond will have high salinity. Groundwater at Atacama has been found at elevations ranging between 95 and 106 m AHD (approximately 30 m below maximum pit depth). And no significant receptors were identified in the area. The overburden within the Project Area is unsaturated and the regional water table is located in the basement. Any seepage of process water at Atacama (either through dust suppression using hypersaline water or failure of any constructed pond lining), is unlikely to be of a volume required to reach groundwater within the basement. However, this is highly reliant on implementation of a control, being the design and ongoing maintenance of constructed ponds. Therefore, an S-P-R linkage is confirmed.	Seepage of hypersaline process water leads to contamination of groundwater (increase in groundwater salinity).

Table 7-15 Control measures and proposed outcomes: Groundwater

Impact ID	Impact event	Control measures	Uncertainties and assumptions	Sensitivity to change in assumptions	Proposed outcome	Draft outcome measurement criteria	Draft leading indicator
GW6	Contamination of groundwater with hypersaline process water	**Design** Water holding ponds are designed with appropriate lining including embankments and base. **Control** Regular inspection and maintenance of water holding ponds. No discharge of process water into the mine pits. **Management** Implementation of Groundwater Management and Monitoring Plan Monitoring of mine site groundwater chemistry Sampling and analysis of water holding ponds in the Project Area. Monitoring of vegetation health	Long term impact of hypersaline water seepage on groundwater chemistry and geochemistry	Low	The Tenement Holder must during construction, operations and closure ensure that there is no adverse change to groundwater quality and quantity as a result of the Project.	**Operation** Water quality samples collected and analysed at a NATA accredited laboratory for pH, EC, TDS, temperature, major cations (Ca, Mg, K, Na,), major anions (Cl, SO_4, Alkalinity, CO_3, HCO_3), dissolved organic carbon and dissolved metals (Fe, Mn Al, Cd, Cu and Ni) and SWL demonstrate no statistically significant deviation from baseline which can be attributed to mining operations.	None proposed

7.8 Surface water, including quality and quantity

This section describes how the Project may impact on surface water values, including quality and quantity and sets out the measures that will be implemented to minimise those impacts.

Section 3.8 provides details on the existing hydrological environment and Section 4.5 provides details of the proposed mining activity.

EMM Consulting have undertaken a Surface Water Impact Assessment which has informed the preparation of this section. The report is attached in full as Appendix C1.

7.8.1 Context

It is predicted that the hydrology of the Project Area will be impacted by the proposed mine construction, operation and closure.

7.8.1.1 Hydrological features

The Project Area lies to the north-east of the J-A catchment and consists predominantly of dunes and swales. The Project Area consists of dunes and swales and contains no named water courses or official hydrolines (EMM, 2022b). Drainage occurs between dunes towards terminal pans in both northwest and southeast directions and the distance that runoff from disturbed areas can travel is typically in the order of 2 to 3 km (EMM, 2022b).

The Project Area does not contain any surface water features of conservation significance, including Ramsar wetlands or springs, and is not located within a prescribed water resource area under the *Landscape South Australia Act 2019* or water protection area including areas under the *River Murray Act 2003*.

The southern section of the Project Area lies in the upper J-A catchment and several defined reaches of Jacinth North Creek and Ambrosia South Creek lie within the south-western portion of the Project Area (Figure 3-26). None of these defined reaches will be impacted by the Project. Several unnamed ephemeral drainage lines lie between the Atacama deposits and the existing J-A operation, which flow east to west after rain, terminating at Lake Ifould. These will be crossed by the proposed haul road between Atacama and the existing J-A operations.

7.8.1.2 Surface water use and dependency

The Project Area is situated in the arid climate zone, with the monthly evaporation exceeding monthly rainfall rates in all months of the year (EMM, 2022b).

There are no townships downstream of the proposed Atacama mine site, and no human third party water users are known to use the ephemeral water resources. As such, there are no residential, commercial or agricultural receptors affected by impacts to surface water.

Investigations into the level of reliance on surface water by ecosystems in the Project Area concluded that 'vegetation species within the Atacama Project Area are not reliant on collection of surface water or periods of inundation to survive' (Alluvium, 2014). Vegetation communities have been assessed as a potential environmental receptor, however there is a lack of understanding on how vegetation communities may be affected by changes in dune field hydrology and assumptions that vegetation will not be affected are based on a hydrodynamic model. Inspections of surface water flows and possible impacts during large rain events may be required to confirm engineering assumptions.

While fauna may use surface water when present, none are expected to be reliant on surface water habitat (Alluvium, 2014).

Beyond opportunistic use, water required for processing and dust suppression at the Project will not be supplied by surface water; rather by groundwater noting that the existing J-A Borefield capacity significantly exceeds the anticipated water demands. Potable water requirements will be produced via modification to the existing RO plant at the J-A site.

7.8.1.3 Stormwater management

Surface water runoff from the disturbed areas, such as roads, MUP pads, contractor area, operation and maintenance areas, will be directed away from infrastructure towards sumps and roadside catchment drains as shown in Figure 4-1. Diversion channels will redirect natural catchments and culverts will be used under roads to direct water towards the roadside catchment drains.

Rainfall will be collected in roadside containment ponds and MUP run off sumps and allowed to evaporate. Due to the arid climate and low rainwater volumes, rainwater has not been considered for input into the process water balance. In the event of a significant rainfall event, any rainwater collected from the mine pits may be pumped into a truck and transferred to the MUP sump. The water will then be used in combination with the process water to slurry the ore and will be pumped offsite (to J-A) with the slurry. Rainwater collected from the mine pits during ordinary rain fall events may also be used for dust suppression to reduce the RO water demands.

Sediment will be retained in the stormwater ponds and periodically cleaned out if required to maintain design parameters.

7.8.1.4 Water Quality

Surface water receptors include:

- dune swales, where run-off may pool following rainfall and predominantly drain to a terminal pan
- unnamed and ephemeral creeks in the southwest of the Project Area that drain west towards various unnamed salt pans and Lake Ifould.
- Lake Ifould, an ephemeral salina approximately 3 km from mine site.

Notably, when rainfall runoff occurs, mining influences on runoff would be contained to dune swales in the immediate vicinity of the activity.

The unnamed creeks and Lake Ifould are not connected to mining activity by overland flow paths other than possibly where the proposed haul road crosses drainage paths between Atacama and existing J-

A operations. Run off may cause impacts downstream and as such water quality is a key consideration particularly in relation to creek receptors in the south of the Project Area.

Due to the arid nature of the Project Area, surface water quality samples are unable to be collected. EMM (2022b) instead undertook sediment leachate testing in the Project Area and compared the results with surface water quality data collected at the J-A site to provide a representative sub-set of baseline water quality records. While the results of sediment leachate testing are not directly comparable to the results of surface water testing due to differing test methods, inferences have been made based on the relative concentration of metals in each sample.

Relevant water quality guidelines for the Atacama Project Area include both national and state government guidelines, which provide default guideline values (DGVs) for water quality objectives relevant to the receiving environment:

- Australian and New Zealand Guidelines (ANZG) for Fresh and Marine Water Quality (2018), using DGVs for the benchmark of protection of 95% of aquatic species.
- South Australian (SA) Environment Protection (Water Quality) Policy (2003), using DGVs assigned to aquatic freshwater receiving environments[15].

The guidelines recommend that site-specific water quality thresholds should be developed where possible with regard to the existing environment and receptors. This is of relevance at the J-A and Atacama sites, as surface water and sediment sampling show that the region is naturally mineral rich, and runoff contains elevated metals concentrations.

DGVs and results are summarised in Appendix C1. Sampling sites in the Project Area were selected within flow pathways and dune swales. Leachate test results indicated that run off generated at the Project Area would be slightly alkaline and of low salinity (EMM, 2022b). The soil and water samples have similar metals and major ion signatures. Each sample has:

- Concentrations of aluminium, zinc, lead, and iron above the DGVs
- similar ratios of calcium, sodium, magnesium and potassium

The existing surface water management plan used at the J-A project will be reviewed and extended to include trigger levels that are site specific to Atacama and not necessarily referencing the DGVs as part of the PEPR development.

7.8.1.5 Flood Modelling

Water modelling was undertaken by EMM (2022b) and the potential for flooding at the site was assessed for annual exceedance probability storms 1% AEP (1 in 100 AEP), 2% AEP (1 in 50 AEP) and 0.5% AEP (1 in 200 AEP) across three scenarios, pre-mining, mining and post closure. The model illustrated that flooding is restricted to ponding in swales between dunes. There are no watercourses in the vicinity of the proposed pits, pads, or contractor facilities.

[15] Where this document provides guidance, it supersedes the national guidance.

Pit excavation will cross a number of dune swales, and bund walls will be required to exclude ponding flood waters from the pits. The peak modelled depth during operation, adjacent to a pit bund in the 1% AEP storm was modelled as 2.5 m (Figure 7-3). At haul road crossing points, flows are expected to be relatively minor, with depths of less than 0.2 m and peak velocities of around 0.6 m/s reported by the model (Figure 7-4). Design of culverts for these crossing locations will be undertaken according to published guidelines utilising the design flow results extracted from the flood model.

Following mine closure, bund walls would be removed, and the pits surfaces would be remediated to become low points within the dune system (Figure 7-5).

During mining and post closure, modelled changes to the flood regime would be restricted to the dune swales in which excavation or construction occurs. Figure 7-6 and Figure 7-7 show the changes in peak design depth during mining and post closure at 1% AEP, depicting areas that will become either wet or dry based on the available modelling.

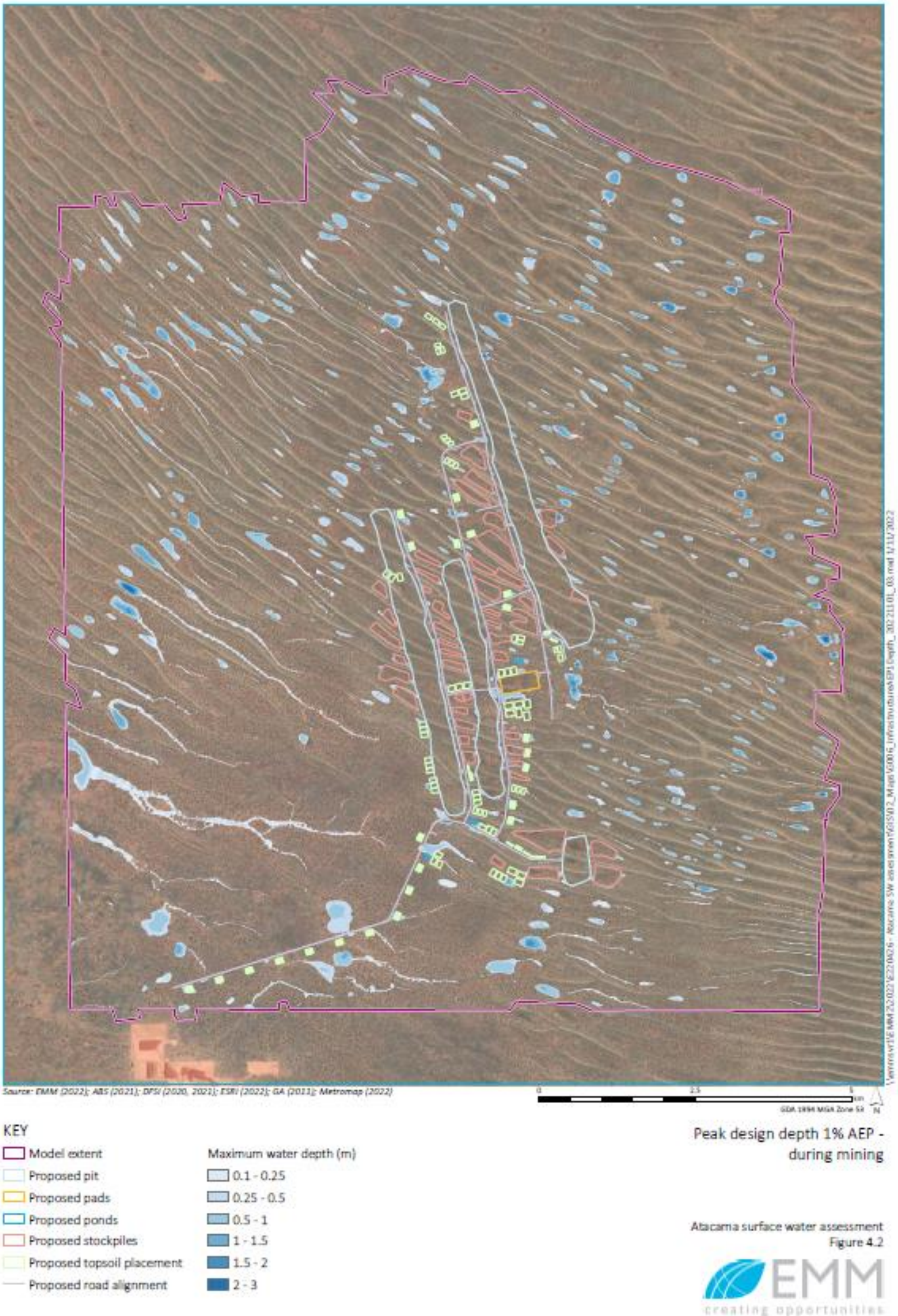

Figure 7-3 Peak Design Depth 1% AEP During Mining (Source: EMM, 2022b)

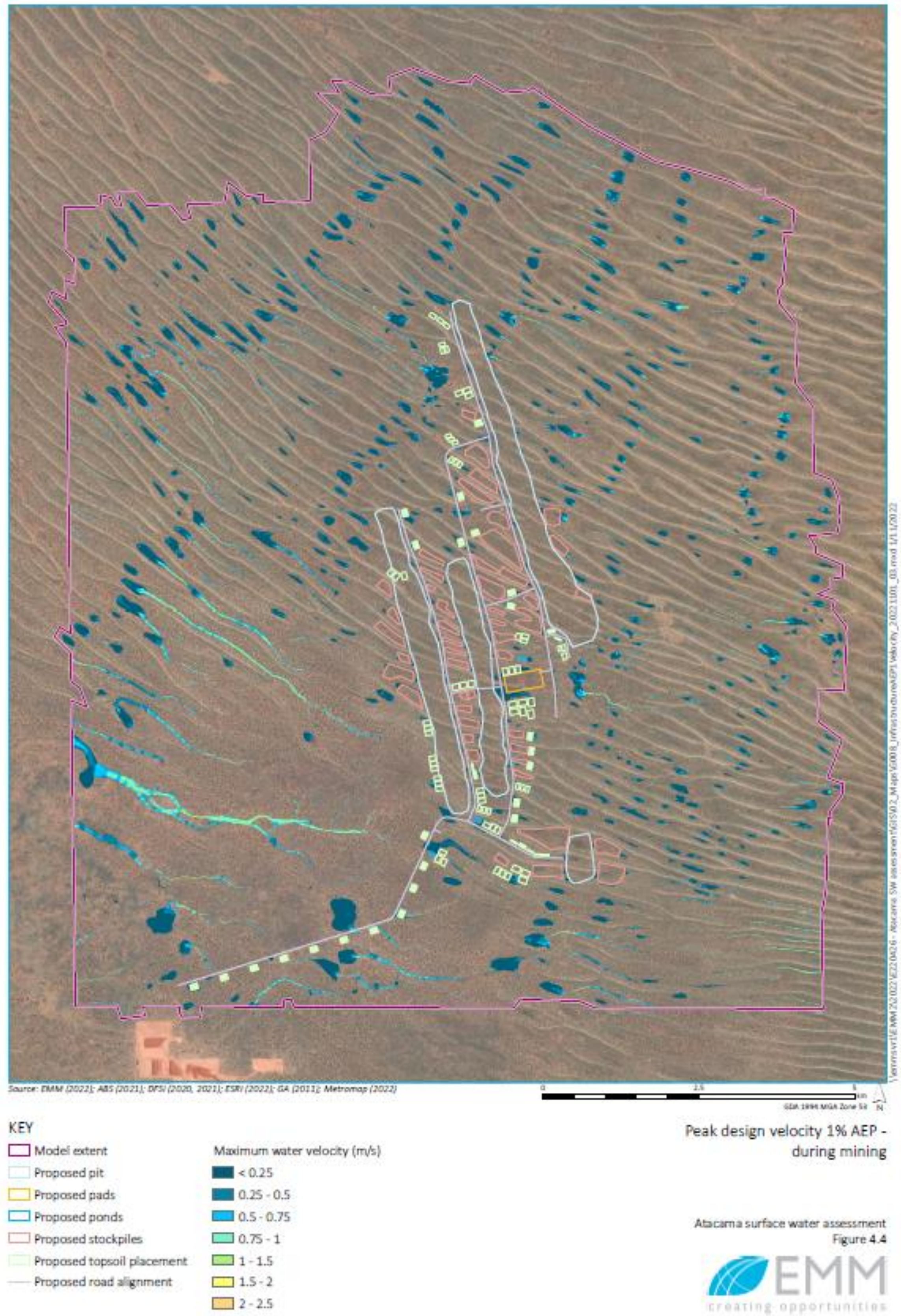

Figure 7-4 Peak design velocity 1% AEP – during mining (Source: EMM, 2022b)

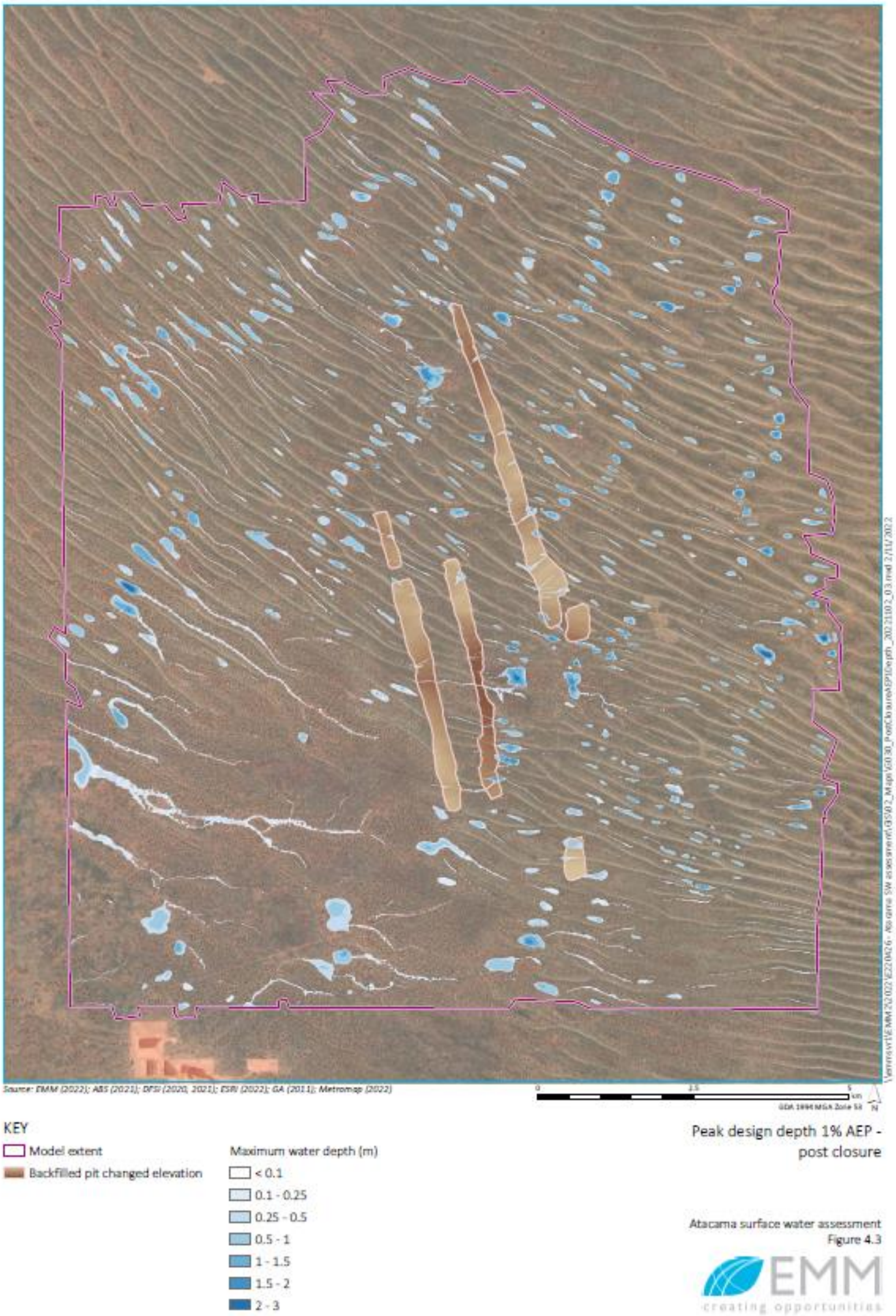

Figure 7-5 Peak design depth 1% AEP post closure (Source: EMM, 2022b)

Figure 7-6 Afflux – change in peak design depth 1% AEP – during mining (Source: EMM, 2022b)

Figure 7-7 Afflux – change in peak design depth 1% AEP – post closure (Source: EMM, 2022b)

7.8.2 Potential impact events

Potential impact events are detailed in Table 7-16.

7.8.3 Design, control and management strategies

Design, control and management strategies for the identified impact event are detailed in Table 7-17.

7.8.4 Impact assessment

The surface water impact assessment is presented in Table 7-16.

7.8.5 Draft outcomes, measurement criteria and leading indicators

The surface water control measures, outcomes and measurement criteria are presented in Table 7-17.

Table 7-16 Potential impact events: Surface water

Environmental element	Phase	Impact ID	Potential impact event	Source	Pathway	Receptor	Uncertainties and assumptions	Sensitivity to change (in assumptions)	S-P-R linkage? (Yes, No or Uncertain)	Justification for the confirmation/ non-confirmation of an S-P-R linkage?	Description of the likely impact event
Surface water	Construction Operation	SW1	Changed rates of subsurface infiltration due alteration of surface water regime within the dune system	Mining activities and landform changes	Changes in hydrology	Groundwater	Impacts on groundwater from flood modelling scenarios were not included in the model.	Low	No	Connecting previously discrete catchments is likely to result in larger catchments and concentrated volumes of surface water on the new low point in the combined catchment (potentially behind levees constructed to protect the mine), resulting in locally higher rates of subsurface infiltration. Groundwater recharge is inferred to be minimal (0.1 <1 mm/year (CDM Smith, 2022)) due to low rainfall in the area, high evapotranspiration rates and the large depth to groundwater (EMM, 2022a). It is unlikely that flooding in the dune swales will result in changes to the groundwater due to the localized impact of ponding. However, impacts on groundwater were not included in the model. There is no S-P-R linkage.	No predicted impact.
Surface water	Construction Operation	SW2	Changed drainage line flow regime and potential for increased sedimentation due construction and operation of the haul road	Haul road construction and operation	Change in hydrology	Unnamed ephemeral drainage lines crossed by the haul road	N/A	Low	Yes	At the locations where the haul road crosses unnamed ephemeral drainage lines, flows are expected to be relatively minor, with depths of less than 0.2 m and peak velocities of around 0.6 m/s reported by the model at the 1% AEP scenario. At these locations there is an increased risk of erosion and sedimentation into the drainage line, particularly on the downstream side of the haul road due to locally changed flow patterns. For example, water flowing over road embankments may locally be shallower with higher velocity, while culverts concentrate flow and can create higher velocity jets at the outlet. During periods of rainfall this erosion and sedimentation may, through rainfall runoff, migrate down the drainage line, which has the potential to increase the turbidity and nutrients within the drainage lines. Whilst the impact is likely to be minimal given the low flow velocities within the drainage lines the impact is dependent upon implementation of design controls. As such, an S-P-R linkage is confirmed.	Construction and operation of the haul road leads to changed flow regime and increased sedimentation within drainage lines crossed by haul road.

Environmental element	Phase	Impact ID	Potential impact event	Source	Pathway	Receptor	Uncertainties and assumptions	Sensitivity to change (in assumptions)	S-P-R linkage? (Yes, No or Uncertain)	Justification for the confirmation/ non-confirmation of an S-P-R linkage?	Description of the likely impact event
Surface Water	Closure	SW3	Alteration of surface water flow regime resulting in impacts to vegetation	Mining activities and landform changes	Change in hydrology	Native flora and vegetation communities	Lack of understanding on how vegetation communities may be affected by changes in dune field hydrology and assumptions that vegetation will not be affected are based on hydrological engineering model.	Moderate	Uncertain	Investigations by Alluvium (2014) into the level of reliance on surface water by ecosystems in the Project Area concluded that 'vegetation species within the Atacama Project Area are not reliant on collection of surface water or periods of inundation to survive'. Alluvium (2014) considered that changes in hydrology within the Atacama Project Area will have limited impacts to the vegetation stratums in the short term (i.e., <10 years). Vegetation communities present within flood zones are not reliant on flows or flooding because these events occur at such infrequent intervals, they would not sustain ephemeral communities. All vegetation communities within the Project Area appear to be driven by soil depth primarily, with transitional communities present as responses to the last flood event. The period in which these areas stay inundated may also drive communities as a response to tolerance of extended wetting rather than reliance (Alluvium, 2014). Post mine completion the surface water model (EMM, 2022b) shows changes to the flood regime of the of the swale catchments, in that some areas which were dry will now be wet and vice versa (Figure 7-7). This change is discrete and limited to the extent of the Conceptual Footprint. All vegetation communities in proximity to the proposed development are well represented and this should ensure the ongoing viability of diverse ecosystems. However, vegetation communities have been assessed as a potential environmental receptor. There is a lack of understanding on how vegetation communities may be affected by changes in dune field hydrology in the long term, and ongoing monitoring should be implemented. The S-P-R linkage is uncertain and will require implementation of monitoring controls to understand this potential impact	Native vegetation is impacted due to redistribution of surface water.

Environmental element	Phase	Impact ID	Potential impact event	Source	Pathway	Receptor	Uncertainties and assumptions	Sensitivity to change (in assumptions)	S-P-R linkage? (Yes, No or Uncertain)	Justification for the confirmation/ non-confirmation of an S-P-R linkage?	Description of the likely impact event
Surface water	Construction Operation Closure	SW4	Reduction or changes in local availability of surface water	Mine operation, dust suppression, rehabilitation watering	Surface water collection, harvesting and use	Other users	Water will be supplied by J-A's existing groundwater wells with no collection or harvesting of surface water proposed in the Project Area.	Low	No	The Atacama site is situated in the arid climate zone, with the monthly evaporation exceeding monthly rainfall rates in all months of the year (EMM, 2022b). There are no townships downstream of the mine site, and no water users are reliant on surface water from the dune swales or watercourses that would be affected by the Project. Water for the J-A mine site is currently sourced from an approved wellfield (MPL 110) which is located approximately 40 km from the J-A site. It is proposed that water for the Atacama project will be sourced from this existing wellfield. There is no S-P-R linkage.	No predicted impact
Surface water	Construction Operation	SW5	Erosion and runoff from disturbed surfaces results in an increase in sedimentation in surface water within watercourses and Lake Ifould	Mining activities and landform changes	Sediment laden discharge / rainfall runoff	Watercourses Lake Ifould	N/A	Low	No	No discharges are proposed into watercourses from the proposed mining operations. No change in flow regime of creeks flowing to Lake Ifould is expected to occur. Surface water runoff from the disturbed areas, such as roads, MUP pads, contractor area, operation and maintenance areas, will be directed away from infrastructure towards sumps and roadside catchment drains. Diversion channels will redirect natural catchments and culverts will be used under roads to direct water towards the roadside catchment drains. The collected rainfall will be allowed to soak and /or evaporate off and will not contribute to the process water balance for the site. Sediment will be retained in the stormwater ponds and periodically cleaned out. Lake Ifould and the watercourses are not located within the Project Area and as such are a significant enough distance away that they will not be impacted by the mining activities, as such sediment laden runoff is not expected to reach these receptors. There is no S-P-R linkage.	No predicted impact

Environmental element	Phase	Impact ID	Potential impact event	Source	Pathway	Receptor	Uncertainties and assumptions	Sensitivity to change (in assumptions)	S-P-R linkage? (Yes, No or Uncertain)	Justification for the confirmation/ non-confirmation of an S-P-R linkage?	Description of the likely impact event
Surface water	Construction Operation	SW6	Reduction in water quality resulting from mobilisation of fuel or oil spill contaminants	Exploration / Infill drilling, Mine operations Fuel or chemical spills	Rainfall runoff and mobilisation of contaminants	Dune swales within the area of disturbance Drainage lines along haul road	N/A	Low	Yes	During construction and operation, equipment will use diesel fuel and be lubricated with oils. There is a low likelihood risk of oil/ fuel spill from vehicles, for example in the case of mechanical failure. Due to the arid environment, the likelihood of fuel/ oil transport by surface water prior to clean up is very low. Heavy vehicles would primarily be used and parked within the dune system, where any transport of spilled material would be contained within the local dune swale and terminal pan. Any fuel stores located at the Atacama site would be constructed on bunded pads in accordance with appropriate guidelines, outside of areas identified to be at risk from flooding and away from watercourses. Spill clean-up procedures would be developed, and spill kits would be available. There is a S-P-R linkage due to the reliance on control and management methods to reduce this impact.	Reduced quality of surface water runoff caused by contamination from hazardous chemicals and waste.
Surface water	Operation	SW7	Reduction in water quality resulting from contamination of hypersaline process water	Storage of process water on site	Unintentional contaminated discharge	Watercourses Lake Ifould	N/A	Low	No	Two 2.5 ML ponds will be established to the north of MUP 1. One pond will store process water and one pond will be RO water. The process water pond will have high salinity. These ponds will be lined with HDPE liner on the embankments and base above a compacted cushion layer. There is a low risk of failure of these ponds if constructed to design and maintained. Whilst there is a reliance on the implementation of design controls to prevent an uncontrolled water release, the location of the two ponds means that separation distances would prevent such a release resulting in an impact to watercourses and/ or Lake Ifould. As such, an S-P-R linkage is not confirmed.	No impact predicted.

Table 7-17 Control measures and proposed outcomes: Surface water

Impact ID	Impact event	Control measures	Uncertainties and assumptions	Sensitivity to change in assumptions	Proposed outcome	Draft outcome measurement criteria	Draft leading indicator
SW2	Changed drainage line flow regime and potential for increased sedimentation due construction and operation of the haul road	**Design** Surface water flow managed by culverts at waterway crossings Requirements for drainage design to minimise storm water runoff to unnamed drainage lines near the haul road **Management** Expand and enhance the existing J-A Surface Water Management Plan to Atacama	N/A	Low	The Tenement Holder must ensure no adverse impact on surface water quality as a result of mining operations.	**Construction and operation** Annual sediment sampling upstream and downstream of haul road drainage line crossings (measuring ECH, turbidity and pH) demonstrate that sediment quality (as a proxy for water quality) downstream is comparable with upstream results.	None proposed
SW3	Alteration of surface water flow regime resulting in impacts to vegetation	Refer to Impact ID FFNV1 in Table 7-6.					
SW6	Reduction in water quality resulting from mobilization of fuel or oil spill contaminants	Refer to Impact ID W2 in Table 7-13.					

7.9 Noise and vibration

This section describes how the Project may impact on noise and vibration and sets out the measures that will be implemented to minimise those impacts.

It is important to note that no noise or vibration monitoring has been undertaken as part of the development of this document, noise sources in the region are detailed in Section 3.19.

7.9.1 Context

The only noise sources identified in the region are the wind blowing through vegetation and the infrequent exploration drilling on Iluka's ELs. The Project is expected to increase the current ambient noise levels during construction and operation. The expected increased noise will be from short, intense pulses from mobile plant equipment sided by a more prolonged noise with consistent vibration, pitch and volume due to generators, excavators, pumps and vehicles.

Based on the nature of the operations (mineral sand mining) blasting activities are not usually employed. However, in exceptional circumstances blasting may be required. In the event that blasting is required, blasting activities will be undertaken in accordance with relevant standards and statutory requirements (including gaining necessary approvals). The Project Area is remote and there are no sensitive receptors (public and local community) which could be impacted by noise and vibration sources from mining operations (due to separation distances). The closest receptor to the Project Area is the J-A accommodation village (14 km) followed by the Yalata Aboriginal community, located 75 km south of the Project.

Public and community sensitive receptors that could be impacted by the Project are restricted to noise and vibration relating to construction activities and transportation including road trains and trucks on public roads.

The Project Area and greater region contains high quality habitat which is largely undisturbed and is home to a diverse range of fauna.

7.9.2 Potential impact events

Potential impact events are presented in Table 7-18.

7.9.3 Design, control and management strategies

There were no S-P-R linkages identified for noise and vibration impacts and as such, no design, control and management strategies are presented.

Please refer to Section 7.3 for fauna related noise and vibration information.

7.9.4 Impact assessment

The noise and vibration impact assessment is presented in Table 7-18.

7.9.5 Draft outcomes, measurement criteria and leading indicators

There were no identified S-P-R linkages and as such, there is no presentation of noise and vibration specific control measures, outcomes and measurement criteria.

Please refer to Section 7.3 for fauna related noise and vibration information.

Table 7-18 Potential impact events: Noise and vibration

Environmental element	Phase	Impact ID	Potential impact event	Source	Pathway	Receptor	Uncertainties and assumptions	Sensitivity to change (in assumptions)	S-P-R linkage? (Yes, No or Uncertain)	Justification for the confirmation/ non-confirmation of an S-P-R linkage?	Description of the likely impact event
Noise and vibration	Construction Operation	N1	Increase in noise and vibration from surface mobile equipment (trucks, excavators, loaders etc.), MUP and vehicles and occasional blasting within the Project Area.	Mining and rehabilitation activities	Atmosphere	Public and local community	Noise and vibration levels during these phases are unknown.	Low	No	The Project is isolated from towns and population centres with the closest community group being Yalata Aboriginal community, located 75 km south of the Project Area. Beyond this, the closest population centre is Ceduna located over 200 km to the southeast. Access restrictions prevent tourists and members of the public from being nearing the Project Area. As such due to separation distances there is no S-P-R linkage.	No impact identified
Noise and vibration	Construction	N2	Increase in noise and vibration along public roads – including Eyre Highway due to the increased traffic to and from the Project Area during construction.	Refer to Change in Operation Application/ Appendix D and the J-A MLP for further information.							
Noise and vibration	Construction Operation	FFNV12	Noise and vibration Anthropogenic sources of noise due to 24 hr operation. Interruption of foraging and circadian rhythms of native fauna	Refer to section 7.3.							
Noise and vibration	Operation	N3	Increase in noise and vibration along public roads – including Eyre Highway due to the increase in duration (not vehicle movement) of existing traffic route.	Refer to Change in Operation Application/ Appendix D and the J-A MLP for further information.							
Noise and vibration	Construction, Operation	N4	Increase in noise and vibration at J-A due to the increase in duration of existing operations.	Refer to Change in Operation Application/ Appendix D and the J-A MLP for further information.							

7.10 Air quality

This section describes how the Project may impact on air quality values and sets out the measures that will be implemented to minimise those impacts.

Details of baseline are provided in Section3.

Jacobs Australia have undertaken an Air Quality Impact Assessment (AQIA) which has informed the preparation of this section. The report is attached in full as Appendix C4.

Greenbase have undertaken an assessment of greenhouse gas emissions which has also informed the preparation of this section. The report is attached in full as Appendix C5.

7.10.1 Context

The Project is in an arid area. High wind levels, a lack of ground cover and lack of rain are likely to be factors which naturally exacerbate dust generation in the area. The development and operation of the Project will result in air emissions due to land clearing and stockpiling of topsoil, subsoil and overburden; mining operations, rehabilitation works and vehicle movements. Air emissions sources comprise the following:

- Gaseous emissions – combustion engine emissions from on-site plant and other mobile machinery, including Carbon Monoxide (CO) and Nitrogen dioxide (NO_2).
- Radiological emissions - radionuclide components of dust emissions sourced from the ore body, HMC stockpiles (which will be located at nearby J-A) and tailings facility (also located at nearby J-A). Radiological emissions are discussed and assessed further in Section 7.14.
- Particulate emissions – fugitive particles, insoluble solids (dust) including Total Suspended Particles (TSP), PM_{10} and $PM_{2.5}$.

Mining activities which have potential for emissions of air pollutants including the following within the Project Area:

- scrapers/ scoops for topsoil/ subsoil
- loading of haul trucks by excavator
- removal of overburden or ore by haul truck
- placement of overburden on stockpiles (end dumping)
- deposit of ore at the MUP
- replacement of overburden and soils in pit area
- haul trucks on unpaved roads
- wind erosion of stockpiles and exposed open pit areas.

Based on a review of relevant National Pollutant Inventory (NPI) emissions estimate manuals, other relevant literature on open-cut mining, and known pollutants from mineral sands mining operations the primary pollutants are considered to be fugitive particulates (Jacobs, 2022c).

Key pollutants include the following particulate fractions:

- TSP, in relation to the determination of deposited dust and as an input to the determination of radionuclide ground level concentrations.

- Particles with an aerodynamic diameter less than or equal to 10 micrometres (µm) (PM_{10}).
- Particles with an aerodynamic diameter less than or equal to 2.5 micrometres (µm) ($PM_{2.5}$).

Gaseous emissions from power generation, nitrogen dioxide (NO_2) and carbon monoxide (CO), were also included in the assessment.

The radiation impact assessment (RCA, 2022) was reviewed to determine radionuclide parameters for dispersion modelling, e.g., uranium and thorium isotope components of the particulate matter emissions.

No significant sources of odour were identified for assessment.

7.10.1.1 Receptors

The Project Area is remote. The nearest (non-mining) sensitive receptor is the Yalata township, approximately 75 km to the south. The nearest (mining) receptor is the Iluka accommodation village (camp) approximately 14 km southwest of the Project Area. Accommodation for Atacama personnel will be provided at the existing village on the J-A MPL, with no accommodation at Atacama. Native flora and fauna are also considered a receptor in this assessment.

The averaging time of Ground Level Concentrations (GLCs) in the *Environment Protection (Air Quality) Policy 2016* (GSA, 2022b), have been used as a guide when determining whether a given location is a potential sensitive receiver.

The GLC for gaseous emissions nitrogen dioxide (NO_2) and CO have assessment criteria with a 1-hour averaging period, and therefore consideration is given to locations within the mine site at which a person would be likely present for an hour or more. In the case of particles (PM_{10} and $PM_{2.5}$), sensitive receivers are those places where people are located for 24 hours, due to the GLCs having a 24-hour averaging time, typically a residence and in this case, the camp.

Impacts to the workforce are excluded from assessment under the Mining Act, however the following sections present the results of the impacts to the camp as being the worst case (nearest) receptor in order to demonstrate no impacts to the public.

7.10.1.2 Air quality objectives

A summary of the GSA (2022b) air quality objectives for the Project is provided in Table 7-19 Air quality objectives comprise the averaging time and maximum concentration for a pollutant and are set out for (airborne) PM_{10}, $PM_{2.5}$, and the gaseous air pollutants NO_2 and CO.

Table 7-19 Air quality objectives (Source Jacobs, 2022c)

Pollutant, Classification	Averaging Time	Maximum Concentration (µg/ m^3)
Particles as PM_{10}, toxicity	24 hours	50
Particles as $PM_{2.5}$, toxicity	24 hours	25
	12 months	8
Nitrogen dioxide (NO_2), toxicity	1 hour	164
	Annual	30
Carbon monoxide (CO), toxicity	1 hour	31,240
	8 hours	11,250

7.10.1.3 Deposited dust objectives

There are no South Australian standards for deposited dust, however, the general environmental duty, defined in section 25 of the EP Act, may be applied to avoid environmental nuisance through the use of 'best available technology economically achievable' (BATEA) and dust management plans (DMPs) (Jacobs, 2022c).

Deposited dust has the potential to impact on amenity, for example, deposited dust is classed as a nuisance by the EPA Victoria (EPAV, 2022), and deposited dust levels are used as air quality impact assessment criteria by EPA NSW (2016). Dust impacts on vegetation health are influenced by a range of factors including the size, shape and composition of the dust, the dust deposition load, meteorological conditions, and the morphology of the vegetation being impacted. As such, there are no accepted standards for assessing dust impacts on vegetation (Jacobs, 2022c).

A summary of dust deposition indicators taken from NSW to assist with interpretation of modelled deposition data is provided in Table 7-20.

Table 7-20 Dust deposition indicators (source Jacobs, 2022c)

Reason for indicator	Dust deposition indicator	Notes
Protection of amenity, maximum totals	Maximum annual average including background, 4 g/ m^2/ month	EPA NSW 2016
	Maximum annual average increase in dust deposition above baseline, 2 g/ m^2/month	EPA NSW 2016

7.10.1.4 Model

The scope of the AQIA was based on meteorological modelling and air dispersion modelling of particulate and gaseous air pollutant emissions for development of the Project. The current assessment included a review of the previous modelling assessment conducted by Katestone (2008) for the J-A site as it was proposed then, and meteorological and dust and other monitoring data collected by Iluka during J-A's operation to date.

Two scenarios were modelled, one representing current emissions from J-A (Scenario 1) and a second consisting of current J-A operation and future Atacama emissions as the future worst-case scenario (Scenario 2). Emissions from Atacama were based on 365 days per year, 24 hours per day operation and peak material volumes in the mining schedule plan, with peak material handling planned for 2029. Emission source locations for Atacama were based on the changes in end of year mining schedule from 2028 to 2029.

It was assumed that stockpiles that were unchanged from 2028 to 2029 in the mine plan were inactive and therefore stabilised or revegetated. The modelling assumed level 2 watering of unsealed roads (>2 L/m^2/hr) and has assumed all roads are unsealed. It also assumed partial pit retention of emissions with mitigation applied to TSP and PM_{10} emission rates per the NPI manual, however no pit retention was assumed for overburden placed back into the pit.

A summary of dust and gaseous pollutant model results for the combined J-A and Atacama mines (Scenario 2) are presented below in Table 7-21 and Table 7-22. The results of this model have been used to inform the air quality impact assessment in Table 7-23, noting that air quality impacts that occur within the J-A lease that are related to the Atacama Project (i.e., Atacama processing and tailings deposition undertaken at existing J-A) will be addressed in the CiO, attached as Appendix D.

Table 7-21 J-A mine and Atacama predicted cumulative model results (Source Jacobs, 2022c)

Pollutant	Averaging statistic	Result location	Predicted cumulative	Air quality objective	Units
Deposited dust	Annual average	Camp	1.6	4	g/ m^2/month
	Increase above background		0.1	2	g/ m^2/month
PM_{10}	24 hr maximum	Camp	36	50	µg/ m^3
$PM_{2.5}$	24 hr maximum	Camp	13	25	µg/ m^3
	Annual average		7.3	8	µg/ m^3
CO	1 hr maximum	Grid	50	31,240	µg/ m^3
	8-hr maximum		8	11,250	µg/ m^3
NO_2	1 hr maximum	Grid	36	164	µg/ m^3
	Annual average	Camp	<1	30	µg/ m^3

Table 7-22 J-A mine and Atacama predicted radiological model results (source Jacobs, 2022c)

Pollutant	Averaging statistic	Result location	Predicted concentration	Units
Radionuclides in deposited dust	Annual average	Camp	0.35	Bq/ m^2/yr
Radionuclides in air	Annual average	Camp	0.13	Bq/ m^2/yr

7.10.1.5 Summary of model results

Modelling assessment results for the worst-case (nearest) sensitive receptor to the existing and proposed operations (the camp) are summarised as follows:

- The results for deposited dust are strongly indicative of a low risk of nuisance dust impact.. A contour plot is shown in Figure 7-8.
- The results for PM_{10} are strongly indicative that dust mitigation measures, (including separation distances), are sufficient for there to be insignificant air quality impacts at the camp (located on J-A's MPL). A contour plot is shown in Figure 7-9.
- The conclusion for 24-hr and annual $PM_{2.5}$ results is that dust mitigation measures, (including separation distances), are sufficient for there to be insignificant air quality impacts at the camp. Contour plots are shown in Figure 7-10 and Figure 7-11.
- The results for the gaseous air pollutants, NO_2 and CO, were insignificant for the camp, as determined by comparisons with their GLCs (Figure 7-12).
- An annual average radionuclide concentration in air of 0.13 Bq/m^3 was predicted for the camp sensitive receptor. The annual average radionuclides in deposited dust 0.35 Bq/m^2/year was predicted for the camp sensitive receptor. Interpretation of radiological model results is not included in Jacobs' scope and is discussed further in Section 7.14.

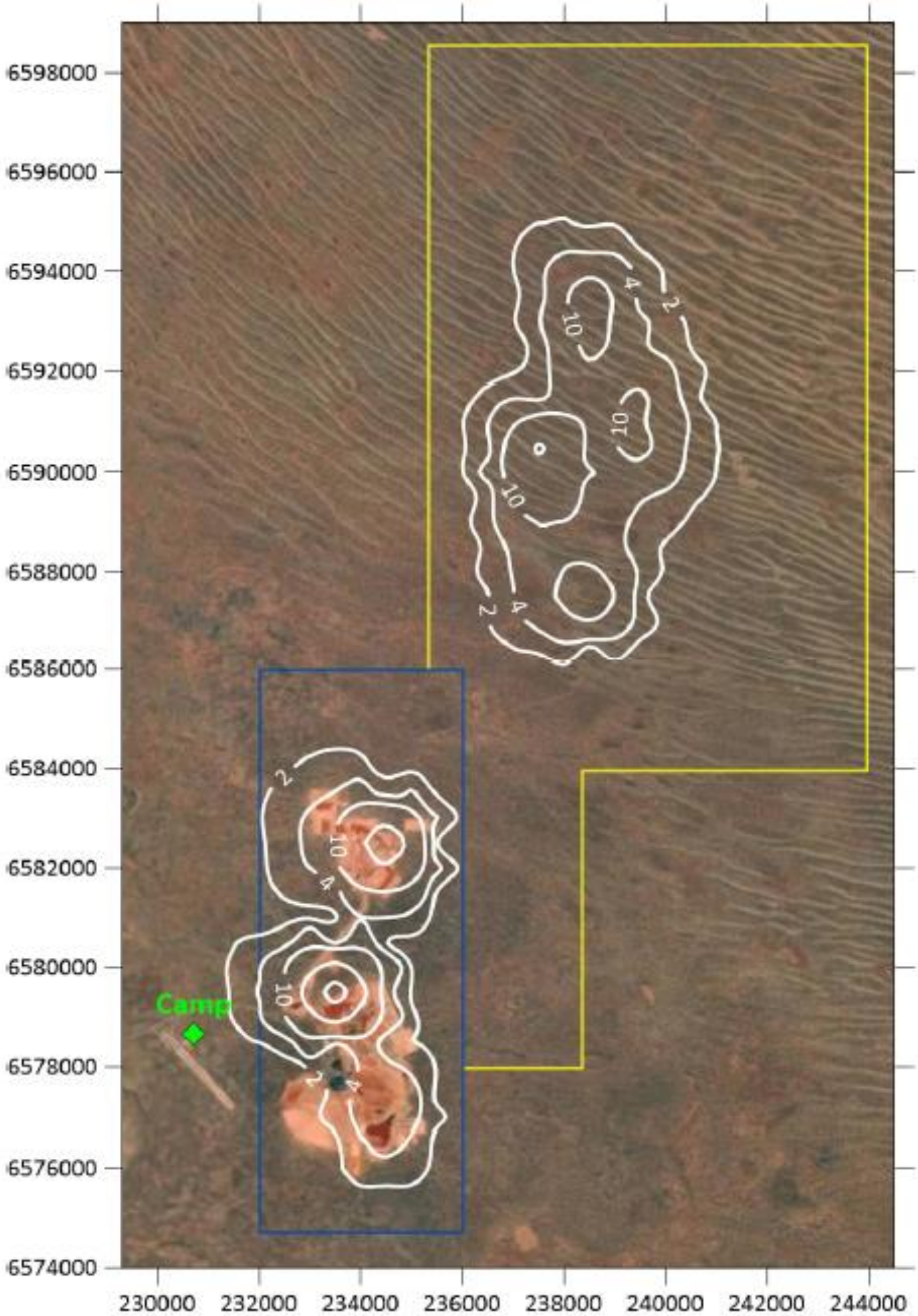

Figure 8-5. Maximum predicted cumulative dust deposition (g/m²/month) – J-A and Atacama

Figure notes:
1. Coordinate reference system UTM Zone 53 in metres

2. Monthly maximum dust deposition assessment criterion is 4 g/m²/month
3. Blue line represents J-A ML
4. Yellow line represents Atacama Project Area

Figure 7-8 Maximum predicted cumulative dust deposition (g/m²/month) (Source: Jacobs, 2022c)

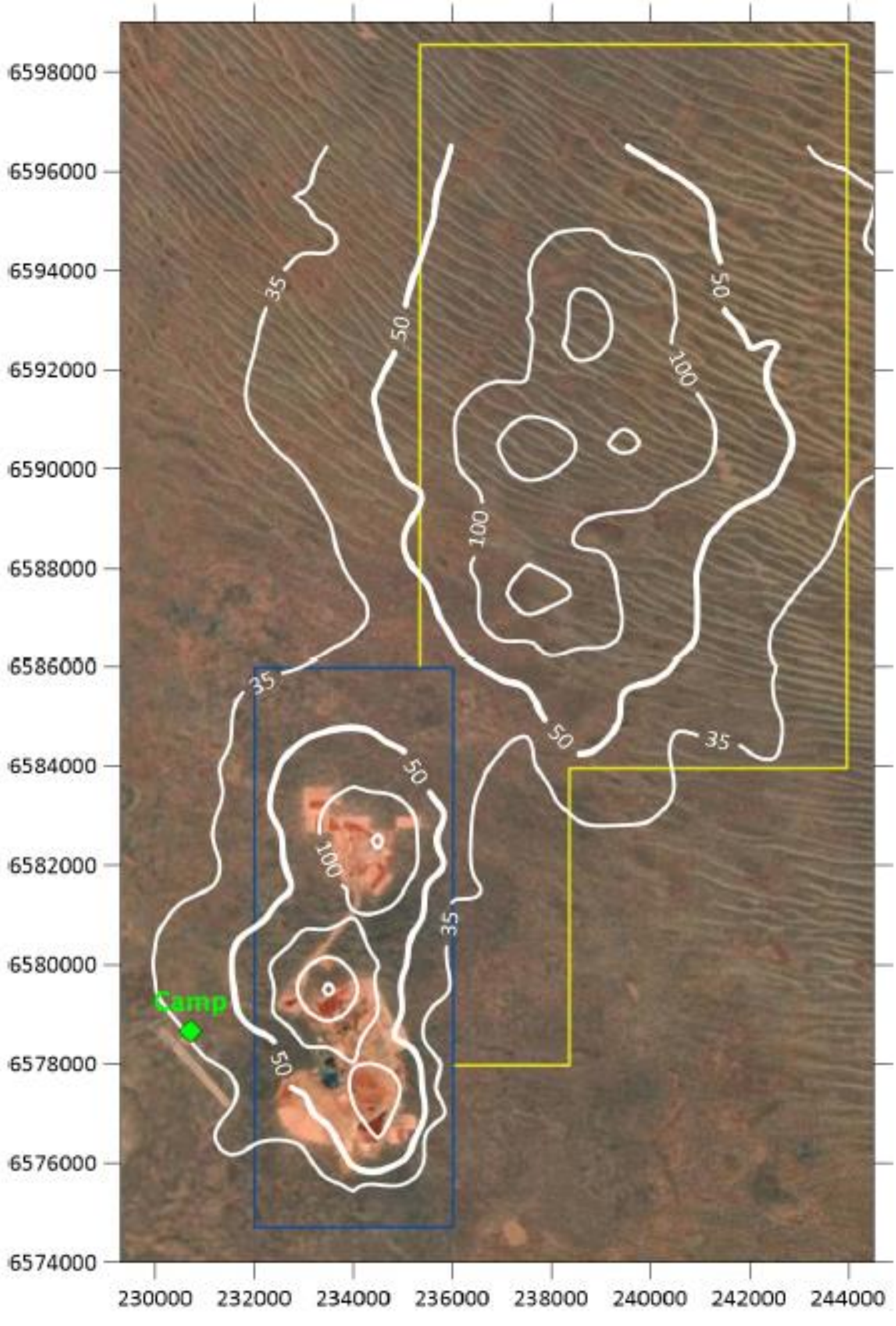

Figure 8-8. Maximum predicted cumulative PM_{10} 24-hour concentrations (µg/m³) – J-A and Atacama

Figure notes:

1. Coordinate reference system UTM Zone 53 in metres
2. 24-hour maximum PM_{10} assessment criterion is 50µg/m³
3. Blue line represents J-A ML
4. Yellow line represents Atacama Project Area

Figure 7-9 Maximum predicted cumulative PM_{10} 24 hour concentrations (g/m³) (Source: Jacobs, 2022c)

Figure 8-6. Maximum predicted cumulative $PM_{2.5}$ 24-hour concentrations (μg/m³) – J-A and Atacama

1. Coordinate reference system UTM Zone 53 in metres
2. 24-hour maximum $PM_{2.5}$ assessment criterion is 25μg/m³
3. Blue line represents J-A ML
4. Yellow line represents Atacama Project Area

Figure 7-10 Maximum predicted cumulative $PM_{2.5}$ 24 hour concentrations (g/m³) (Source: Jacobs, 2022c)

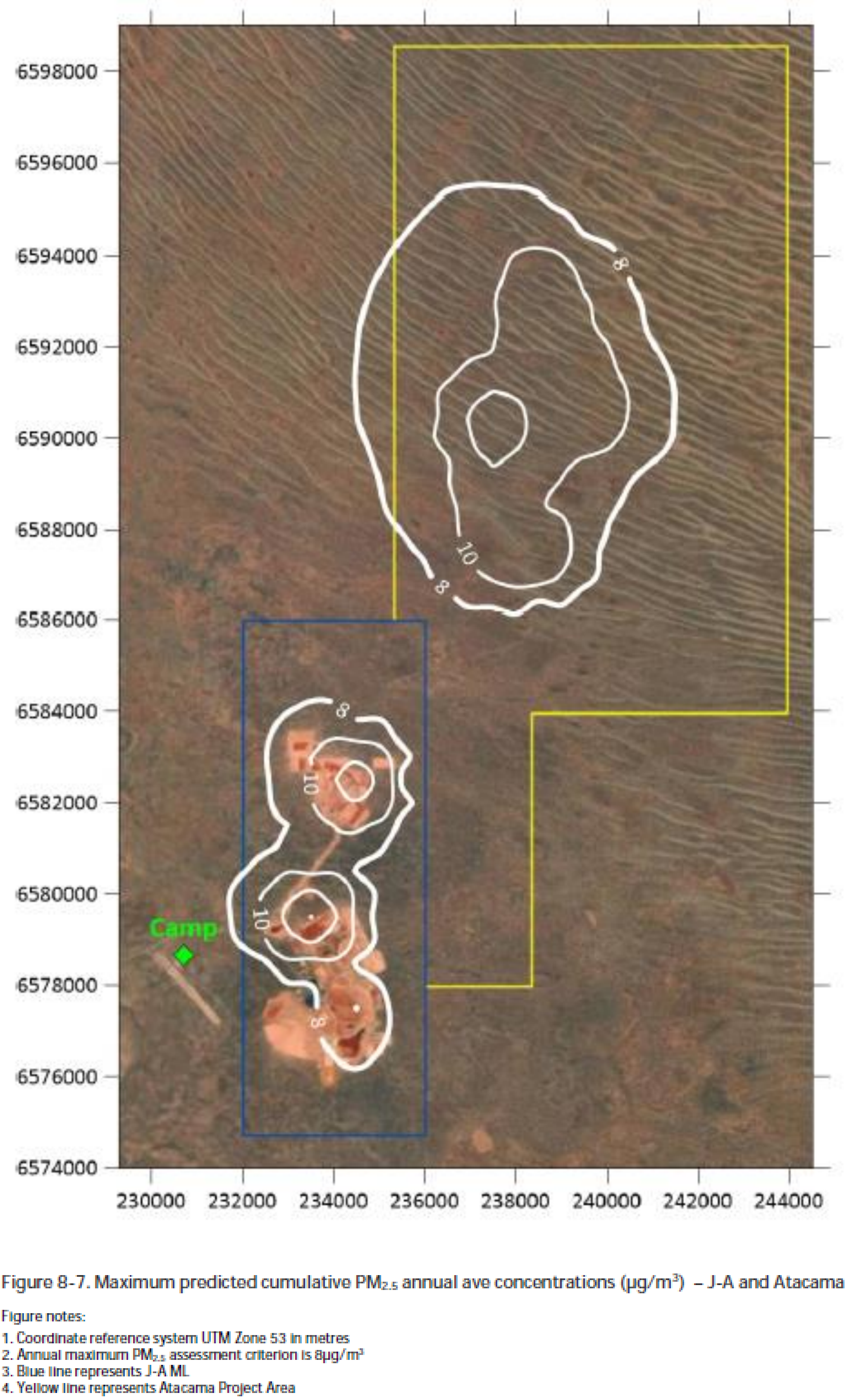

Figure 7-11 Maximum predicted cumulative $PM_{2.5}$ annual average concentrations (g/m³) (Source: Jacobs, 2022c)

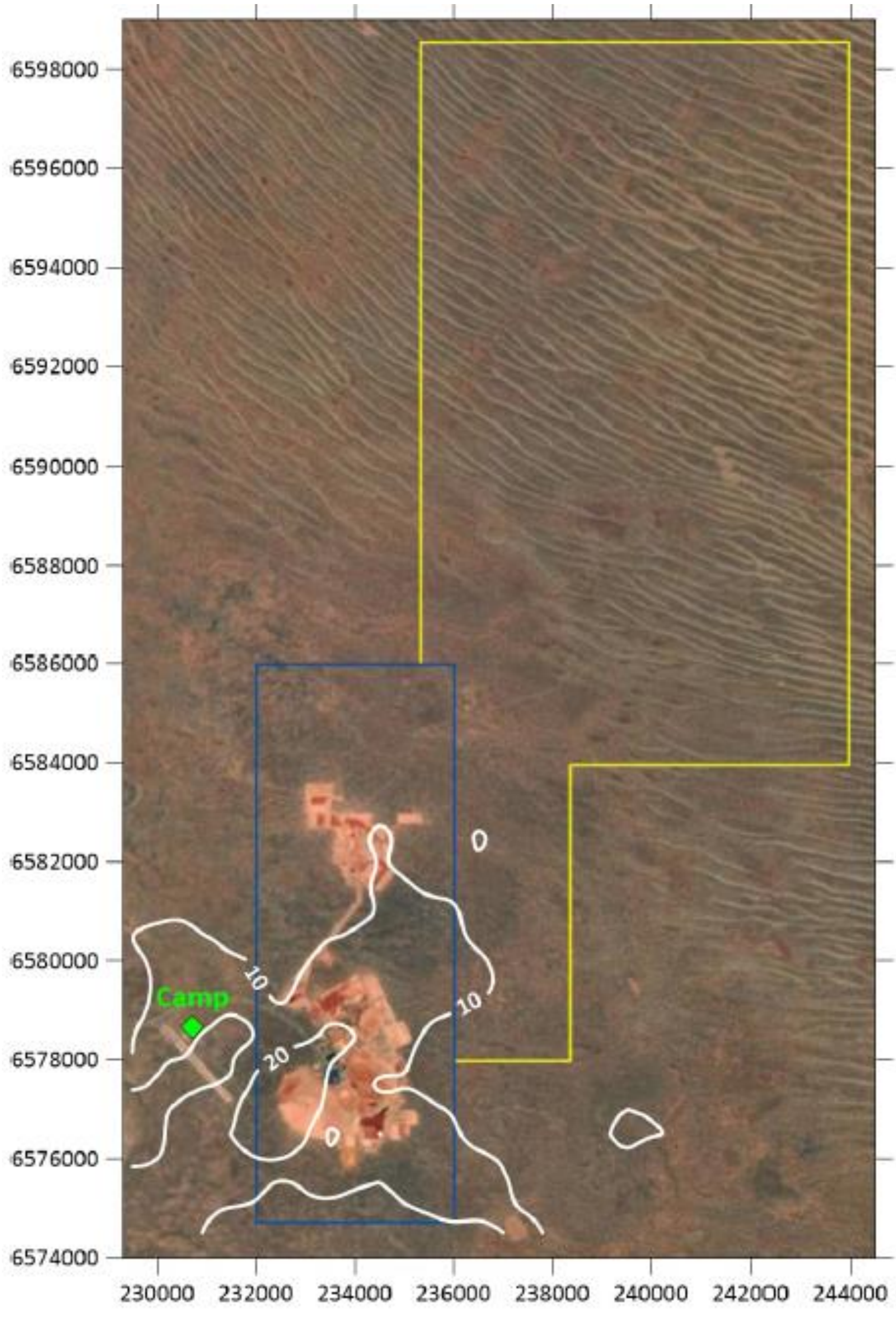

Figure 8-9. Maximum predicted NO_2 1-hour concentrations (µg/m³) – J-A and Atacama

Figure notes:

1. Coordinate reference system UTM Zone 53 in metres
2. 1-hour maximum NO_2 assessment criterion is 164µg/m³
3. Blue line represents J-A ML
4. Yellow line represents Atacama Project Area

Figure 7-12 Maximum predicted NO_2 1 hour concentrations (g/m³) (Source: Jacobs, 2022c)

7.10.1.6 Greenhouse gas emissions

Greenbase Pty Ltd (Greenbase) was engaged to prepare a greenhouse gas (GHG) estimate over the life of the Atacama Project.

The key inputs for estimating the GHG emissions from the Project are diesel combustion from the mining, ancillary and rehabilitation fleets, and electricity sourced from diesel generators.

Emission estimates were provided for the production period, which spans the period 2024 to 2031; and the rehabilitation period, which spans the period 2032 to 2051, inclusive. The Project boundary (for the assessment) included the new mining pits and associated equipment. Additional processing at the existing J-A facility will be required, and the emissions associated with this activity were included in the Greenbase assessment. Business as usual emissions for the J-A facility were not included in the assessment as data were not available (Greenbase, 2022). It was assumed that all electricity required for processing would be sourced from diesel generators and these estimates were provided as Scope 1 emissions. It is noted that this is a conservative assumption as some of the power will be supplied from solar as discussed in Section 4 and Appendix C5.

Scope 2 emissions have not been calculated by Greenbase. If electricity is to be sourced from the grid, Scope 2 emissions will need to be calculated based on the South Australia grid factor (Greenbase, 2022).

The total GHG emissions over the LOM, including rehabilitation, are projected as 636,479 tCO_2-e, with annual emissions peaking at 66,601 tCO_2-e in 2029 (Greenbase, 2022). This includes additional processing of Project ore at the existing J-A facility and equates to average annual emissions of operations of around 23,000 t CO_2-e per annum. This would contribute 0.005% to Australian annual estimated greenhouse gas emissions for the year up to June 2022 of 486.9 Mt CO_2-e/annum (DCCEEW, 2022) and 0.09% to South Australia's 'business as usual' 2020 greenhouse gas emissions of 25 Mt CO_2-e/annum (DEW, 2023).

These figures are based on a worst-case scenario and do not allow for the contribution of solar energy. Upon completion of construction, Atacama will be using solar power supplied from the J-A power network. The existing solar farm located in the J-A ML will be upgraded, with an additional 1 MW generator, bringing the total potential capacity to 13 MW. Further, the existing 11 kV overhead line will be upgraded to a 33 kV overhead power line from the power station to the Ambrosia operation and extended 12 km, adjacent to the access road to MUP 1 and MUP 2.

Cumulative impacts of other Projects have not been considered in this assessment. No carbon offsets are proposed at this time.

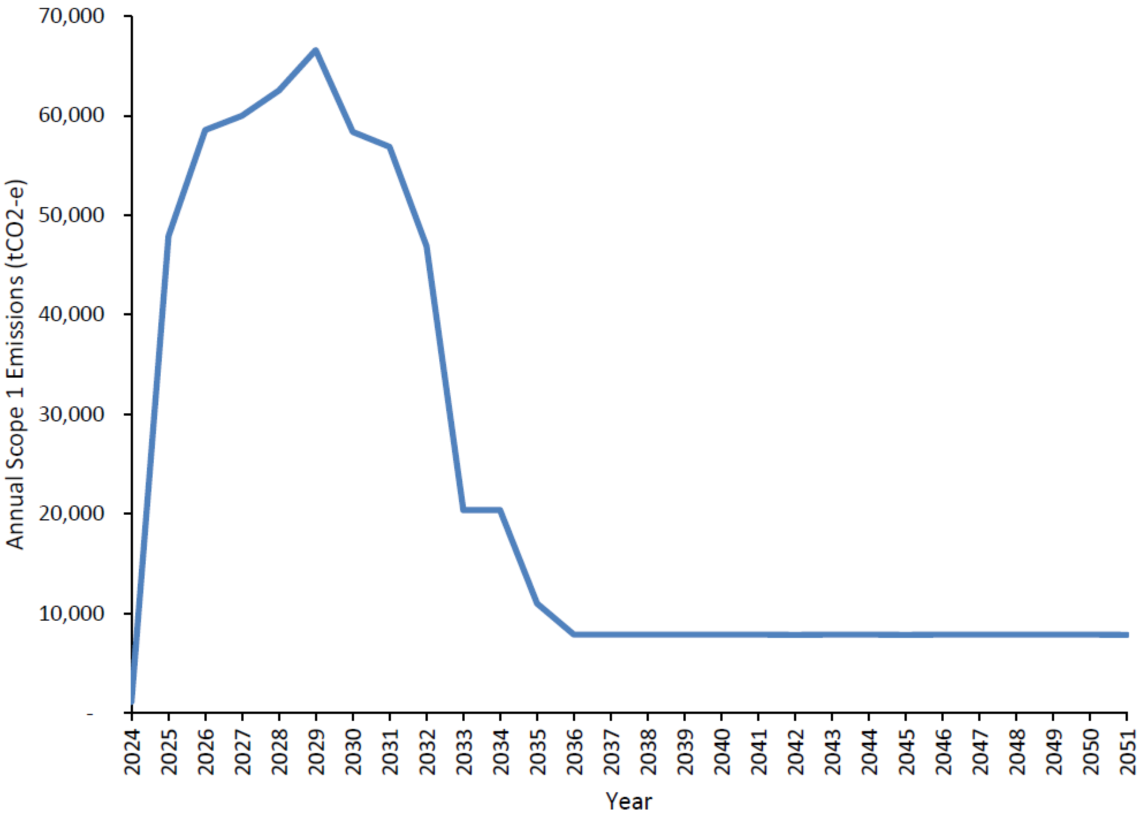

Figure 7-13 Annual diesel combustion emissions over life of mine (Source: Greenbase, 2022).

7.10.2 Potential impact events

Potential impact events are detailed in Table 7-23.

7.10.3 Design, control and management strategies

Design, control and management strategies for the identified impact events are detailed in Table 7-24.

7.10.4 Impact assessment

The air quality impact assessment is presented in Table 7-23.

7.10.5 Draft outcomes, measurement criteria and leading indicators

The draft air quality control measures, outcomes and measurement criteria are presented in Table 7-24.

Table 7-23 Potential impact events: Air quality

Environmental element	Phase	Impact ID	Potential impact event	Source	Pathway	Receptor	Uncertainties and assumptions	Sensitivity to change (in assumptions)	S-P-R linkage? (Yes, No or Uncertain)	Justification for the confirmation/ non-confirmation of an S-P-R linkage?	Description of the likely impact event
Air Quality	Construction Operation Closure	AQ1	Mining activities cause a decrease in air quality due to nuisance dust emissions impacting health of the public.	Dust quantity - wheel generated from mine truck and plant operation. Wind generated dust – stockpiles and disturbed open pit areas.	Aeolian/ wind	Public	AQIA dispersion modelling assumptions are correct. Model assumed the following mitigation measures in place: Water carts on unpaved roads Inactive stockpiles are stabilised. Mining operation progressively backfills and rehabilitates as mining progresses.	Low	No	There are no predicted air quality impacts to the general public due to remoteness of the Project Area with the nearest non mining receptor being Yalata, approximately 75 km to the southwest. No public roads, townships, residential receptors and facilities are in proximity to the Project. Dust modelling undertaken by Jacobs (2022c) for the peak production year indicates that the risk of air quality impacts to the camp (located 14 km from the Project disturbance area) will be low, further demonstrating that potential impacts to the public will not occur. There is no S-P-R linkage.	No predicted impact.
Air Quality	Construction Operation Closure	AQ2	Mining activities cause a decrease in air quality due to fuel combustion contaminant emissions impacting health of the public.	Mine construction and operations Vehicle and machinery operation and idling.	Aeolian	Public	AQIA dispersion modelling assumptions are correct	Low	No	The Project will result in an increase in gaseous emissions, however the nearest non mining receptor, Yalata, is approximately 70 km to the southwest and the modelling assessment undertaken by Jacobs (2022c) showed that all predicted gaseous pollutant concentrations were insignificant for the worst-case mining receptor, the camp, at 8 km from the Project Area. Consideration was also given to locations within the mine site at which a person (employees) would be likely to be present for an hour or more with results indicating a low risk. There is expected to be only a relatively small number of vehicles associated with the Project and air quality impacts due to combustion engine emissions will be negligible. There is no S-P-R linkage.	No predicted impact.

Environmental element	Phase	Impact ID	Potential impact event	Source	Pathway	Receptor	Uncertainties and assumptions	Sensitivity to change (in assumptions)	S-P-R linkage? (Yes, No or Uncertain)	Justification for the confirmation/ non-confirmation of an S-P-R linkage?	Description of the likely impact event
Air Quality	Construction Operation	AQ3	Mining activities cause a decrease in air quality due to nuisance dust emissions impacting native flora.	Dust quantity - wheel generated from mine truck and plant operation. Wind generated dust – stockpiles and disturbed open pit areas.	Aeolian	Native flora	AQIA dispersion modelling assumptions are correct	Low	Uncertain	The development and operation of the Project will result in air pollutant emissions due to land clearing and stockpiling of topsoil and overburden; mining operations in open pits; rehabilitation works and vehicle movements. Increases in dust within the atmosphere can result in adverse effects on vegetation through smothering the plant and inhibiting their ability to photosynthesize. Resulting in reduced plant growth or causing death to existing vegetation, consequently, decreasing the quality habitat. The extent of vegetation exposed to heavy dust is restricted to areas within close proximity to the Conceptual Footprint. Therefore, the impact to vegetation within the Yellabinna Regional Reserve would be minor as the disturbance footprint is relatively small (comparative to the size of the I Reserve). The modelling assessment undertaken by Jacobs (2022c) showed results that are strongly indicative of a low risk of nuisance dust impact. Jacobs further concluded that the recommended dust mitigations for the protection of human health and amenity are generally considered to be adequate for the protection of flora and fauna surrounding the mine site boundaries. The science behind this is uncertain, therefore it is considered still possible that dust emissions could impact on native flora due to stress and dieback. Research into dust deposition at J-A has not supported a definitive fatal effect on flora species, however some species such as the Pearl Bluebush has been affected by dust emissions from J-A. Visual observations have recorded smothering of plants and associated dieback, however, none of those plants have died, and many recover following rainfall and new leaf growth. These results have not been published.	Reduced health of native vegetation resulting from dust emissions and dust deposition.

Environmental element	Phase	Impact ID	Potential impact event	Source	Pathway	Receptor	Uncertainties and assumptions	Sensitivity to change (in assumptions)	S-P-R linkage? (Yes, No or Uncertain)	Justification for the confirmation/ non-confirmation of an S-P-R linkage?	Description of the likely impact event
Air Quality	Construction Operation	AQ4	Increase in emissions due to vehicle and machinery use cause a decrease in air quality impacting native flora and fauna.	Mine construction and operations Vehicle and machinery operation and idling.	Aeolian	Native flora and fauna	AQIA dispersion modelling assumptions are correct	N/A	No	The modelling assessment undertaken by Jacobs (2022c) showed that all predicted gaseous pollutant concentrations were well below respective air quality objectives. Vehicle emissions due to fuel combustion are not expected to occur at a level where there would be negative affects to flora or fauna, as guided by general descriptions in the Evaluation distance for effective air quality and noise management (EPA 2016). There is no S-P-R linkage.	No predicted impact

Environmental element	Phase	Impact ID	Potential impact event	Source	Pathway	Receptor	Uncertainties and assumptions	Sensitivity to change (in assumptions)	S-P-R linkage? (Yes, No or Uncertain)	Justification for the confirmation/ non-confirmation of an S-P-R linkage?	Description of the likely impact event
Air Quality	Construction Operation	AQ5	Combustion of fossil fuels releases GHG to the atmosphere that contribute to GHG emissions impacting on the environment and the ability to achieve National and State greenhouse gas targets.	Vehicle and machinery operation and idling. Diesel generators – energy production	Aeolian	Australia State of South Australia	Emission estimates were provided for the production period, which spans the period 2024 to 2031; and the rehabilitation period, which spans the period 2032 to 2051, inclusive. Emission estimates include the additional processing required at the existing J-A facility. Business as usual emissions for the J-A facility were not included in the assessment as data were not available. The estimate assumed that all electricity required for processing would be sourced from diesel generators. Scope 2 emissions have not been calculated. Cumulative impacts of other projects have not been considered in this assessment.	Low	Yes	Greenbase was engaged to prepare a GHG estimate over the life of the Atacama Project. The key inputs for estimating the GHG emissions from the Project are diesel combustion from the mining, ancillary and rehabilitation fleets, and electricity sourced from diesel generators. The total GHG emissions over the LOM, including rehabilitation, are projected as 636,479 tCO2-e, with annual emissions peaking at 66,601 tCO2-e in 2029 (Greenbase, 2022). This includes additional processing of Project ore at the existing J-A facility. This equates to average annual emissions of operations are anticipated to contribute emissions of around 23,000 t CO2-e per annum, resulting from diesel consumption, as a worst-case scenario. This would contribute 0.005% to Australian projected 'business as usual' greenhouse gas emissions of 656 million tonnes of carbon dioxide equivalent per annum (Mt CO2-e/annum) and 0.09% to South Australia's 'business as usual' 2020 greenhouse gas emissions of 25 Mt CO2-e/annum. These figures are based on a worst-case scenario and do not allow for the contribution of solar energy. Upon completion of construction, Atacama will be using solar power for some of the power demand supplied from the J-A power network. The existing solar farm located in the J-A lease will be upgraded, with an additional 1 MW generator, bringing the total potential capacity to 13 MW. Further, the existing 11 kV overhead line will be upgraded to a 33 kV overhead power line from the power station to the Ambrosia operation and extended 12 km, adjacent to the access road to MUP 1 and MUP 2. Whilst the amount of GHG emissions from the Project is minor compared to both the State and National total, the Project will still contribute. As such an S-P-R linkage is confirmed.	Release of carbon emissions through combustion of fossil fuels causes impact on environment and affects the ability to achieve National and State targets.

Table 7-24 Impact assessment: Air quality

Impact ID	Impact event	Control measures	Uncertainties and assumptions	Sensitivity to change in assumptions	Proposed outcome	Draft outcome measurement criteria	Draft leading indicator
AQ3	Mining activities cause a decrease in air quality due to nuisance dust emissions impacting native flora.	**Design** Vegetation cleared in accordance with approval, with retention maximized. Minimisation of open areas through staged clearing. **Control** Use of water carts on unpaved roads to minimise wheel-generated dust by haul trucks. Stabilisation of stockpiles using suppressant (enhancing surface crusting). Vehicle speed limits in accordance with TMP. Procedures for vegetation clearance and removal of soil profiles for stockpiling or direct return. Timing and management of clearance to minimise erosion. Revegetation of rehabilitated areas. **Management** Ongoing maintenance of haul roads. Dust and Air Quality Management Plan. Native Vegetation Management Plan. Mineral Stockpiles Management Plan. Rehabilitation Management Plan. Weather forecast and field suppression plans as part of the Dust and Air Quality Management Plan. Site induction inclusive of details on dust risks and management.	Research into dust deposition at J-A have provided credible, but so far unpublished results of non-fatal impacts on flora species including smothering of foliage with dust and associated dieback with recovery following rainfall.	N/A	The Tenement Holder must ensure that all clearance of native vegetation is authorised under appropriate legislation	**Construction and operation** Monitoring of vegetation health to be undertaken to measure: • plant mortality • new growth • evidence of flowering and fruiting • extent of smothering • evidence of saline stress.	None proposed
AQ5	Potential contribution of greenhouse gas to state and national emissions.	**Design** Reduce disturbance footprint that would otherwise be disturbed during land clearing. Incorporation of renewable energy electricity sources to replace diesel generated electricity. Use of emissions control equipment on fixed and mobile plant and equipment. **Management** Consideration of Iluka's emission offset strategy	N/A	N/A	The Tenement Holder will provide annual updates on GHG emissions	**Construction and operation** Annual reporting of operational emissions into the National Pollution Inventory (NPI) database and reporting under the National Greenhouse and Energy Reporting NGER (www.cleanenergyregulator.gov.au).	None proposed

7.11 Visual amenity

This section describes how the Project may impact on visual amenity values and sets out the measures that will be implemented to minimise those impacts.

Sections 0, 3.12 and 3.13 provide detail on the existing topography and landscape, local community and landowners and land use, all of which are relevant in the context of visual amenity. Section 4 provides details of the proposed mining activity.

7.11.1 Context

The landscape and visual amenity of the Project Area will be impacted by the proposed mine, including during construction, operation and closure.

The Project Area is within the western fringe of the Yellabinna Dunefield within the Yellabinna Regional Reserve, known for its high natural and wilderness values. Dominant land uses of the Reserve are the conservation of wildlife, conservation of landscape, Aboriginal land use, mineral exploration and tourism. The dunefields in the Project Area are characterised by a gradational change from north to south with parallel steep sided dunes in the north grading to dunes with broader swales and change of vegetation, which then grade to the gentle slopes and plains associated with bluebush and saltbush. Rehabilitation of this landform will avoid post closure mine voids and will reinstate natural contours outside of mine pits and minimise impacts to dunal vegetation. No tailings will be deposited in the pits, and upon rehabilitation a swale landform will be reinstated in place of the pit and the batters to the dune crests softened and stabilised with woody debris. Additional overburden will be used where available to reinstate a 'saddle' between cut dunes with the swales and dune crests reinstated with topsoil to depths of 10 cm and 30 cm, respectively. Figure 4.16 presents the conceptual final landform.

The Project Area is isolated from town and population centres and the current adjacent land use includes the mining of heavy mineral sands at J-A. There are no residents or communities in the vicinity of the Project Area, with the nearest town being the Yalata Aboriginal community approximately 75 km to the south, whilst Ceduna is the nearest largest population centre, approximately 290 km to the southeast. Similarly, there are no public roads adjacent to, or in the vicinity of the Project Area and all transport and traffic associated with the Project will enter through the neighbouring J-A haul road (from Ambrosia) which will be extended to service the Project.

Receptors potentially affected by alteration to the landscape include local Aboriginal groups and tourists and staff visiting the Yellabinna Regional Reserve. Aboriginal groups may be affected during construction, operation and closure. Members of the FWCAC are permitted to access areas on Iluka's tenements for cultural purposes, including hunting and gathering and the use of Atacama is likely to be limited to occasional passing through; as no significant cultural or hunting sites are currently known to be close by and greater than 24-hour residency by Aboriginal groups would be unusual (Joanne Lee, personal communication, 20 July 2022).

Tourists and visitors may also be affected during closure. The Yellabinna Regional Reserve is remote and at present, the main visitor facilities and walking tracks are located at Mt Finke Campground, approximately 168 km east of the Project Area. Public access to the Reserve is via the Googs Track only and travel from south to north is recommended by Parks SA (Department for Environment and Water, 2023). Figure 7-14 presents the Project Area in the context of the Reserve, the campground and public access from Googs Track, highlighting that it is unlikely that visitors will be walking in proximity to the Project Area however the possibility remains given that the post closure landform will return to pre mine land use as a regional reserve.

Consultation with Aboriginal groups, DEW as the landowner and the Yumbarra Co-Management Board have been and will continue to be undertaken, with relevance to visual amenity and the proposed post disturbance landform design and how the Project will affect the long-term character of the landscape and the nature of changes to landform and vegetation. The Project aims to ensure that visual impacts are kept as low as reasonably practicable throughout operation and that the post closure landform is consistent with the surrounding topography. Visual simulations[16] have been produced by Truescape (2022) for the three largest pits; western, central and eastern, to aid in comparison of the likely pre and post mining landscapes. Three viewpoints (Figure 7-15) were selected and are shown in Figure 7-16, Figure 7-17 and Figure 7-18.

The Project Area is remote and will not affect residential receivers, or the general public. Potential visual amenity issues at both a local and regional level are related to construction and operation of the mine and the post mining landform and how this may affect cultural groups and Reserve visitors.

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[16] Camera Positions

The virtual cameras have been placed close the given location of from-which the reference photography was taken. The ground level viewpoints are placed at 1.65 m above the digital terrain, which is considered average human eye level and rendered with a 24 mm lens.

Surrounding3DContextModels:

Foreground features and any other surrounding context visible from the chosen viewpoint was 3D modelled using any publicly available photography of the areas as well as Google Earth and other Satellite imagery. The species as well as heights of any 3D tree and other vegetation models are determined using any of the above-mentioned image references as well as any publicly available regional data.

3DTerrainModels:

SRTM Worldwide Elevation Data (1-arc-second Resolution, SRTM Plus V3) DEM was used to create the 3D terrain model in this simulation at approximately 30 m spatial resolution. The 1 arc-second DEM tiles are derived from diverse source data that are processed to a common coordinate system and unit of vertical measure. Accuracy of the simulations therefore lie within the tolerances of datasets available. The absolute vertical accuracy for SRTM heights has been found to be ~9 m (90 % confidence) or better (Rodriguez et al. 2005). In addition to the above, LIDAR data as well as Iluka positioned DXF models of landforms were used, as supplied by Iluka.

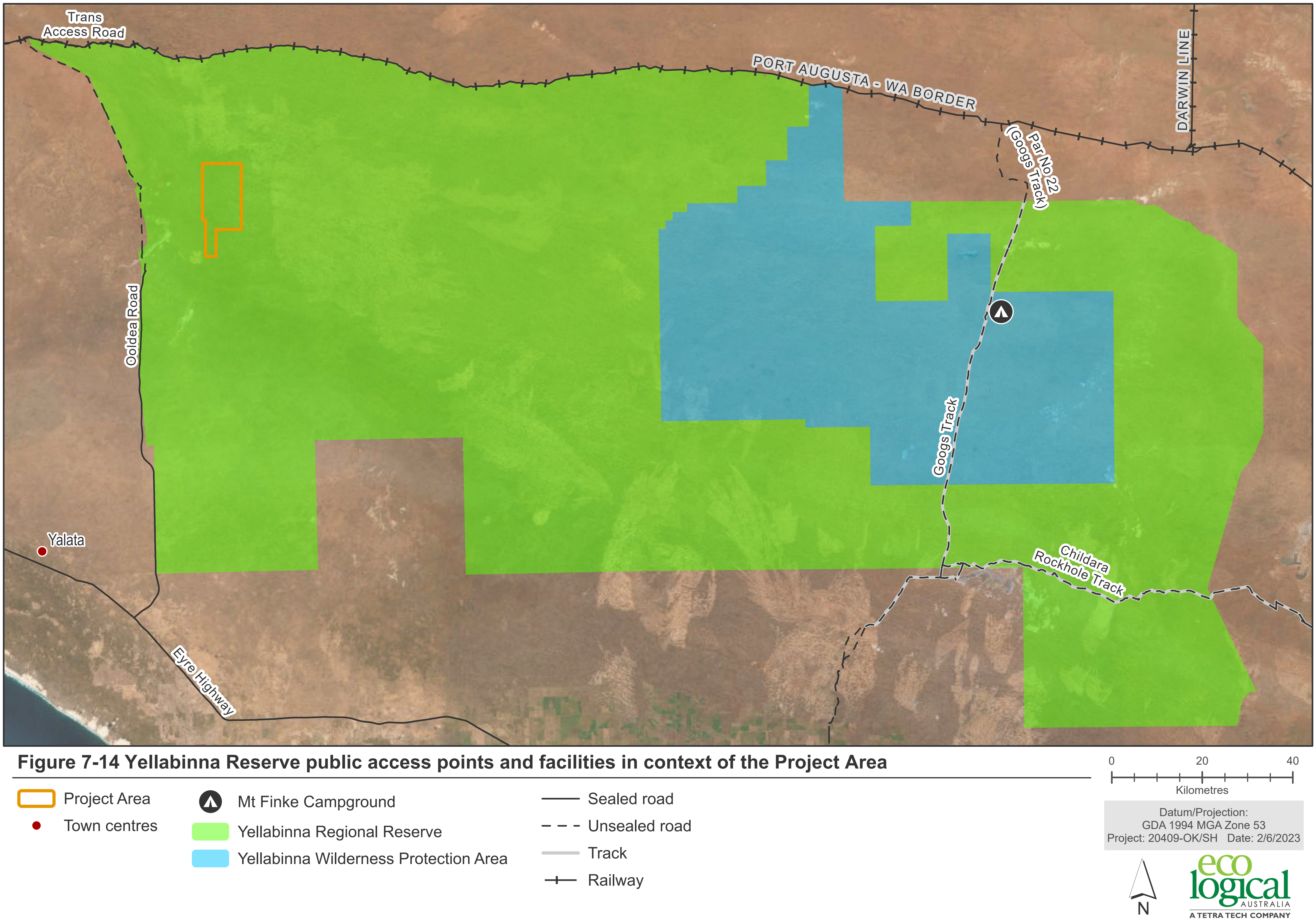

Figure 7-14 Yellabinna Reserve public access points and facilities in context of the Project Area

Figure 7-15 Visual simulation viewpoint location map (Source: Truescape, 2022)

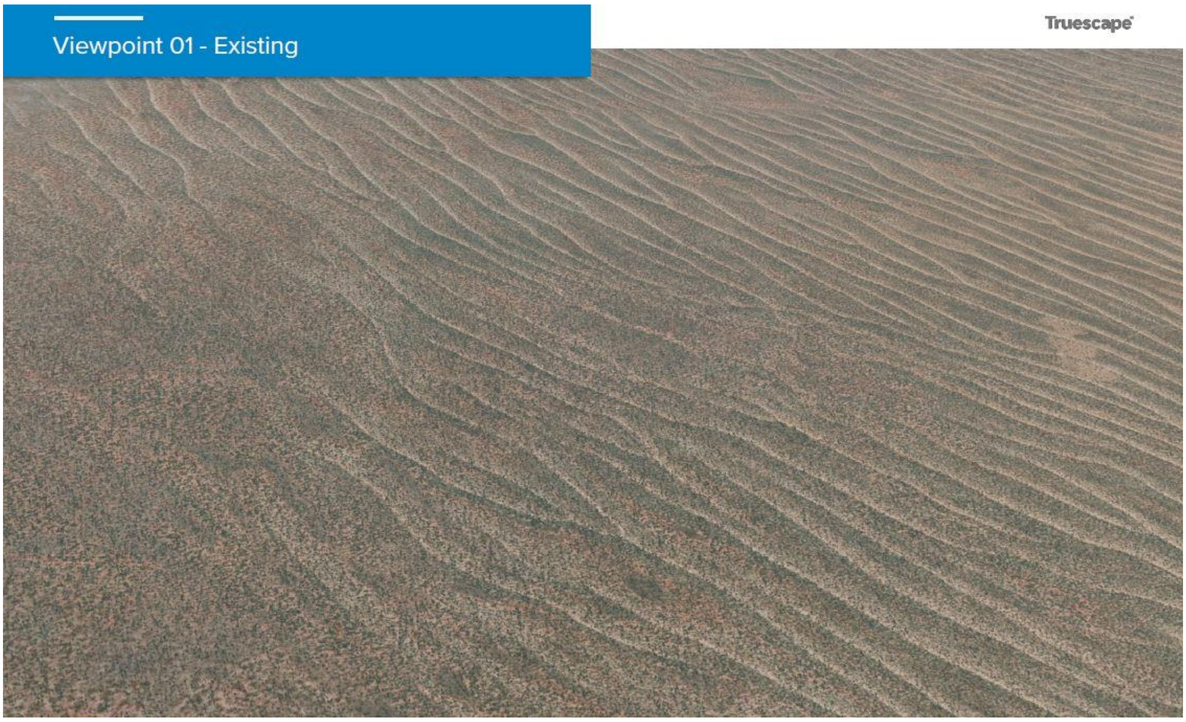

Figure 7-16 Viewpoint 01 looking northwest towards western, central and eastern pits showing pre mining (top) and proposed filled voids (bottom) (Source: Truescape, 2022)

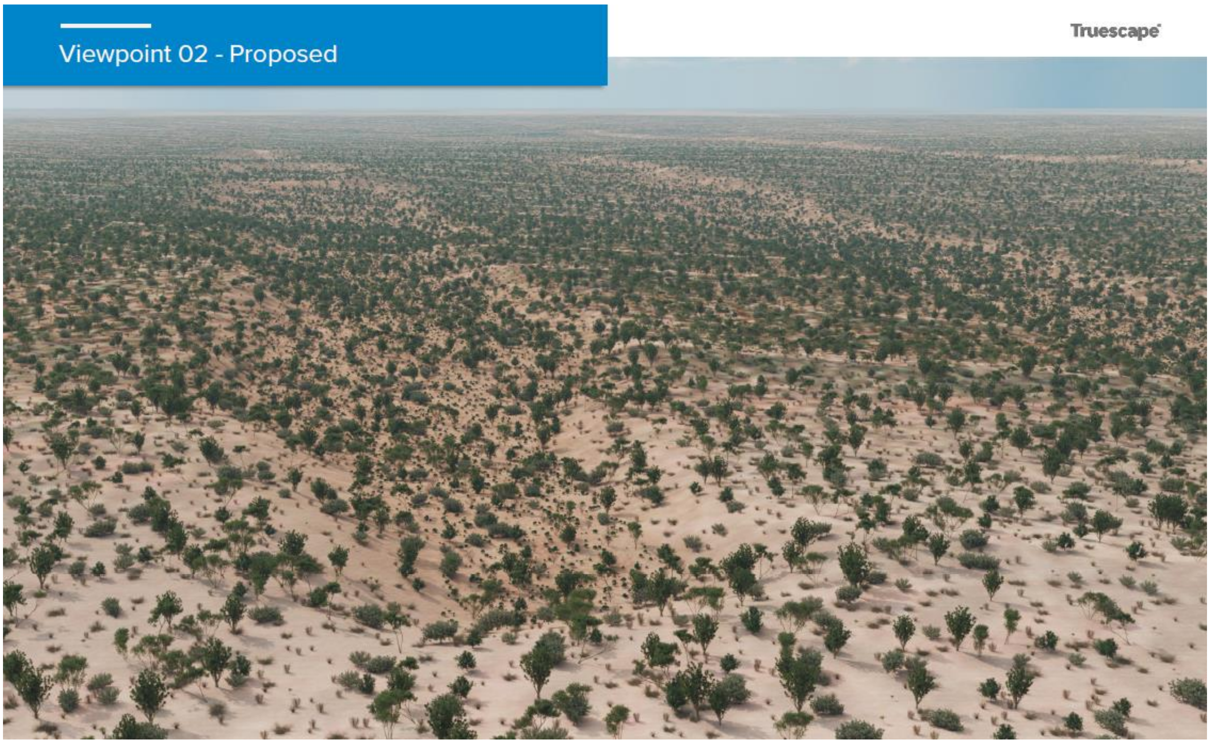

Figure 7-17 Viewpoint 02 at southern extent of western pit, looking north towards western, central and eastern pits showing pre mining (top) and proposed filled voids (bottom) (Source: Truescape, 2022)

Figure 7-18 Viewpoint 03 at the southern extent of central pit, looking slightly northwest north towards western, central and eastern pits showing pre mining (top) and proposed filled voids (bottom) (Source: Truescape, 2022)

7.11.2 Potential impact events

Potential impact events are detailed in Table 7-25.

7.11.3 Design, control and management strategies

Design, control and management strategies for the identified impact events are detailed in Table 7-26.

7.11.4 Impact assessment

The visual amenity environmental impact assessment is presented in Table 7-25.

7.11.5 Draft outcomes, measurement criteria and leading indicators

The draft visual amenity control measures, outcomes and measurement criteria are presented in Table 7-26.

Table 7-25 Potential impact events: Visual amenity

Environmental element	Phase	Impact ID	Potential impact event	Source	Pathway	Receptor	Uncertainties and assumptions	Sensitivity to change (in assumptions)	S-P-R linkage? (Yes, No or Uncertain)	Justification for the confirmation/ non-confirmation of an S-P-R linkage?	Description of the likely impact event
Visual Amenity	Construction Operation	VA1	The presence of mine infrastructure as well as mine construction and operation activities (including clearing, excavation of pits, stockpiling, dust generation and lighting) result in adverse impacts to visual amenity.	Mine operations and infrastructure	Line of sight	Visitors and staff of Yellabinna Regional Reserve Aboriginal people – members of FWCAC	Receptors are adequately consulted with thorough stakeholder engagement. There are no private landholders/ residents in 75 km radius or in Yellabinna Regional Reserve.	Low	Yes	The Project Area is remote and away from developed areas. The Project Area is isolated with the nearest town, the Yalata Aboriginal community, located approximately 75 km to the south. Ceduna, the closest large population centre is 290 km to the southeast of the Project Area (WSP, 2023). There are no residential or rural residential receptors in the vicinity, with the nearest residence at Yalata. The Project Area is not visible from public roads, and no new public roads are proposed to be constructed to facilitate the Atacama operation. No visual screening is proposed. There are no anticipated impacts to private landholders or public road users during construction and operation. Despite the above, the Project Area is within a Reserve and given the regional reserve status of the site, it is possible that in rare instances, there may be visitors to the broader area, including Aboriginal people and tourists/ visitors and staff of the Reserve. There may be impact to these users on rare occasion during construction and operation.	Reduced visual amenity to visitors and staff of Yellabinna Regional Reserve and Aboriginal people caused by mining construction and operations.

Environmental element	Phase	Impact ID	Potential impact event	Source	Pathway	Receptor	Uncertainties and assumptions	Sensitivity to change (in assumptions)	S-P-R linkage? (Yes, No or Uncertain)	Justification for the confirmation/ non-confirmation of an S-P-R linkage?	Description of the likely impact event
Visual Amenity	Closure	VA2	The post mining landforms result in adverse impacts to visual amenity, within the context of the broader Reserve.	Rehabilitation and altered landforms	Line of sight	Visitors and staff of Yellabinna Regional Reserve Aboriginal people - members of FWCAC	Receptors are adequately consulted with through stakeholder engagement. There are no private landholders/ residents in 75 km radius or in Yellabinna Regional Reserve.	Low	Yes	It is possible that if not adequately designed and successfully implemented the post-mining landform and vegetation will have an impact on the visual amenity of the Project Area. The Project Area is in a Regional Reserve, managed by the Yumbarra Co-Management Board, a partnership between the FWCAC and the DEW. Members of the FWCAC can access areas on the tenement for cultural purposes, including hunting and gathering and the use of Atacama both during Operation and Post Closure may include occasional passing through. Although the area is remote from the existing Yellabinna Regional Reserve visitor facilities located at Mount Finke Campground, the Project Area is located within a regional reserve which is considered to have high natural and wilderness values. Access to the public will be allowed when rehabilitation is completed, and the lease is relinquished. The post closure landform may impact these users on rare occasion following completion of rehabilitation.	Reduced visual amenity at site closure caused by post mining landforms, affecting visitors and staff of Yellabinna Regional Reserve and Aboriginal people.

Table 7-26 Control measures and proposed outcomes: Visual amenity

Impact ID	Impact event	Control measures	Uncertainties and assumptions	Sensitivity to change in assumptions	Proposed outcome	Draft outcome measurement criteria	Draft leading indicator
VA1	Construction and presence of mine infrastructure as well as excavation of pits and mine operation results in adverse impacts to visual amenity	**Design** Design and siting of infrastructure to minimize impact. The MUP and roads will be aligned with pits and will disturb dune crests. All other infrastructure, stockpiles and disturbances will be limited to within the swales rather than the crests to the greatest extent practicable. The Project will maximise the use of services at J-A to minimize infrastructure required at the Project Area. Incorporation of progressive rehabilitation into the rehabilitation plan to the greatest extent practicable. **Control** Ongoing dust control during construction, operation and rehabilitation, implemented as discussed in Section 7.10. Staging of pit excavation and clearing of vegetation to minimise the disturbed area at any time during the operation phase. Progressive rehabilitation of the site will be undertaken during the life of the mine in accordance with rehabilitation plan. **Management** Implementation of Stockpile Management Plan. Implementation of Rehabilitation Management Plan.	Mine construction will be as per design. Rehabilitation activities are effective and in accordance with the rehabilitation plan.	Low	The tenement holder must ensure that the mining operations are conducted in accordance with the approved mine plan and that key stakeholders are engaged with throughout construction and operation.	**Construction and operation** Internal audit demonstrates that the mine infrastructure and layout are constructed in accordance with the approved mine plan.	None proposed
VA2	Reduced long term visual amenity caused by post mining landforms, affecting visitors and staff of Yellabinna Regional Reserve and local Aboriginal people.	**Design** Design of final landform to be compatible with existing environment including all areas outside mine pits. Design of final landform to be developed in accordance with erosion and surface water assessment. Consultation with land managers and FWCAC on proposed post disturbance landform design. **Management** Implementation of rehabilitation plan during operations and post closure. Implementation of mine closure plan	Rehabilitation activities are effective and in accordance with rehabilitation plan.	Low	The tenement holder must ensure that the reconstructed final landform is consistent with approved rehabilitation plan.	**Closure** Topographic survey of rehabilitated site compared with approved design (comparison of RLs).	None proposed

7.12 Traffic

This section describes how the Project may impact on the existing traffic environment. Section 4 provides details of the proposed mining operations, including access and existing roads in Section 4.7.1.

Hatch have completed a Traffic Impact Assessment for Atacama (Hatch 2022) which has informed the preparation of this section. The report is attached in full as Appendix C6.

7.12.1 Context

The Atacama Project is located in a remote area, located approximately 200 km northwest of Ceduna, or 265 km by road. Penong is the closest town directly impacted by traffic, located 71 km west of Ceduna.

A new haul road will be constructed (Figure 7-19) between Ambrosia and Atacama which will be utilised for supplies transport to the mine site. The new haul road is designed so that heavy vehicular traffic including fully loaded semi-trailer and road trains can be accommodated. The haul road will follow the existing surveyed exploration track alignment to minimise dunes cuts. After primary screening through the MUP ore will be slurry pumped from Atacama to J-A for processing. The pipeline will follow the same alignment as the haul road.

All transportation of product will occur from J-A to Port Thevenard, along the current route used by the J-A operation (Figure 7-19) – via Ooldea Road (93 km) and then the Eyre Highway (176 km).

Figure 7-19 Proposed haulage route between Ceduna and Atacama (Source: Hatch, 2022)

There are no upgrades required to public roads as Iluka has already invested $25 million (Hatch, 2022) in upgrades as part of the J-A operation.

During the construction phase building materials will be required to be brought to the Project, likely via heavy vehicles (B-doubles or road trains), modules which will be transported to comply with oversize and/ or overmass (OSOM) pilot and escort requirements and transportation of surface mining equipment (SME). This is likely to require between 400-450 trucks over the construction phase (12 months), which represents an average of nine trucks per week (Hatch, 2022) and 45 pieces of SME. Extra people will be required during construction which will for the most part be FIFO. Conservatively it has been estimated that 20-40 additional vehicle movements a day may occur during construction for people (Hatch, 2022).

The haulage of HMC during operations represents a continuation of the J-A operation in terms of daily truck frequency, vehicle type and route. Atacama will move approximately 4.1 Mt of additional HMC which represents approximately 33,580 additional loads over the LOM (Hatch, 2022). A comparison of the trucking profile from J-A with and without the Atacama Project is presented in Table 7-27.

Table 7-27 Comparison of trucking profile with and without Atacama (Source: Hatch, 2022)

Year	J-A without Atacama			J-A with Atacama		
	Loads per day	Loads per year	Comments	Loads per day	Loads per year	Comments
2022	14	5,510	Business as usual	14	5,510	J-A only
2023	14	5,510		14	5,510	J-A only
2024	14	5,510		14	5,510	J-A only
2025	6	2,190	Winding down of transport	14	5,510	J-A and Atacama
2026	6	2,190		14	5,510	J-A and Atacama
2027	6	2,190		14	5,510	J-A and Atacama
2028	6	2,190		14	5,510	J-A and Atacama
2029	0	0	-	14	5,510	J-A and Atacama
2030	0	0	-	14	5,510	J-A and Atacama
2031	0	0	-	14	5,510	J-A and Atacama
2032	0	0	-	6	2,190	Atacama only
2033	0	0	-	6	2,190	Atacama only
2034	0	0	-	6	2,190	Atacama only

Year	J-A without Atacama			J-A with Atacama		
	Loads per day	Loads per year	Comments	Loads per day	Loads per year	Comments
Indicative remaining loads without Atacama			**24,090**	**Indicative remaining loads with Atacama**		**57,670**
Tonnes per truck			**124**	**Tonnes per truck**		**124**
Total tonnes			**2,987,160**	**Total tonnes**		**7,151,080**

During operations people will also be required to be transported. It is expected that a further 300-350 FTE (including contractors) will be required. The majority of this workforce will be fly-in-fly-out (FIFO), however a small percentage will drive-in-drive-out (DIDO) from within the Far West Coast region. It is estimated that this would result in an additional 20-40 vehicle movements per day (Hatch, 2022).

7.12.2 Potential impact events

Potential impact events are presented in Table 7-28.

Please note that all potential impact events have been listed, however only those relating to this MLP are discussed in detail. Where relevant those relating to already approved tenements are discussed in the Change in Operations document (Appendix D).

7.12.3 Design, control and management strategies

There were no S-P-R linkages identified for traffic impacts and as such, no design, control and management strategies are presented.

7.12.4 Impact assessment

The traffic impact assessment is presented in Table 7-28.

7.12.5 Draft outcomes, measurement criteria and leading indicators

There were no identified S-P-R linkages and as such, there is no presentation of traffic specific control measures, outcomes and measurement criteria.

Table 7-28 Potential impact events: Traffic

Environmental element	Phase	Impact ID	Potential impact event	Source	Pathway	Receptor	Uncertainties and assumptions	Sensitivity to change (in assumptions)	S-P-R linkage? (Yes, No or Uncertain)	Justification for the confirmation/ non-confirmation of an S-P-R linkage?	Description of the likely impact event
Traffic	Operation	T1	Increased traffic accidents involving mining traffic due to an increase in duration (not vehicle movements) of the use of the existing traffic route for HMC transport.	Vehicle Movements	Transport of HMC along Eyre Highway and other publicly accessible roads	Other vehicles, members of the public, livestock	HMC transport will occur from the already approved J-A tenement. Please refer to the CiO Application (Appendix D) or the J-A MLP for more information.				
Traffic	Operation	T2	Increased traffic accidents involving mining traffic (persons) driving to the Project from the Far West Coast region.	Vehicle Movements	Transport (persons) along Eyre Highway and other publicly accessible roads.	Other vehicles, members of the public, livestock	Majority of the workforce will be FIFO; the DIDO workforce is expected to add around 20-40 vehicles on the road per day. The exact number of DIDO workers at this stage is unknown. The crash history on the current road route (J-A to Thevenard) is low.	Low	Yes	Mining for the Project is expected to last seven years, followed by three to four years of processing of stockpiled material (all processing to occur at J-A). The quantum and composition of this traffic is difficult to estimate, however it is reasonable to assume that (worst case) during this time 20-40 additional vehicles can reasonably be expected to be on public roads per day as a result of the Project (Hatch, 2022). The Traffic Impact Assessment by Hatch (2022) concluded that this additional transport is likely to have a negligible impact on the public road network.	Increased traffic incidents involving workforce traffic due to an increase in vehicle movements the operation phase of the Project.
Traffic	Operations	T3	Increased potential for amenity issues or complaints due to an increase in population size in the regional towns and traffic movements relating to the transportation of HMC from the J-A ML.	Vehicle movements	Transport of HMC along Eyre Highway and other publicly accessible roads	Other vehicles, members of the public, livestock	HMC transport will occur from the already approved J-A tenement. Please refer to the CiO Application (Appendix D) or the J-A MLP for more information.				
Traffic	Operation	T4	Increased potential for amenity issues or complaints due to an increase in duration of HMC transportation from the J-A ML.	Vehicle Movements	Transport along Eyre Highway and other publicly accessible roads.	Members of the public	HMC transport will occur from the already approved J-A tenement. Please refer to the CiO Application (Appendix D) or the J-A MLP for more information.				

Environmental element	Phase	Impact ID	Potential impact event	Source	Pathway	Receptor	Uncertainties and assumptions	Sensitivity to change (in assumptions)	S-P-R linkage? (Yes, No or Uncertain)	Justification for the confirmation/ non-confirmation of an S-P-R linkage?	Description of the likely impact event
Traffic	Construction	T5	Increased potential for amenity issues or complaints due to an increase in vehicle movements or change in type/ size of vehicles during the construction phase.	Vehicle Movements	Transport along Eyre Highway and other publicly accessible roads.	Members of the public	Complaints received for the J-A operation relating to amenity issues for transport is low.	Low	Yes	During the construction phase (12 months) there will be an increase in vehicle movements along public roads to bring construction related items (SME, persons, modules and building supplies) to the Project Area. This will be approximately 400-450 trucks (average of nine trucks per week), 45 pieces of SME and 20-40 additional vehicle movements a day. During this time there is the potential for complaints to be raised by members of the public.	Increase in complaints and amenity issues from sensitive receptors regarding traffic generated during the construction phase of the Project.
Traffic	Construction	T6	Increased traffic accidents involving mining traffic due to an increase in vehicle movements and change in type and size of vehicle during the construction phase of the Project.	Vehicle Movements	Transport along Eyre Highway and other publicly accessible roads. Transport along haul road/s.	Other vehicles, members of the public	The crash history on the current road route (J-A to Thevenard) is low.	Low	Yes	See above. During this time there is the potential for accidents to occur as a result of construction traffic changes.	Increased traffic incidents involving mining traffic due to an increase in vehicle movements and/ or change in type/ size of vehicles during the construction phase of the Project.

Table 7-29 Control measures and proposed outcomes: Traffic

Impact ID	Impact event	Control measures	Uncertainties and assumptions	Sensitivity to change in assumptions	Proposed outcome	Draft outcome measurement criteria	Draft leading indicator
T2	Increased traffic incidents involving workforce traffic due to an increase in vehicle movements during the operation phase of the Project.	**Control** Policy to limit heavy vehicle travel after dark, speed controls around townships. **Management** Regular review, update and implementation of existing Traffic Management Plan for the operations to ensure that the Plan is current and fit for purpose throughout the proposed route use duration extension. The review must include, but not be limited to speed restrictions, access points, road inspections, sensitive receptors along the route. Implementation of an Emergency Response Plan and training. Maintain on-site emergency response team, including assets and equipment. Road maintenance. Training on traffic and incident management.	Existing systems and procedures Traffic Management Procedures for the J-A Operations exists and is fit for purpose for the extended duration of the route use and will be complied with.	Low	The Tenement Holder must demonstrate that during construction and operation, there are no traffic incidents resulting in public injury or death caused by the mining operations that could have been reasonably prevented.	**Operation** All traffic accidents/ near misses are recorded in the Iluka Incident Management System. All recorded traffic incidents are investigated within 14 days or other time period as agreed with the Director of Mines.	None proposed
T5	Increase in complaints and amenity issues from sensitive receptors regarding traffic generated during the construction phase of the Project.	**Management** Development and implementation of a Traffic Management Plan for the Construction Phase of the Project Maintain Complaints and Corrective Action Register	All traffic related to the construction phase of the Project is assumed to comply with a Construction Environment Management Procedure/Plan for Traffic. It is assumed the Construction Environment Management Procedure/Plan for Traffic is fit for purpose.	Low	The Tenement Holder must demonstrate that during construction and operation all reasonable complaints raised by the public have been recorded and investigated.	**Construction** All complaints and feedback from public are recorded in the Iluka Incident Management System. All recorded complaints are investigated by the tenement holder, and where required, corrective actions are implemented to prevent recurrence or to minimise the future potential impact as far as reasonably practicable.	None proposed
T6	Increased traffic incidents involving mining traffic due to an increase in vehicle movements and/ or change in type/ size of vehicles during the construction phase of the Project.	See T2 (for construction)					

7.13 Social

This section describes how the Project may impact on social values and sets out the measures that will be implemented to minimise those impacts.

As noted in Section 6, MG2a does not explicitly detail information on how to undertake a social assessment for a mining project. After discussion with DEM, it was determined that using the S-P-R model was not appropriate for the social environment. Therefore, it should be noted that the presentation of information is different within this section then others in Section 7.

With an absence of social impact guidelines in South Australia this assessment has been undertaken in general accordance with the *2021 Social Impact Assessment Guideline for State Significance Projects* from the New South Wales Department of Planning and Environment (NSW DPE).

WSP completed a Social Impact Assessment (SIA) for Atacama (WSP, 2023) which has informed the preparation of this section. The report is attached in full as Appendix C2.

7.13.1 Scope of assessment

Scoping of the SIA was undertaken through:

- determination of assessment scenarios: Pre-construction, construction, operation and closure
- determination of social impact categories to be studied: Livelihoods, community wellbeing, Aboriginal outcomes, services and infrastructure and surroundings
- a review of J-A's previous SIAs and management plans
- consultation with the Iluka Atacama senior approvals and environmental specialist and J-A environmental and community manager.

7.13.2 SIA study area

WSP (2023) defined two study areas for the SIA:

- **Local study area** refers to the area expected to experience the most social change as a result of the Project. This local study area represents the immediate geographic area around the Project site, including surrounding settlements and communities nearest the mine; road transportation routes from J-A to Thevenard Port; townships that provide supplies of goods or services to the Project and J-A; and the FIFO and DIDO transfer locations of the Project workforce and Project contractor personnel. The local study area is made up of:
  - the Ceduna LGA, which encompasses the town of Ceduna and surrounding localities including Thevenard, Smoky Bay, Denial Bay, and Koonibba
  - key townships and communities outside the Ceduna LGA (within Unincorporated SA), including Yalata, Penong, Maralinga (Oak Valley), and Scotdesco.
- **Regional study area** refers to the broader regional area in which the Project is located, which is unlikely to experience direct social impacts, but may be subject to secondary or indirect impacts associated with the Project. The regional study area also shares social and cultural links with communities in the local study area and would likely experience flow on economic impacts

due to the Project's operational supply chain. Residents within the regional study area would be considered part of the local FIFO labour force. The regional study area is made up of:

- Eyre Peninsula and Southwest Region ABS Statistical Area Level 3 (SA3).

These two study areas are presented in Figure 7-20.

7.13.3 Consultation

Consultation was undertaken to understand the community and stakeholder experiences, views and perceptions relating to the Project. The objectives of consultation were to:

- discuss outcomes expected to occur in relation to the Project and understand the interests and potential concerns of individuals and groups, as well as attitudes towards J-A, the Project and Iluka
- collect qualitative data, evidence and insights for assessing potential impacts and benefits in ways that maximise the diversity and representation of varying community and stakeholder viewpoints
- create synergies between other consultation and engagement activities to minimise potential consultation fatigue amongst key stakeholders and groups.

A targeted consultation plan was developed for the SIA, the plan was informed by previous consultation which had occurred for other SIAs for the J-A mine. A set of questionnaires guided consultation with stakeholders, please refer to Appendix C2 for a copy of the questionnaires.

7.13.4 Social impacts

After consultation potential impact events were identified and the following criteria was used to assess the significance of each identified impact event:

- the four impact characteristics that demonstrate the material effect of the impact (extent, duration, severity, sensitivity), and how they are considered in determining magnitude is explained in Appendix C2
- who specifically may be affected (directly, indirectly or cumulatively) and the level of concern they feel about the matter (high, medium, low), recognising that impacts may affect population groups or individuals differently
- when the potential impact is expected to occur (pre-construction, construction, operation, closure)
- defining likelihood as per the SIA guideline (DPE, 2021)
- determining the significance of the potential impact pre-mitigation.

7.13.5 Mitigation measures

Mitigation measures and enhancement strategies were then assigned for potential impact events. Mitigation measures were assigned to all unmitigated impacts from low to very high, noting that existing J-A controls will be continued and strengthened by an adaptative management process, so that the outcomes of existing controls are monitored, measured and changes and improvements to controls are made if needed.

For potential impacts with a low significance rating monitoring has been recommended.

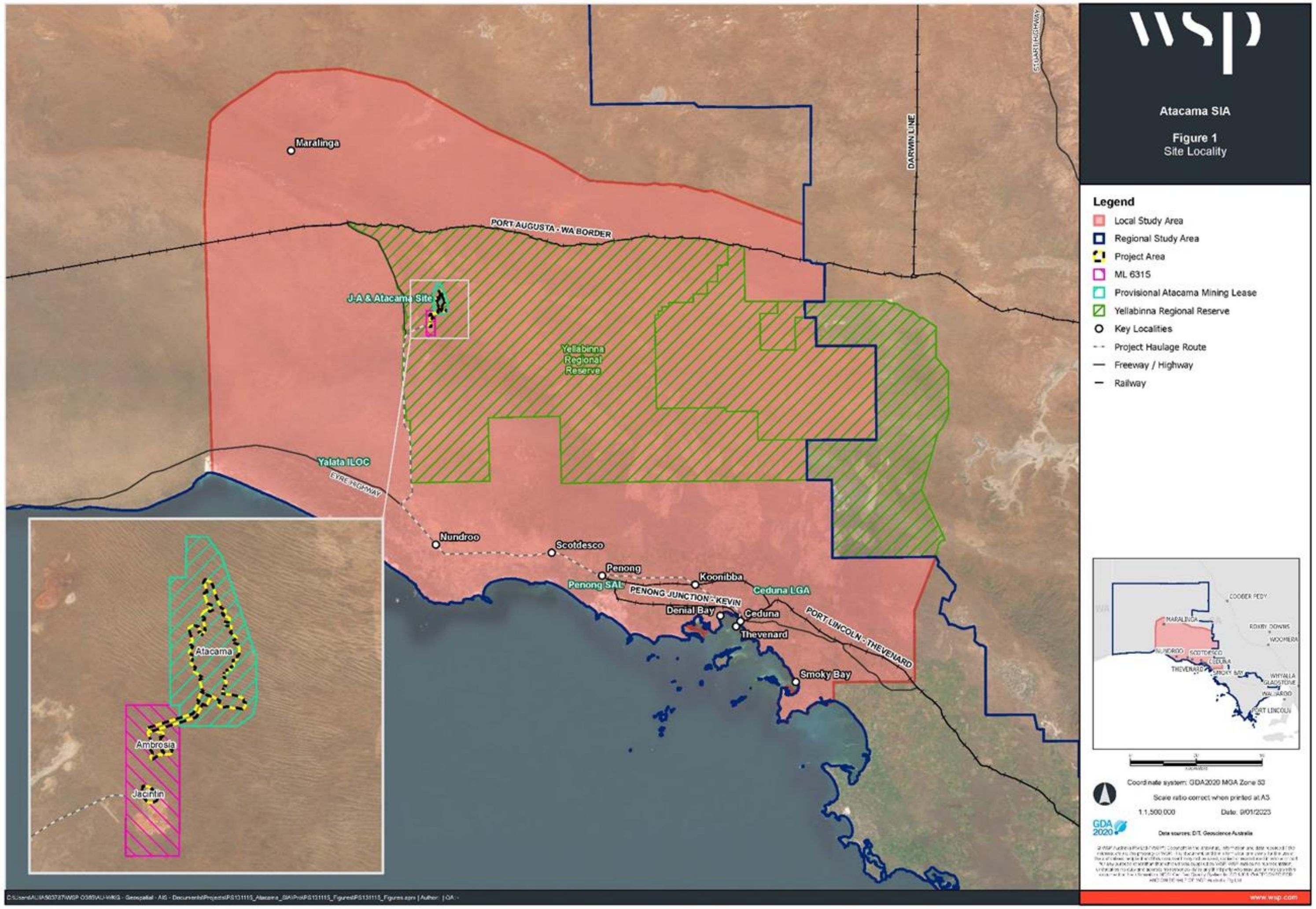

Figure 7-20 Local study area – Social Impact Assessment (Source WSP, 2023)

7.13.6 Potential impact events

Potential impact events are presented in Table 7-30.

7.13.7 Design, control and managements strategies

Design, control and management strategies for the identified impact events are detailed in Table 7-30.

7.13.8 Impact assessment

A summary of WSP's SIA is provided in Table 7-30, for more detailed information please refer to Appendix C2.

7.13.9 Overview of conclusions

The Atacama Project has had an SIA undertaken by WSP which assessed the Project as an extension of the existing J-A operation, therefore the combined effects were considered throughout the assessment.

The continuity and enhancement of existing controls, in addition to the implementation of new measures, will bring the impacts identified as High and Very High to a Medium and Low level of significance, and in some cases, bring High benefits to a Very High level of significance. Mitigation measures suggested include a Social Management Plan in order to establish the ongoing monitoring and evaluation of social impacts with an adaptive management approach to identify any emerging impacts.

The potential positive social benefits expected during construction and operation of the Atacama Project are as follows:

- increased employment opportunities for local residents
- increased local procurement and business opportunities
- enhanced community cohesion, wellbeing and active lifestyles as a result of the continuation of the Iluka sponsorship program
- increased employment, education and business opportunities for FWC people
- increased organisational capacity of FWCAC
- increased accessibility of local infrastructure.

Four pre-mitigated High or Very High negative social impacts were identified to potentially occur during construction and operation of the Atacama Project, which would all be reduced to a medium level of significance given the continuation and implementation of suggested measures. The negative social impacts with a Medium residual significance are summarised below, with all other construction and operation impacts receiving a Low residual impact rating:

- diminished wellbeing amongst Aboriginal employees
- disturbance or damage to Aboriginal material cultural heritage
- impacts to Aboriginal cultural landscapes and values
- impacts to the landscape and associated aesthetic values.

The potential social impacts with a Medium residual significance rating that may occur during closure of the Atacama Project are summarised below:

- detrimental effects on local livelihoods as a result of lower remuneration in alternative employment and drop-in economic activity in local townships
- changes to community wellbeing and cohesion as a result of a decline on active workforce and families, increased welfare dependency and loss of sponsorships
- deterioration of Aboriginal outcomes as a result of fewer employment and training opportunities, as well as reduced FWCAC revenue
- reduced accessibility to services, goods and infrastructure as a result of increased prices; and
- permanent changes to landscape affect aesthetic values of local communities, FWCAC and visitors to Yellabinna Parks.

Table 7-30 Potential impact events: Social

Social Element Impacted	Phase	Impact ID	Potential impact event	Extent	Description of the likely impact event	Likelihood	Magnitude	Significance	Mitigation and Control Measures	Residual likelihood	Residual magnitude	Residual significance	Type of impact
Livelihood	Construction	SI01	Increased employment opportunities for residents 50-90 workers employed during the construction program over 12months (approximately)and 300-350 workers to be employed during operations in additional to the existing J-A workforce	Business owners and employees within the local study area, with benefits potentially extending to the broader community within the local study area.	It is likely that the unemployed residents of Ceduna LGA will require short to medium term training to access these employment opportunities. Currently employed Ceduna LGA residents with transferrable skills in construction, transport or trade may seek Project employment opportunities.	Possible	Moderate	Medium	Continuity and enhancement of local employment programs. Develop a Procurement management plan to maximize procurement opportunities for local businesses.	Likely	Moderate	High Benefit	Positive
	Operations				Iluka's existing programs at J-A to increase Aboriginal participation through direct employment and via contractors demonstrate almost certain employment benefits to the local community. Indirect impacts will flow to the community through the direct employment.	Almost certain	Moderate	High		Almost certain	Major	Very High benefit	Positive
	Construction	SI02	Increased local procurement opportunities.	Business owners and employees within the local study area, with benefits potentially extending to the broader community within the local study area.	Provision of civil works, haulage of materials, supplying fuel and services is likely to benefit region and state. Locally, opportunities in earthmoving, workforce transport and supporting some limited services or goods for the accommodation camp.	Possible	Minimal	Low	Develop a Procurement management plan to maximize procurement opportunities for local businesses.	Likely	Minimal	Low benefit	positive
	Operation				Current J-A mining supports many businesses to varying extents and is a consistent positive economic impact. This is expected to continue with expanded trade and maintenance service requirements.	Possible	Moderate	Medium		Likely	Moderate	High Benefit	Positive
	Constructio n	SI03	Reduction of local workforce availability for existing businesses to due increased Project employment	Business owners within the local study area.	Short term jobs during construction may appeal to the mostly younger demographics and those currently unemployed.	Possible	Minimal	Low	Monitor, continue and enhance local employment programs. Develop a Procurement management plan to maximize procurement opportunities for local businesses.	Unlikely	Minimal	Low Impact	Negative
	Operations				Given the size of the increase compared to the population of the Ceduna LGA, workforce availability is likely to be minimally affected.	Possible	Minor	Medium		Possible	Minimal	Low Impact	

Social Element Impacted	Phase	Impact ID	Potential impact event	Extent	Description of the likely impact event	Likelihood	Magnitude	Significance	Mitigation and Control Measures	Residual likelihood	Residual magnitude	Residual significance	Type of impact
	Closure	SI04	Detrimental effects on local livelihoods as a result of low renumeration in alternative employment and drop-in economic activity in local townships	NA	Loss of employment opportunities and reduced business opportunities will impact the growth of ancillary businesses and services. The closure of the project will result in the loss of 99 jobs locally and approximately 23 jobs from flow on impacts.	Possible	Moderate	Medium	Dependency assessment Pre-closure and closure Community and Stakeholder Engagement Plan Pre-closure social investment strategy	Possible	Minor	Medium Impact	Negative
	Cumulative	SI05	Cumulative impacts to livelihoods during construction and operation due to labour shortages	NA	NA	Possible	Minor	Medium	Continuity and enhancement of local employment programs.	Unlikely	Minor	Low Impact	Negative
Community Wellbeing	Construction	SI06	Increased traffic movements associated with the project resulting in a reduce sense of safety on local roads.	Residents, businesses and services along the Project route, specifically in Thevenard, Ceduna, Penong, Scotdesco and Nundroo	An additional 400-450 total deliveries over a 12-month period, resulting in approximately 9 additional trucks per week. An additional 20-40 vehicle movements per day due to increased construction workforce. J-A product movements will continue during the construction period of the project. The overall increase is expected to be minor and is short term.	Possible	Moderate	Medium	Road safety and awareness campaign. Development and implementation of a Construction Traffic Management Plan. Continue and enhance communication with key stakeholders.	Unlikely	Moderate	Low Impact	Negative
	Operation				While number of truck movement s are not expected to increase, the Project traffic expected to extend for an additional 6 years. Current Iluka implemented controls are considered effective by the community and will continue.	Unlikely	Moderate	Medium	Road safety and awareness campaign. Continue implementation of J-A Traffic Management Plan.	Very Unlikely	Moderate	Low Impact	Negative
	Construction	SI07	Additional traffic movements associated with construction may increase noise, vibration and dust.	Residents, businesses and services along the Project route and surrounding the Port, specifically in Thevenard, Ceduna, and Penong.	These impacts are generally in locations that amenity impacts on-site will be experienced by sensitive receivers in the surrounding area.	Unlikely	Minor	Low	Monitor, continue and enhance communication with key stakeholders	Possible	Minimal	Low Impact	Negative
	Operation		Increased traffic movements associated with the project over a longer period.		No change expected in dust deposition on site. Current mitigation measures result in Air quality objectives being met at the camp. Impacts to Yalata, the nearest non-mining sensitive receiver are unlikely.	Unlikely	Moderate	Medium	Increase communication with key stakeholders via Community and Stakeholder Engagement Plan.	Unlikely	Minimal	Low Impact	Negative

Social Element Impacted	Phase	Impact ID	Potential impact event	Extent	Description of the likely impact event	Likelihood	Magnitude	Significance	Mitigation and Control Measures	Residual likelihood	Residual magnitude	Residual significance	Type of impact
	Construction	SI08	An additional 50-90 FTE operational employees for 12 months non-residential workforce to reside on site may result in impacts on cohesion and wellbeing of the local community due to increased non-residential workforce.	Community members and residents within the local study are, specifically Ceduna and Penong	The short-term nature of the construction workforce will be FIFO and residing on site at the workforce accommodation camp resulting in disconnect between the Project and the community.	Unlikely	Minimal	Low	Continuation of employee assistance program and mental health awareness training. Monitor, continue and enhance communication with key stakeholders.	Unlikely	Minimal	Low Impact	Negative
	Operation		An additional 300-350 FTE operational employees for 7 years non-residential workforce and reside on site. May result in impacts on cohesion and wellbeing due to increased FIFO workforce.		Social impacts associated with the FIFO and residing on site at the workforce accommodation camp resulting in disconnect between the Project and the community.	Possible	Moderate	Medium	Continue to evaluate and monitor the effectiveness of volunteering program (every 5 years).	Unlikely	Minor	Low Impact	Negative
	Construction	SI09	Impacts on health related to extended shift work schedules.	Project FIFO workforce and families, including workforce from the local and regional study area.	Key challenges that arise around the FIFO workers include impacts to mental health and wellbeing, increased social support needs and difficulty managing multiple roles at work and at home. These impacts may extend to the families and social networks of the workers. Medium impact – shifts are expected to be longer than the current J-A operational workforce schedule over the 12-month period.	Likely	Minor	Medium	Continuation of employee assistance program and mental health awareness training.	Unlikely	Minor	Low impact	Negative
	Operation				Proposed to adopt the 8/6 or 4/3 roster as per J-A currently. DIDO workers currently supported from Yalata. Key challenges that arise around the FIFO workers include impacts to mental health and wellbeing, increased social support needs and difficulty managing multiple roles at work and at home. These impacts may extend to the families and social networks of the workers.	Possible	Moderate	Medium	Continue to evaluate and monitor the effectiveness of the Employee Assistance Program and mental health awareness training.	Unlikely	Moderate	Low Impact	Negative
	Construction	SI10	Procedural fairness regarding potential impacts and changes	Communities and residents within the local study area.	Current perception is that it is difficult for the community to seek out the information required about the Project.	Possible	Moderate	Medium	Continue and enhance communication with key stakeholders via Community and Stakeholder Engagement Plan.	Very Unlikely	Moderate	Low Impact	Negative
	Operation				Seven complaints related to the J-A site since January 2009. All have been actioned and closed.	Possible	Moderate	Medium		Very Unlikely	Moderate	Low Impact	Negative

Social Element Impacted	Phase	Impact ID	Potential impact event	Extent	Description of the likely impact event	Likelihood	Magnitude	Significance	Mitigation and Control Measures	Residual likelihood	Residual magnitude	Residual significance	Type of impact
	Construction	SI11	Unequal distribution of impacts and benefits	Communities and residents within the local study area, particularly smaller communities outside of Ceduna such as Penong, Koonibba, Scotdesco, and Yalata.	Unequal distribution of project impacts and benefits will contribute to existing inequality. Impacts are likely to be distributed unequally with some stakeholders and communities will likely experience the effects of impacts to a greater degree due to proximity to the project and/or pre-existing vulnerability. Currently 64% of the community sponsorship program is awarded to Ceduna area, with Penong and Yalata receiving smaller percentages of 2.5% and 0.5%. The application process for the community sponsorship program is currently a barrier to those with a higher level of vulnerability.	Almost certain	Minor	Medium	Continue to implement and enhance social investment. Continue to implement and evaluate the effectiveness of volunteering program.	Unlikely	Minor	Low Impact	Negative
	Operation					Almost Certain	Minor	Medium	Continue and enhance communication with key stakeholders. Continue to implement and Enhance social Investment mechanisms.	Unlikely	Minor	Low Impact	Negative
	Construction	SI12	Enhanced community cohesion wellbeing and active lifestyles as a result of the implementation of the Iluka community benefit program.	Communities and residents within the local study area.	Existing community benefit programs funded by Iluka include: • Iluka social investment program • Iluka small grants program. The social significance of reoccurring community events such as organised sport and Oysterfest was emphasised by stakeholders.	Likely	Moderate	High	Enhance social Investment mechanisms.	Almost Certain	Moderate	High	Positive
	Operation					Likely	Moderate	High	Continue and enhance communication with key stakeholders. Enhance social investment mechanisms.	Likely	Major	High	Positive
	Closure	SI13	Changes in community wellbeing and cohesion as a result of a decline in active workforce and families, increased welfare dependency and loss of sponsorship.	NA	Changes to population paired with loss of community funding, may result on increased welfare dependency or increased demand for social services (public and non-governmental). The decreased demand for educational services, sport and recreational facilities and community programs and social services, may led to: • fewer aged and childcare facilities • new and/or upgraded community infrastructure and sports facilities could become unfeasible • reduced funding for health care services • potential fewer school enrolments due to fewer families and fewer children residing in Ceduna, this ultimately impacts the provision of quality education negatively.	Likely	Moderate	High	Pre closure social investment strategy. Pre engagement plan closure and closure Community stakeholder.	Possible	Minor	Medium	Negative
	Cumulative	SI14	Cumulative community wellbeing impacts as a result of amenity impacts, specifically amongst residents and businesses located adjacent to the Project haulage route between Ceduna and Penong, during construction.	NA		Possible	Moderate	Medium	Continual and enhanced communications. Continuity and enhancement of Traffic Management Plan.	Unlikely	Minor	Low Impact	Negative

Social Element Impacted	Phase	Impact ID	Potential impact event	Extent	Description of the likely impact event	Likelihood	Magnitude	Significance	Mitigation and Control Measures	Residual likelihood	Residual magnitude	Residual significance	Type of impact
Aboriginal Outcomes	Construction	SI15	Increased employment, education and business opportunities for FWC people	FWC people in the local and regional study area, and across Australia more broadly.	Target of a minimum of 20% of the workforce to be FWC people. Existing J-A NTMA agreement between Iluka and FWCAC will establish a charitable trust for the purposes of improving living standards and enhancing education and employment opportunities for members of the Native Title Group. The existing J-A FWC training, employment and procurement programs and policies will extend to the project. This program has resulted in 8 FWC students into employment, 3 onsite at J-A, 6 FWC people successfully completed apprenticeships and 16 more have completed pre-employment training and secured employment.	Likely	Moderate	High	Enhance rehabilitation by actively involving and consulting FWCAC members	Likely	Major	High Benefit	Positive
	Operation					Likely	Moderate	High	Continuity and enhancement of local employment programs. Implement and monitor updated NTMA.	Almost Certain	Major	Very High Benefit	Positive
	Construction	SI16	Increased organizational capacity of FWCAC due to annual payments	FWCAC and members, as well as residents of communities including Ceduna, Yalata, Koonibba, Maralinga and Scotdesco	FWCAC will be engaged to assist in the preparation of the Aboriginal Cultural Heritage Management Plan Report, during site clearing and construction activities. Royalty and lease payments will be made to FWCAC.	Likely	Moderate	High	Implement and monitor updated NTMA. Increase communication and engagement with FWC stakeholders.	Almost Certain	Moderate	High Benefit	Positive
	Operation					Almost Certain	Moderate	High		Almost Certain	Major	Very High Benefit	Positive
	Construction	SI17	Impacts to procedural fairness	FWCAC and members, as well as FWC residents within the local study area	Concerns regarding the NTMA negotiation including process of information sharing and transparency regarding current and proposed operations. Committed to a good faith approach in reaching an agreement with the FWCAC.	Unlikely	Moderate	Low	Implement and monitor updated NTMA Monitor communication and engagement with FWC stakeholders.	Unlikely	Minimal	Low Impacts	Negative

Social Element Impacted	Phase	Impact ID	Potential impact event	Extent	Description of the likely impact event	Likelihood	Magnitude	Significance	Mitigation and Control Measures	Residual likelihood	Residual magnitude	Residual significance	Type of impact
	Operation				Engaged with the FWCAC during planning and approvals phase of the Project. Established a J-A FWC liaison committee to guide discussion, collaboration and engagement between Iluka and Traditional Owners. Drafting of a detailed agreement has commenced and the matter will go to the community vote in Q1 2023.	Unlikely	Moderate	Low		Very Unlikely	Minor	Low Impact	Negative
	Construction	SI18	Impacts on Aboriginal employee wellbeing due to perceived negative working environment and lack of Aboriginal cultural understanding.	Aboriginal Project employees, including FWC employees	The construction and operation workforce are expected to be predominately FIFO, with a roster similar to the existing J-A Roster of 8:6 or 4:3. At this point, no decision from Iluka with regard to changes to work shift and cultural leave.	Possible	Moderate	Medium	Cultural provisions for all Aboriginal employees. Enhance cultural awareness training.	Very Unlikely	Moderate	Low Impact	Negative
	Operation					Likely	Moderate	High	Enhance cultural awareness training. Cultural provisions for all Indigenous employees Evaluate and monitor the effectiveness of the Employee Assistance Program and mental health awareness training (every 5 years).	Unlikely	Moderate	Medium Impact	Negative

Social Element Impacted	Phase	Impact ID	Potential impact event	Extent	Description of the likely impact event	Likelihood	Magnitude	Significance	Mitigation and Control Measures	Residual likelihood	Residual magnitude	Residual significance	Type of impact
	Construction	SI19	Disturbance of Aboriginal material cultural heritage.	FWC people and organisations, potentially extending to the broader Indigenous and non-Indigenous people throughout the local and regional study area and State.	Addressed in the Heritage Management Plan. Atacama project drilling and investigation have adopted Heritage discovery and clearance produced for the J-A operation. No Aboriginal findings have occurred. An ACHAR will be developed once NTMA is reached and will inform the MLA. The continued implementation of J-A Cultural Heritage management plan and heritage discover and clearance procedure will be extended.	Possible	Major	High	Review and continue to implement Cultural heritage management plan and heritage discover and clearance procedure. Enhance rehabilitation by actively involving and consulting with FWCAC members.	Unlikely	Major	Medium Impact	Negative
	Operation					Unlikely	Major	Medium	Implement and monitor updated NTMA. Implement and monitor Aboriginal Cultural Heritage Management Plan.	Very unlikely	Major	Medium Impact	Negative
	Construction	SI20	Impacts to Aboriginal Cultural Value due to changes to FWC Cultural Landscapes	FWC people and organisations, potentially extending to the broader Indigenous and non-Indigenous community within the local and regional study area and State.	The project will result in landscape changes due to related construction activities, with the construction being a smaller footprint than the operational disturbance footprint. Progressive landscape rehabilitation plans are being developed, with FWC consultation and input into landscape design and revegetation. Footprint of the disturbance will be minimized by the use of disturbance footprints for sand tailings. A resultant landform change at Atacama which has been agreed to in principle by key external stakeholders and traditional owner groups.	Almost Certain	Minimal	Low	Enhance rehabilitation by actively involving and consulting with FWCAC members.	Likely	Minimal	Low Impact	Negative
	Operation					Almost Certain	Major	Very High	Enhance rehabilitation by actively involving and consulting with FWCAC members. Implement and monitor updated NTMA. Implement and monitor Aboriginal Cultural Heritage Management Plan. Implementation of the Rehabilitation Management Plan.	Possibly	Moderate	Medium Impact	Negative

Social Element Impacted	Phase	Impact ID	Potential impact event	Extent	Description of the likely impact event	Likelihood	Magnitude	Significance	Mitigation and Control Measures	Residual likelihood	Residual magnitude	Residual significance	Type of impact
	Closure	SI21	Deterioration of Aboriginal outcomes as a result of fewer employment and training opportunities as well as reduced FWCAC revenue	NA	The organisational capacity of the FWCAC has been strengthened and improved due to annual royalty payments received by Iluka as per the NTMA. This has in turn improved the protection of rights and interests of FWC Aboriginal people, their autonomy, self-determination, and their management of land across the FWC Native Title region and the co-management of the Yellabinna Regional Reserve Several Aboriginal owned and run businesses have been established due to financial support targeting small businesses of FWCAC members through the FWC Investments (FWCI) Group Closure will result in loss of employment opportunities for FWCAC members and potentially on increased unemployment among FWCAC members, fewer education or training opportunities for FWCAC members and reduced revenue to FWCAC affecting organisational capacity for community service and cultural heritage protection. As such, after J-A MCP implementation, it is possible that FWCAC members would see a moderate reduction in social benefits as a result of fewer employment and training opportunities, as well as reduced FWCAC revenue.	Possible	Moderate	Medium	Support FWC business in transitioning. Financial planning of the FWCAC. Support FWCAC in adopting the management of Aboriginal cultural heritage in the Project sites.	Possible	Minor	Medium Impacts	Negative
	Cumulative	SI22	Cumulative impacts to Aboriginal Outcomes	NA		Possible	Moderate	Medium	Review and continue to implement Cultural Heritage management plan and Heritage Discover and Clearance Procedure.	Possible	Moderate	Medium Impact	Negative
Services and infrastructure	Construction	SI23	Increased and extended utilization and contributions to local services and infrastructure	Residents, businesses and services within the local and regional study area.	Anticipated increased and extended utilization and contribution to local services and infrastructure would be a medium benefit and high benefit during operations. The construction materials will be sourced from the local, regional and interstate context and will be primarily transported by road to the Project site. The product will be transported by road to Port Thevenard and will be shipped to the processing facilities in WA. In the event that emergency care is required, on-site workforce will be transported to Ceduna Hospital.	Almost Certain	Minor	Medium	Maintain communication with key stakeholders about service needs.	Almost Certain	Moderate	High benefits	Positive
	Operation					Almost Certain	Moderate	High	Maintain communication with key stakeholders about service needs.	Almost Certain	Major	Very High Benefit	Positive

Social Element Impacted	Phase	Impact ID	Potential impact event	Extent	Description of the likely impact event	Likelihood	Magnitude	Significance	Mitigation and Control Measures	Residual likelihood	Residual magnitude	Residual significance	Type of impact
	Construction	SI24	Road damage and deterioration	All road users sharing the Project transport route, including local and regional residents, businesses, service providers and tourists.	The construction phase will result in an additional 400-450 total deliveries to site by road. Project will extend current haulage activities for an additional 6 years. Existing J-A controls include Ooldea Road maintenance and speed limit restrictions, Penong and Ceduna speed limit restrictions through town and residential areas. Traffic management procedures and Kalari EHS Plan	Possible	Minor	Medium	Road safety Campaign.	Unlikely	Minor	Low Impact	Negative
	Operation					Unlikely	Minor	Low	Continue and enhance monitoring of potential social changes. Continue to implement Traffic Management Plan	Very Unlikely	Minor	Low Impact	Negative
	Construction	SI25	Impacts to accommodation availability	Project workforce, existing J-A workforce, accommodation providers, tourists and renters within the local study area.	Construction workforce of 50-90 FTE employees to reside on site during their shifts. A small increase in technical or specialist staff temporarily residing off-site during construction.	Possible	Minor	Medium	Avoid use of private rental housing during construction. Continue and enhance monitoring of potential social changes. Continue and enhance communication with key stakeholders.	Very Unlikely	Minor	Low Impact	Negative
	Operation				During operation, the workforce is expected to increase by approximately 300-380 direct workforce, with potential further increases to indirect workforce. Small increases in technical or specialist workforce temporarily residing off-site during operation. Existing camp at J-A to be upgraded to accommodate an additional 197 workers. For more details see Appendix D.	Unlikely	Minor	Low	Continue and enhance monitoring of potential social changes. Continue and enhance communication with key stakeholders.	Very unlikely	Minor	Low Impact	Negative

Social Element Impacted	Phase	Impact ID	Potential impact event	Extent	Description of the likely impact event	Likelihood	Magnitude	Significance	Mitigation and Control Measures	Residual likelihood	Residual magnitude	Residual significance	Type of impact
	Construction	SI26	Impacts to local health service capacity due to increased demand	Ceduna Hospital and residents within the local and regional study area who access these services	Ceduna Hospital is the closest hospital to the Project and the major healthcare provider within the region. Due to the FIFO nature of the project, the Ceduna Hospital will be unlikely to experience a significant patient influx as a result of the Project. The hospitals limited capacity and resources, and the regional and local community reliance on services mean that any Project impacts are considered significant. 2 onsite medics during construction and dedicated on site medical facilities for Project personnel including two on site medics	Very Unlikely	Minor	Low	Monitor local health service capacity during construction. Continue and enhance monitoring of potential social changes.	Very unlikely	Minor	Low Impact	Negative
	Operation					Unlikely	Minor	Low	Continue and enhance monitoring of potential social changes. Continue and enhance communication with key stakeholders.	Very Unlikely	Minor	Low Impact	Negative
	Closure	SI27	Reduced accessibility to goods and services as a result of increased prices	NA	NA	Possible	Moderate	Medium	Mine and infrastructure audit and repurpose assessment.	Possible	Minor	Medium Impact	Negative
	Cumulative	SI28	Cumulative impacts to road infrastructure	NA	NA	Likely	Moderate	High	Continuity and enhancement of Traffic Management Plan.	Likely	Minor	Medium Impact	Negative
Surrounds	Construction	SI29	Impacts to the landscape and associated aesthetic values due to Project construction and operation.	Local and regional residents, FWC community members, and broader State and national population.	Permanent landform changes are expected including: • Vegetation clearing • Pathogens or toxins • Fire- changes to regime or ignition sources • Erosion of soil- loss of topsoil and seedbank	Possible	Minor	Medium	Increase communication with key stakeholders.	Possible	Minimal	Low Impact	Negative

Social Element Impacted	Phase	Impact ID	Potential impact event	Extent	Description of the likely impact event	Likelihood	Magnitude	Significance	Mitigation and Control Measures	Residual likelihood	Residual magnitude	Residual significance	Type of impact
	Operation				• Altered landforms- permanent changes prevent return to pre-mining conditions. Anticipated that Impacts to landscapes associated aesthetic value due to increased project workforce demand would be medium during construction and high during operations. The impacts on the environment in relation to the Yellabinna Regional Reserve are being effectively managed through specialist environmental work including rehabilitation activities. Updates to J-A rehabilitation management plan will be updated to include the project and rehabilitation will be managed jointly between the two operations.	Almost Certain	Moderate	High	Enhance rehabilitation by actively involving FWCAC members.	Possible	Moderate	Medium Impact	Negative
	Closure	SI30	Permanent changes to landscape affect aesthetic values of local communities, FWCAC and visitors to Yellabinna Parks.	NA	NA	Possible	Moderate	Medium	Enhance rehabilitation by actively involving FWCAC members. Site visits to rehabilitated land. Implementation of the Rehabilitation Management Plan. Site-specific closure framework that includes progressive rehabilitation. Support FWCAC in adopting cultural heritage management at Project site.	Possible	Minor	Medium Impact	Negative
	Cumulative	SI31	Cumulative Impacts to surroundings	NA	NA	No Impact	No Impact	No Impact	NA	NA	NA	NA	**NA**

7.14 Radiation

This section describes how the Project may impact on radiation values and sets out the measures that will be implemented to minimise those impacts.

Radiation Consulting Australia (RCA) have undertaken a radiation impact assessment which has informed the preparation of this section. The report is attached in full as Appendix C7.

7.14.1 Context

The Atacama Project Area was extensively surveyed in 2016 (SA Radiation, 2016) to determine pre-mining baseline radiological conditions in the immediate area surrounding proposed mining activities. Details of baseline conditions are provided in Section 3.19.

The average concentrations of uranium and thorium were 0.75 ppm and 2.97 ppm respectively. These concentrations are low, but still typical of normal soil levels (RCA, 2022). For reference, the worldwide average uranium concentration in soils is approximately 3 ppm, and the worldwide average thorium concentration is approximately 9 ppm (UNSCEAR, 2000).

Low levels of uranium and thorium mineralisation are associated with the Atacama ore bodies as well as the waste (tailings) material. When processing is carried out with materials containing uranium and thorium, there is the potential for radiological impacts to occur. As such potential impacts are more likely to occur through the storage and transport of HMC on and from the J-A tenement (those these impacts are not discussed further in this MLP and are addressed in the CiO Application for J-A, attached as Appendix D).

RCA (2022) assessed the potential for radiation related impacts specific to non-human biota (NHB) and members of the public through consumption of bush tucker. Impacts to the workforce are excluded from assessment under the Mining Act and will not be discussed further within this section.

The assessment demonstrated population protection of NHB and negligible impacts to members of the public from bush tucker collection (RCA, 2022) within the Project Area of proposed mining and storage of Atacama ore (prior to processing).

7.14.1.1 Receptors

Radiation damage arises due to ionisation along the path radiation takes as it passes through tissues, hence the dimensions of the organism have relevance to the degree of radiation damage that can occur (RCA, 2022).

Receptors considered for potential exposure to, and protection from radiation emissions for the Project are NHB (flora and fauna) and humans. In the context of this radiation assessment, receptors are further defined as:

- flora and fauna
- Aboriginal people (through consumption of bush tucker)

It is important to note that protection of NHB is demonstrated at the species level.,

7.14.1.2 Non-human biota doses

Model

The Environmental Risk from Ionising Contaminants Assessment (ERICA) Tool was used as the method of assessing the impact of radiological contaminants to the natural environment. The software uses changes in radionuclide concentrations and concentration ratios in species, derived from monitoring and studies, to provide an estimated dose and measure of radiological impact to a number of reference animals and plants (RAPs).

User defined animals and plants were added to the model and selected based on the availability of Australian data; the species used to determine doses to humans from bush tucker ingestion; and species of interest to the Atacama Project (threatened species identified under the EPBC Act).

Indicators

The default ERICA screening dose rate is 10 µGy/h (ARPANSA, 2015), which is the threshold at which even the most sensitive NHB are unlikely to suffer any population effects as a result of chronic exposure to that dose.

Summary of results

Radionuclide exposure within the Project Area is expected to be low (when compared to the current J-A operation) as the ore material contains considerably lower radionuclide concentrations than the HMC (0.26 Bq/g Th^{232} and 0.39 Bq/g U^{238} in ore based on assays conducted by Iluka, compared to up to 1.93 Bq/g Th^{232} and up to 2.78 Bq/g U^{238} in HMC), therefore considerably larger quantities would need to be released into the environment in order to observe radionuclide exposes similar to that occurring at J-A (RCA, 2022).

A conservative approach was taken to calculating total dose rates for the Project, and these include:

- dust deposition levels in the Project Area were assumed to be double those observed at the most impacted site at J-A (based on operational data), acknowledging that operational dust data at J-A will be mitigated by dust suppression management methods
- that 50% of all the dust deposition generated is a result of ore stockpiling
- all dust generated from stockpiling mixes with the top 10 mm of soil over time.

Using these assumptions, the total dose rates to reference and user defined animals and plants within the Project Area (after a total of 10.5 years of operations, assuming 6.5 years of operating and allowing for up to 4 further years of stockpiling at Atacama while processing at J-A) are shown in Figure 7-21.

All doses to RAPs and user-defined species in ERICA are below the screening threshold of 10 µGy/h, apart from Lichen and Bryophytes. It is however unlikely that lichen and bryophytes will be present within the Project Area due to the unsuitable climatic conditions. Lichens do not have a waxy cuticle and are unable to conserve water through dry periods. Similarly, bryophytes generally require damp ground, high humidity or both preferably for their primitive cells to absorb moisture directly. Whilst occasionally bryophytes use dormancy and microhabitats to persist in an arid environment, none were recorded during ecological surveys and further consideration is considered unwarranted. Further to this, acute exposure (mortality) data demonstrates Lichen and Bryophytes to be among the least radiosensitive organisms (RCA, 2022).

These dose rates are relevant to the operational phase only and therefore considered the maximum dose that could be expected upon conclusion of operations. Doses will decrease over time during the rehabilitation phase and into closure.

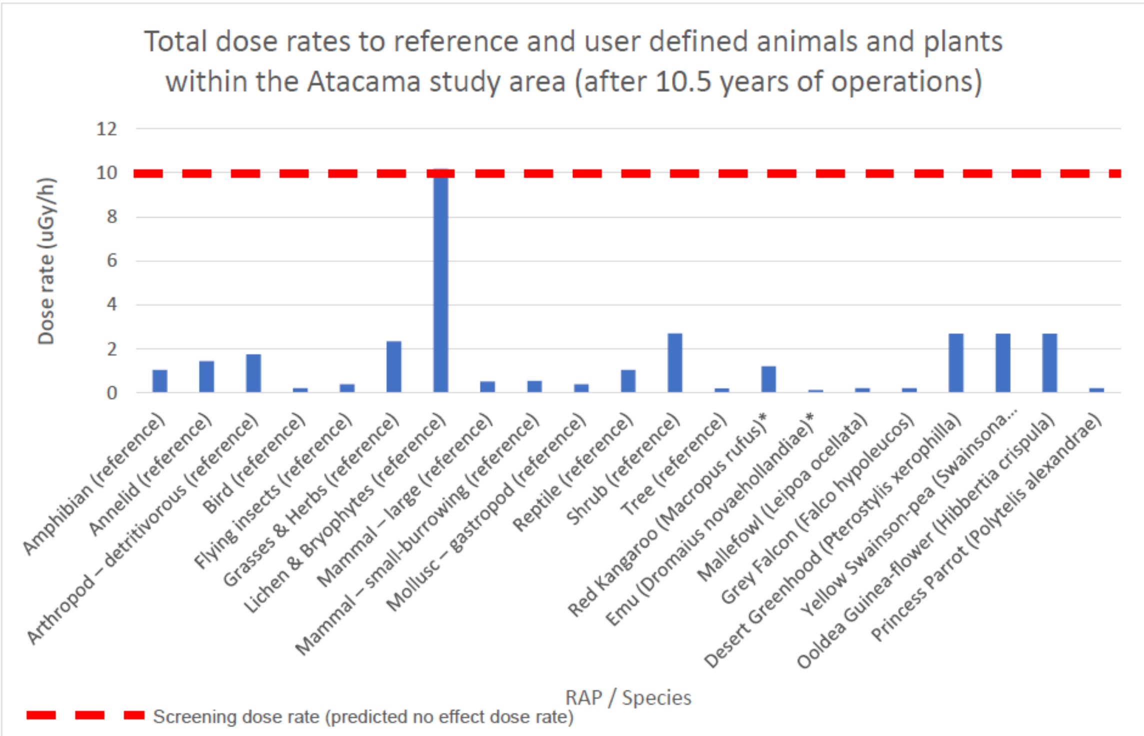

Figure 7-21 Doses to reference and user defined animals and plants within the Project Area (after 10.5 years of operations)

7.14.1.3 Human Doses – bush tucker

Model

The ERICA Tool was also used to calculate bush tucker dose assessments using site specific data. An estimate of the potential dose from the ingestion of bush tucker has been made for members of the public living in the region and consuming bush tucker that has biologically accumulated radionuclides at the most impacted sites.

Three main factors were considered when making an ingestion dose assessment; food consumption rates, concentration factors into foods, and radionuclide concentrations released into the environment from the Project.

Consumption rates assume a diet that consists of an intake of 155 kg/y of plant material and 125 kg/y of animal material based on the food consumption rates of traditional owners of the Maralinga lands (AAEC, 1986). ERICA derived radionuclide concentrations for the kangaroo and goanna have been used to estimate doses due to meat ingestion, based on bioaccumulation in or close to the most impacted sites. Published uptake factors for vegetation were used as there is no readily available published data for Australian vegetation.

It has conservatively been assumed that all plant and meat sources have accumulated radionuclides exclusively from the impacted area. In reality, kangaroos and goannas will spend time in surrounding areas containing much lower concentrations of operationally derived radionuclides.

Indicators

The annual dose limit to members of the public, as a result of mining or operational activities, is 1 mSv/year above natural background levels.

Summary of results

The dose to members of the public due to bush tucker consumption was estimated at 0.023 mSV/year, which is well below the dose limit of 1 mSv/year, and comparable to the dose received from short haul domestic flights within Australia.

Public doses are considered highly conservative, given that consumption of food from the local area is likely over-estimated, and that it is unlikely that all food could be sourced from the areas of greatest radiological impact.

7.14.2 Potential impact events

Potential impact events are presented in Table 7-31.

7.14.3 Design, control and management strategies

There were no S-P-R linkages identified for radiation impacts and as such, no design, control and management strategies are presented.

Please refer to Section 7.10 air quality related information.

7.14.4 Impact assessment

The radiation impact assessment is presented in Table 7-31.

7.14.5 Draft outcomes, measurement criteria and leading indicators

There were no identified S-P-R linkages and as such, there is no presentation of radiation specific control measures, outcomes and measurement criteria.

Table 7-31 Potential impact events: Radiation

Environmental element	Phase	Impact ID	Potential impact event	Source	Pathway	Receptor	Uncertainties and assumptions	Sensitivity to change (in assumptions)	S-P-R linkage? (Yes, No or Uncertain)	Justification for the confirmation/ non-confirmation of an S-P-R linkage?	Description of the likely impact event
Radiation	Operation Closure	R1	Excavation and storage of ore generates naturally occurring radioactive material that impacts on the public.	Radioactive material in soils	Direct exposure – external gamma radiation Aeolian- dust, soil and radon inhalation Contaminated food consumption	Public	N/A	Low	No	The Project Area is within the Reserve and there are no sensitive public receivers in the vicinity. It is also highly unlikely that post closure land uses will include agricultural or production industries due to the nature of sandy soils (poor nutrient retention, poor water retention) in the Project Area, which has extremely limited cropping or pasture potential. The immediate surrounds are furthermore a conservation area. The ore material which will be temporarily stockpiled in the Project Area contains low levels of NORM which do not meet the definition of radioactive material as defined in the RPC Act. When radiation levels are below 1 Bq/g, material is considered to be non-radioactive. The ore will be moved to nearby J-A for further processing and refinement. Given the low levels of uranium and thorium within the ore, the temporary storage of material and the separation distances to members of the public, there is no S-P-R linkage.	No predicted impact.

Environmental element	Phase	Impact ID	Potential impact event	Source	Pathway	Receptor	Uncertainties and assumptions	Sensitivity to change (in assumptions)	S-P-R linkage? (Yes, No or Uncertain)	Justification for the confirmation/ non-confirmation of an S-P-R linkage?	Description of the likely impact event
Radiation	Operation Closure	R2	Excavation and storage of ore generates naturally occurring radioactive material, contaminating bushtucker that has biologically accumulated radionuclides, impacting on the health of Aboriginal people.	Residual radioactive material in soils	On site bush food consumption - ingestion	Aboriginal people	Model results based on assumptions: • All food consumed is sourced from the immediate area where the maximum radionuclide deposition has/will occur (conservative assumption). • All dust deposited by the storage of ore (and therefore radionuclides) are taken up by plants and animals. • Kangaroo and goanna used to estimate doses due to mean ingestion. • Vegetation uptake values not available for Australian vegetation • Locally sourced bush tucker makes up 0.56% of a person's diet; based on ratio of combined J-A and Atacama mine lease to greater regional reserve footprint. • Assumed that all meat and vegetation sources have accumulated radionuclides to the same concentration. • Assumed that dust levels generated (and therefore radionuclide levels) are the same as the most impacted site at J-A	Low	No	Bush tucker assessments have been completed separately using the ERICA Tool and (RCA, 2022). Dose estimated to members of the public due to bush tucker consumption at 0.023 mSV/year, which is well below the public dose limit of 1 mSv/year, and comparable to the dose received from short haul domestic flights in Australia. Public doses are considered highly conservative, given that consumption of food from the local area is likely over estimated, and that it is unlikely that all food could be sourced from the areas that represent the greatest radiological impact. Members of the FWCAC are permitted to access areas on Iluka's tenements for cultural purposes, including hunting and gathering. The use of Atacama is likely to be limited to occasional passing through; as no significant cultural or hunting sites are close by and greater than a 24-hour residency by Aboriginal groups would be unusual (Joanne Lee, personal communication, 20 July 2022). No ore material will remain onsite upon completion of operation and as such the doses described above are the maximum that would occur during operations, with doses decreasing during rehabilitation and into closure. There is no S-P-R linkage.	No predicted impact.

Environmental element	Phase	Impact ID	Potential impact event	Source	Pathway	Receptor	Uncertainties and assumptions	Sensitivity to change (in assumptions)	S-P-R linkage? (Yes, No or Uncertain)	Justification for the confirmation/ non-confirmation of an S-P-R linkage?	Description of the likely impact event
Radiation	Operation	R3	Excavation and storage of ore generates naturally occurring radioactive materials in dust emissions that reduce vegetation health, impacting on the abundance and / or diversity of native flora and fauna.	Emissions	Aeolian- dust deposition, soil and radon inhalation	Flora and Fauna	Limited published data regarding the effects of radiation on non-human biota. Model results based on conservative assumptions: • Doses considered in the model are maximum doses at end of operations. • Timeframe includes mining of material for a 6.5-year period followed by processing of stockpiled material for up to a further 4 years. • The ore material contains significantly lower radionuclide concentrations than HMC (which is stored at J-A), therefore significantly greater quantities would need to be released to equal the doses observed at J-A. • To be conservative the ERICA Tool has assumed that dust generated (and therefore radionuclide release) at Atacama is twice that of the most effected dust deposition site at J-A, which would be an approximate uranium and thorium concentration of 31 ppm and 63 ppm respectively. • User defined animals and plants were selected based on availability of Australian data; the species used to determine doses to humans from bush tucker ingestion; and species of interest to the Atacama Project (threatened species identified under the EPBC Act).	Low	No	The Atacama soil material contains considerably lower radionuclide concentrations than HMC (0.26 Bq/g Th232 and 0.39 Bq/g U238 in ore based on assays conducted by Iluka, compared to up to 1.93 Bq/g Th232 and up to 2.78 Bq/g U238 in HMC). So considerably larger quantities need to be released into the environment to give rise to doses greater than or equal to the doses that have been estimated at the J-A site (RCA, 2022). An ERICA Tool was performed based on doses to reference and user defined animals and plants within the Atacama Project Area after 10.5 years operation (6.5 years mining and 4 years further processing of stockpiled material). No RAP or user defined animal or plant received a dose of above the screening dose rate of 10 µGy/h apart from Lichen and Bryophytes (measured at 10.18 µGy/h). Lichens and Bryophytes are unlikely to be present in the Project Area and have low radio-sensitivity. Given that the results of the ERICA demonstrate that the threshold for an impact to occur (10 µGy/h) has not been met except for Lichen and Bryophytes and that these results are very conservative given they are allowing for radionuclide results based off concentrations double that observed at J-A, it is considered that there is no S-P-R linkage.	No predicted impact.

7.15 Summary of outcomes

All outcomes, outcome measurement criteria, leading indicators and control measures/ management strategies from Section 7.2 to 7.12 and Section 7.14 have been summarised Table 7-32 and the entire impact assessment is presented in Appendix C8.

Table 7-32 Consolidated summary of Project outcomes

Environmental element	Project phase	Impact ID	Control measures and management strategies	Proposed outcome	Draft outcome measurement criteria	Draft leading indicator
Heritage (Aboriginal, European, and geological)	Construction Operation Closure	H1	**Control** No – go areas clearly marked in consultation with Traditional Owners. **Design** A clearance survey is to be undertaken across the proposed ML with the FWCAC and a heritage consultant for Aboriginal heritage. **Management** Induction to include the requirements of the *Aboriginal Heritage Act 1988* and the importance of maintaining no-go areas. Workforce cultural awareness training. A Cultural Heritage Management Plan will be developed and implemented and will include: • discovery protocol for potential heritage items • notification protocols • general information about the Aboriginal heritage exclusion areas (within confidentially requirements)	The tenement holder must during construction, operation and closure ensure there is no damage, disturbance, or interference to Aboriginal heritage items, objects and/or remains as a result of the Project activities, unless it is authorised under relevant legislation.	**Construction and operation** No unapproved disturbance to Aboriginal heritage sites, objects and/or remains. Mine records demonstrate that if an Aboriginal site, object or remain was discovered/ disturbed during operations, works ceased and the native title claimants and the Aboriginal Affairs and Reconciliation Division were notified. Works re-commenced only after notification and consultation over the appropriate actions. Compliance with agreed disturbance and heritage protection requirements, as defined in the *Aboriginal Heritage Act 1988*, and as agreed with the FWCAC. **Closure** All Aboriginal heritage sites are restored as agreed to with FWCAC.	None proposed
Heritage (Aboriginal, European, and geological)	Construction Operation Closure	H2	As above for H1	As above for H1		
Heritage (Aboriginal, European, and geological)	Construction Operation Closure	H3	**Control** No – go areas clearly marked. **Design** A clearance survey is to be undertaken across the proposed ML with a heritage consultant (for European heritage). Based on observations during the Aboriginal heritage survey the need for a targeted European survey can be assessed near key areas (such as water courses) by a Heritage Consultant. Any remaining areas not surveyed can be managed seeing a site discovery processes to be included within the Cultural Heritage Management Plan. **Management**	The tenement holder must during construction, operation and closure ensure there is no damage, disturbance, or interference to European heritage objects and/or places as a result of the Project activities, unless it is authorised under relevant legislation.	**Construction and operation** No unapproved disturbance to European objects and/or places. Mine records demonstrate that if a European object or places is discovered/ disturbed during operations, works ceased and a European Heritage Consultant was engaged to assess significance and advice of future actions and requirements to meet the *Heritage Places Act 1993*. Compliance with agreed disturbance and heritage protection requirements, as defined in the *Heritage Places Act 1993*. **Closure** If applicable all European heritage objects to be returned to their original position or relocated and managed in accordance with the relevant approval.	None proposed

Environmental element	Project phase	Impact ID	Control measures and management strategies	Proposed outcome	Draft outcome measurement criteria	Draft leading indicator
			Induction to include the requirements of the *Heritage Places Act 1993* and the importance of maintaining no-go areas. A Cultural Heritage Management Plan will be developed and implemented and will include: • Discovery protocol for potential heritage items • Notification protocols • General information about the European heritage exclusion zones (within confidentially requirements).			
Heritage (Aboriginal, European, and geological)	Construction Operation Closure	H4	As above for H3	As above for H3		
Flora, fauna, and native vegetation	Construction Operation Closure	FFNV1	**Design** All vegetation clearance restricted to approved footprint. Undertake a Landscape Function Analysis. **Control** Progressive rehabilitation of disturbed area, commencing as soon as practical Comparison of annual aerial photography to ensure vegetation clearance is within approved limits. Use of ground disturbance permit system. Restricting access to undisturbed areas not required during operations. **Management** Implementation of a Native Vegetation Management Plan. Implementation of a Rehabilitation Management Plan. Provision of a SEB.	The Tenement Holder must ensure that all clearance of native vegetation is authorised under appropriate legislation. The Tenement Holder 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.	**Construction and operation** Annual GIS comparison of approved clearance boundary and actual clearance boundary to show all vegetation is within authorised clearance boundaries (annual SEB reconciliation report). Annual vegetation health survey to be undertaken to measure: • plant mortality • new growth • evidence of flowering and fruiting • extent of smothering • evidence of saline stress. **Closure** Landscape Function Analysis (over a minimum of five years after the completion of rehabilitation) to show rehabilitated areas are trending towards pre-disturbance landscape function based on comparison with control site. The following will be collected: • Soil cover • basal cover of vegetation • litter cover • BSC • crust entirety • erosion type and severity • deposited materials • surface roughness • surface resistance to disturbance • slake testing • soil texture • vegetation diversity and abundance.	None proposed

Environmental element	Project phase	Impact ID	Control measures and management strategies	Proposed outcome	Draft outcome measurement criteria	Draft leading indicator
Flora, fauna, and native vegetation	Construction Operation	FFNV2	**Control** Personnel forbidden from feeding or harassing wildlife. Fauna caution signage on haul road. Speed limits on roads used for Project activities. **Management** Implementation of a Fauna Management Plan. Maintenance of a fauna sightings and deaths register. Fauna handling and euthanasia procedures.	The Tenement Holder must ensure that there are no net adverse impacts from site operations on native fauna abundance or diversity within the lease area and adjacent areas.	**Construction and operation** Opportunistic visual observations and incident investigation (report stored in Iluka Incident Management System) demonstrates that the Mine Operator did not cause or could not have reasonably prevented fauna deaths or injuries from occurring. A review of mine records demonstrates that where an animal was found to be sick or injured as a result of mining operations Iluka complied with the *Animal Welfare Act 1985.N*	**Construction and operation** Quarterly review of the incident register for the management of sick or injured fauna, including the identification of any procedural changes required
Flora, fauna, and native vegetation	Construction Operation Closure	FFNV3	As per FFNV1	The Tenement Holder must ensure that there are no net adverse impacts from site operations on native fauna abundance or diversity within the lease area and adjacent areas.	**Construction and operation** As per FFNV1 Biennial Fauna survey of the diversity and abundance of native fauna species in project (impact) areas and control sites **Closure** As per FFNV1.	**Construction and operation** Quarterly review of the incident register for the occurrence of injured or deceased fauna, including the identification of any procedural changes required.
Flora, fauna, and native vegetation	Construction Operation Closure	FFNV4	**Design** Minimisation of disturbance areas. **Control** Ensure road building material is not brought in from an area where weeds may be present. Implementation of vehicle and equipment hygiene / wash down procedure. Inspect and if identified, treat weeds ahead of vegetation clearance to prevent transfer of pest plants to stockpiles. **Management** Regularly monitor disturbance areas for presence of weeds. Reporting of weed sightings via internal reporting system and reporting requirements highlighted in site induction program. Implement targeted weed management of observed significant increases in distribution or abundance or presence of new weed. Implementation of Pest Species Management Plan.	The Tenement Holder must ensure there is no introduction of new weeds or plant pathogens nor an increase in abundance of existing weed or pest animal species in the lease area and adjacent areas caused by mining operations.	**Construction and operations** Annual weed survey to measure the diversity and abundance of weed species. Monthly field monitoring for the presence of weed species in disturbance areas (including soil stockpiles, road edges and mining infrastructure) to demonstrate no introduction of new weeds of plant pathogens nor an increase in abundance due to mining operations. Opportunistic visual observations of weed species demonstrates no introduction of new weeds or plant pathogens. **Closure** Following completion of active rehabilitation, and annually for a minimum of five years, a weed survey demonstrates that weed species diversity and abundance at closure is consistent with control sites.	**Construction and operation** Annual review of the weed survey and weed management register (comprising results of field monitoring and visual observations) considering trends that could indicate population increase or introduction of new weed species

Environmental element	Project phase	Impact ID	Control measures and management strategies	Proposed outcome	Draft outcome measurement criteria	Draft leading indicator
Flora, fauna, and native vegetation	Construction Operation Closure	FFNV5	**Design** Waste storage infrastructure is designed and maintained to prevent access by pest animal species Ensure all waste and food storage containers are adequately sealed **Control** Domestic animals prohibited on-site Prohibit feeding of wildlife Reporting of pest plant sightings via internal reporting system and reporting requirements highlighted in site induction program **Management** Implementation of Pest Species Management Plan Implement targeted pest species management for observed significant increases in distribution or abundance or presence of new pest species. Methods will be those used at J-A and align with regional practises.	The Tenement Holder must ensure there is no introduction of new weeds or plant pathogens nor an increase in abundance of existing weed or pest animal species in the lease area and adjacent areas caused by mining operations.	**Construction and operation** Biennial fauna survey demonstrates that there is no significant increase in abundance of pest animal species in the lease and adjacent areas. Monthly field monitoring of the presence of pest animal species including warrens and tracks in disturbance areas (including soil stockpiles, road edges and mining infrastructure) to demonstrate no increase in abundance and diversity due to mining operations. Opportunistic field observations for the presence of pest animal species demonstrates no increase in abundance in the lease area and adjacent areas. **Closure** Following completion of active rehabilitation, and annually for a minimum of five years, a fauna survey demonstrates pest animal abundance at closure to be consistent with control sites.	**Construction and operation** Annual review of register of pest animal sightings considering trends that could indicate population increase.
Flora, fauna, and native vegetation	Construction Operation Closure	FFNV6	As FFNV5	As FFNV5	As FFNV5	As FFNV5
Flora, fauna, and native vegetation	Construction Operation Closure	FFNV7	**Management** Implementation of Pest and Weed Management Plan.	The Tenement Holder must ensure there is no introduction of new weeds or plant pathogens nor an increase in abundance of existing weed or pest animal species in the lease area and adjacent areas caused by mining operations.	As per FNNV4	As per FNNV4
Flora, fauna, and native vegetation	Construction Operation Closure	FFNV8	**Control** Regular checks of baiting stations.	The Tenement Holder must ensure that there are no net adverse impacts from site operations on native fauna abundance or diversity within the lease are and adjacent areas.	As per FFNV2	As per FFNV2

Environmental element	Project phase	Impact ID	Control measures and management strategies	Proposed outcome	Draft outcome measurement criteria	Draft leading indicator
Flora, fauna, and native vegetation	Construction Operation	FFNV9	**Design** Fire suppression systems installed. **Control** Hot works permitting system. Site based emergency response team and firefighting equipment. **Management** Implementation of a Native Vegetation Management Plan. Implementation of a Fire Risk Management Plan.	The Tenement Holder will ensure there are no uncontrolled fires that could have been reasonably prevented as a result of mining activities.	**Construction and operation** Fire incidents caused by mine operations recorded (incident type, description, classification and action taken) in Iluka incident management system reviewed annually to demonstrate outcome achievement (Does not apply to natural bushfires recorded for purposes of internal hazard reporting).	None proposed.
Flora, fauna, and native vegetation	Closure	FFNV10	**Management** Implementation of a Native Vegetation Management Plan. Implementation of a Rehabilitation Management Plan.	The Tenement Holder 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.	**Closure** Landscape Function Analysis to show rehabilitated areas are trending towards pre-disturbance landscape function based on comparison with control site. The following will be collected: • Soil cover • basal cover of vegetation • litter cover • BSC • crust entirety • erosion type and severity • deposited materials • surface roughness • surface resistance to disturbance • slake testing • soil texture • vegetation diversity and abundance.	**Closure** Assessment of early rehab success.
Flora, fauna, and native vegetation	Construction Operation	FFNV11	Light only the object areas intended- keep lights as close to the ground as practicable to avoid light spill. Use the lowest intensity lighting appropriate for the task. **Control** Use adaptive light controls to manage light timing.	The Tenement Holder will ensure that there are no net adverse impacts from the site operations on native fauna abundance or diversity in the lease area and in adjacent areas.	As per FFNV3 (for construction and operation)	As per FFNV3 (for construction and operation)
Flora, fauna, and native vegetation	Construction Operation	FFNV12	**Control** Equipment, machinery and vehicles should be regularly maintained (documented). All machinery and equipment to be used will comply with the relevant Australian standard for noise attenuation (e.g., have noise mufflers and be well maintained).	The Tenement Holder will ensure that there are no net adverse impacts from the site operations on native fauna abundance or diversity in the lease area and in adjacent areas.	As per FFNV3 (for construction and operation)	As per FFNV3 (for construction and operation)

Environmental element	Project phase	Impact ID	Control measures and management strategies	Proposed outcome	Draft outcome measurement criteria	Draft leading indicator
			Vehicles and machinery should not be left idling when not in use.			
Public health and safety	Construction Operation	PHS1	**Design** Access to Atacama through single point access from the J-A mine site entrance. Signage erected and maintained to deter unauthorised access. Mine plan designed to ensure the village is the first point of contact on the access road. **Control** Pre-mobilisation-site Access Request (SAR) process. Authorised public visits are managed through SAR process. Implementation of a travellers' drop-in procedure. **Management** Personnel educated to direct any unauthorised visitors to the village office at J-A. Maintain site-based Emergency Response Team and Ambulance Officers including assets and equipment. Implementation of an Emergency Crisis System and Iluka Group Standard. Incident reports concerning unauthorised site access, operational fires and traffic/ haulage events recorded in Iluka's Incident Management System.	The Tenement Holder must during construction and operation ensure that unauthorised entry to the land does not result in public injuries or deaths that could have been reasonably prevented.	**Construction and operation** Unauthorised access incident recorded (incident type, description, classification and action taken) in Iluka's Incident Management System. Investigation completed in 14 days, or as agreed with the Director of Mines (or other authorised officer).	None proposed
Public health and safety	Closure	PSH2	**Design** Final landform design reviewed against approved design. **Management** Implementation of a Rehabilitation Management Plan. Implementation of a Mine Closure Plan.	The Tenement Holder must demonstrate that at closure the risks to the health and safety of the public so far as they may be affected by the final landforms are as low as reasonably practical.	**Closure** Topographic survey of rehabilitated site compared with approved design (comparison of RLs). Site audit of infrastructure type, disposal location and record of infrastructure having been removed offsite. Site audit of safety and compliance certificates (or similar records) for any retained infrastructure. Negotiation and sign off from Landowners (DEW and FWCAC) on relinquishment/ handover of any retained infrastructure.	None proposed

Environmental element	Project phase	Impact ID	Control measures and management strategies	Proposed outcome	Draft outcome measurement criteria	Draft leading indicator
Public health and safety	Construction Operation	PSH3	**Control** Maintenance of fire breaks. Vehicles and equipment carry fire suppressant equipment. Emergency evacuation procedures established and communicated. **Management** Implementation of Fire Risk Management Plan, and the J-A Emergency Response Plan which will be extended to Atacama. Observation of fire ban rules. Fire truck, suppression equipment and trained emergency response team on call 24/7. Consultation with CFS, DEW, Ceduna Council and emergency service providers prior and during fire danger periods.	The Tenement Holder must during construction and operation ensure that uncontrolled fires due to the mining operation does not result in public injuries or deaths that could have been reasonably prevented.	**Construction and operation** Fire incidents caused by mine operations recorded (incident type, description, classification and action taken) in Iluka Incident Management System Incident investigations completed within 14 days or other time period as agreed with the Director of Mines. Incident trends reviewed annually. *(Does not apply to natural bushfires recorded for purposes of internal hazard reporting)*	**Construction and operation** Quarterly review of incidents, audits and hazards relating to fire.
Waste	Construction Operation Closure	W1	**Control** Waste Transfer Station for segregation of wastes. Waste facility fencing for exclusion of fauna/ containment of litter located at J-A. Receptacles for general wastes and recyclables installed throughout Project Area. Approved Wastewater Treatment Plants for treatment of greywater and sewage. Waste collection by EPA-licensed transporters and treatment/ disposal to EPA-approved facilities (where applicable). **Management** Preventive baiting programs for vermin (house mouse) Monitoring and housekeeping inspections. Site induction inclusive details onsite waste management procedures. Waste management awareness training. Implementation of a Waste Management Plan. Implementation of a Pest Species Management Plan.	The Tenement Holder must ensure that no demolition, industrial or solid domestic waste (other than treated sewage) is disposed of on site.	**Construction and operation** Visual monitoring and recording in the site waste register demonstrates appropriate waste treatment, segregation and disposal demonstrates that appropriate waste treatment, segregation and disposal has occurred. Audit of waste disposal records for all waste types (general waste, recyclables, hazardous and listed wastes) demonstrates that waste has been stored and managed in accordance with the Waste Management Plan. **Closure** Audit report demonstrates that no demolition, industrial or solid domestic wastes (except biosolids and residual infrastructure detailed in the Mine Closure Plan) have been left onsite.	**Construction and operation** Quarterly review of site waste register containing records of all waste movements from site.

Environmental element	Project phase	Impact ID	Control measures and management strategies	Proposed outcome	Draft outcome measurement criteria	Draft leading indicator
Waste	Construction Operation Closure	W2	**Design** Bunding and containment of dangerous goods and hazardous substances per relevant legislation, guidelines and Australian/New Zealand standards. **Management** Implementation of a Hazardous Materials Management Plan. Implementation of a Waste Management Plan that covers management of hazardous wastes. Hazardous Materials Approval procedure Inventory management, monitoring and inspection requirements. Spill response/ clean-up procedures. Emergency Response Team trained in fire and hazmat emergency response, including spill response trailer. Site induction inclusive details on-site hazardous materials management. Hazardous materials management training awareness program. Planned workplace inspections. Loss Control reporting system. Vehicle, plant and infrastructure preventative maintenance programs. Vehicle and equipment pre-start checks.	The Tenement Holder must ensure that fuel and liquid chemicals (hazardous materials) are managed in accordance with relevant EPA guidelines to prevent spillage and leakage to the environment.	**Construction and operation** Visual monitoring and recording of the appropriate clean up and disposal of contaminated material demonstrates that all spills were managed in accordance with Spill Response/ Clean Up Procedure and Iluka HSEC Group Standard – Hazard, Incident and Emergency Classification. Annual reporting to DEM (via the Annual Compliance Report) provides a summary of all Level 2 or higher hazardous material spill events, response clean up (as ranked according to the Iluka HSEC Group Standard – Hazard, Incident and Emergency Classification). Visual observations and incident investigation (report stored in Iluka Incident Management System demonstrates that all hazardous materials storage facilities comply with SA EPA Bunding Guidelines, or to a design agreed to with the SA EPA to prevent spillage and leakage to the environment. Visual monitoring and recording of the appropriate clean up and disposal of contaminated material demonstrates that all spills were managed in accordance with Spill Response/ Clean Up Procedure and Iluka HSEC Group Standard – Hazard, Incident and Emergency Classification. Annual reporting to DEM (via the Annual Compliance Report) provides a summary of all Level 2 or higher hazardous material spill events, response clean up (as ranked according to the Iluka HSEC Group Standard – Hazard, Incident and Emergency Classification). **Closure** Audit report demonstrates: • that soil sampling of target sites and management of any impacted soils has occurred in accordance with the *National Environment Protection (Assessment of Site Contamination) Measure 1999* (ASC NEPM) and • that classification for off-site disposal of material has occurred as per SA EPA information sheet (March 2010) *Current criteria for the classification of waste – including industrial and Commercial Waste (Listed) and Waste Soil*.	**Construction and operation** Quarterly review of incident register for spillages and leaks and the clean-up and disposal of contaminated material, including the identification of any procedural changes required. Quarterly review of incident register for spillages and leaks and the results of visual observations of hazardous materials storage facilities, including identification of any procedural changes required

Environmental element	Project phase	Impact ID	Control measures and management strategies	Proposed outcome	Draft outcome measurement criteria	Draft leading indicator
Groundwater, including quality and quantity	Operation	GW6	**Design** Water holding ponds are designed with appropriate lining including embankments and base. **Control** Regular inspection and maintenance of water holding ponds. No discharge of process water into the mine pits. **Management** Implementation of Groundwater Management and Monitoring Plan Monitoring of mine site groundwater chemistry Sampling and analysis of water holding ponds in the Project Area. Monitoring of vegetation health	The Tenement Holder must during construction, operations and closure ensure that there is no adverse change to groundwater quality and quantity as a result of the Project.	**Operation** Water quality samples collected and analysed at a NATA accredited laboratory for pH, EC, TDS, temperature, major cations (Ca, Mg, K, Na,), major anions (Cl, SO_4, Alkalinity, CO_3, HCO_3), dissolved organic carbon and dissolved metals (Fe, Mn Al, Cd, Cu and Ni) and SWL demonstrate no statistically significant deviation from baseline which can be attributed to mining operations.	None proposed
Surface Water, including quality and quantity	Construction Operation	SW2	**Design** Surface water flow managed by culverts at waterway crossings. Requirements for drainage design to minimise storm water runoff to unnamed drainage lines near the haul road. **Management** Expand and enhance the existing J-A Surface Water Management Plan to Atacama	The Tenement Holder must ensure no adverse impact on surface water quality as a result of mining operations.	**Construction and operation** Annual sediment sampling upstream and downstream of haul road drainage line crossings (measuring ECH, turbidity and pH) demonstrate that sediment quality (as a proxy for water quality) downstream is comparable with upstream results.	None proposed
Surface Water, including quality and quantity	Closure	SW3	Refer to Impact ID FFNV1.			
Surface Water, including quality and quantity	Construction Operation	SW6	Refer to Impact ID W2.			

Environmental element	Project phase	Impact ID	Control measures and management strategies	Proposed outcome	Draft outcome measurement criteria	Draft leading indicator
Air quality	Construction Operation	AQ3	**Design** Vegetation cleared in accordance with approval, with retention maximized. Minimisation of open areas through staged clearing. **Control** Use of water carts on unpaved roads to minimise wheel-generated dust by haul trucks. Stabilisation of stockpiles using suppressant (enhancing surface crusting). Vehicle speed limits in accordance with TMP. Procedures for vegetation clearance and removal of soil profiles for stockpiling or direct return. Timing and management of clearance to minimise erosion. Revegetation of rehabilitated areas. **Management** Ongoing maintenance of haul roads. Dust and Air Quality Management Plan. Native Vegetation Management Plan. Mineral Stockpiles Management Plan. Rehabilitation Management Plan. Weather forecast and field suppression plans as part of the Dust and Air Quality Management Plan. Site induction inclusive of details on dust risks and management.	The Tenement Holder must ensure that all clearance of native vegetation is authorised under appropriate legislation	**Construction and operation** Monitoring of vegetation health to be undertaken to measure: • plant mortality • new growth • evidence of flowering and fruiting • extent of smothering • evidence of saline stress.	None proposed
Air quality	Construction Operation	AQ5	**Design** Reduce disturbance footprint that would otherwise be disturbed during land clearing. Incorporation of renewable energy electricity sources to replace diesel generated electricity. Use of emissions control equipment on fixed and mobile plant and equipment. **Management** Consideration of Iluka's emission offset strategy	The Tenement Holder will provide annual updates on GHG emissions	**Construction and operation** Annual reporting of operational emissions into the National Pollution Inventory (NPI) database and reporting under the National Greenhouse and Energy Reporting NGER (www.cleanenergyregulator.gov.au).	None proposed

Environmental element	Project phase	Impact ID	Control measures and management strategies	Proposed outcome	Draft outcome measurement criteria	Draft leading indicator
Visual amenity	Construction Operation	VA1	**Design** Design and siting of infrastructure to minimize impact. The MUP and roads will be aligned with pits and will disturb dune crests. All other infrastructure, stockpiles and disturbances will be limited to within the swales rather than the crests to the greatest extent practicable. The Project will maximise the use of services at J-A to minimize infrastructure required at the Project Area. Incorporation of progressive rehabilitation into the rehabilitation plan to the greatest extent practicable. **Control** Ongoing dust control during construction, operation and rehabilitation, implemented as discussed in Section 7.10. Staging of pit excavation and clearing of vegetation to minimise the disturbed area at any time during the operation phase. Progressive rehabilitation of the site will be undertaken during the life of the mine in accordance with rehabilitation plan. **Management** Implementation of Stockpile Management Plan. Implementation of Rehabilitation Management Plan.	The tenement holder must ensure that the mining operations are conducted in accordance with the approved mine plan and that key stakeholders are engaged with throughout construction and operation.	**Construction and operation** Internal audit demonstrates that the mine infrastructure and layout are constructed in accordance with the approved mine plan.	None proposed
Visual amenity	Closure	VA2	**Design** Design of final landform to be compatible with existing environment including all areas outside mine pits. Design of final landform to be developed in accordance with erosion and surface water assessment. Consultation with land managers and FWCAC on proposed post disturbance landform design. **Management** Implementation of rehabilitation plan during operations and post closure. Implementation of mine closure plan	The tenement holder must ensure that the reconstructed final landform is consistent with approved rehabilitation plan.	**Closure** Topographic survey of rehabilitated site compared with approved design (comparison of RLs).	None proposed

Environmental element	Project phase	Impact ID	Control measures and management strategies	Proposed outcome	Draft outcome measurement criteria	Draft leading indicator
Traffic	Operation	T2	**Control** Policy to limit heavy vehicle travel after dark, speed controls around townships. **Management** Regular review, update and implementation of existing Traffic Management Plan for the operations to ensure that the Plan is current and fit for purpose throughout the proposed route use duration extension. The review must include, but not be limited to speed restrictions, access points, road inspections, sensitive receptors along the route. Implementation of an Emergency Response Plan and training. Maintain on-site emergency response team, including assets and equipment. Road maintenance. Training on traffic and incident management.	The Tenement Holder must demonstrate that during construction and operation, there are no traffic incidents resulting in public injury or death caused by the mining operations that could have been reasonably prevented.	**Operation** All traffic accidents/ near misses are recorded in the Iluka Incident Management System. All recorded traffic incidents are investigated within 14 days or other time period as agreed with the Director of Mines.	None proposed
Traffic	Operation	T5	**Management** Development and implementation of a Traffic Management Plan for the Construction Phase of the Project Maintain Complaints and Corrective Action Register	The Tenement Holder must demonstrate that during construction and operation all reasonable complaints raised by the public have been recorded and investigated.	**Construction** All complaints and feedback from public are recorded in the Iluka Incident Management System. All recorded complaints are investigated by the tenement holder, and where required, corrective actions are implemented to prevent recurrence or to minimise the future potential impact as far as reasonably practicable.	None proposed
Traffic	Construction	T6	See T2	See T2 (for construction)		
Soil and land quality	Construction Operation	SL1	**Design** All vegetation clearance restricted to approved footprint. **Control** Prohibiting topsoil and subsoil (if other than brown loam) stripping when winds exceed 20 km/h. Vegetation clearance will be staged, and progressive rehabilitation will be undertaken. Restricting access to stockpiles. **Management** Implementation of a Dust & Air Quality Management Plan. Implementation of a Minerals Stockpile Management Plan. Implementation of a Native Vegetation Management Plan.	The Tenement Holder must ensure that the soil function is capable of supporting the agreed land use.	**Construction and operation** Annual soil balance completed from year 1 of vegetation clearance / stockpiling and a soils balance and inventory is subject to annual documented reconciliation and audit.	None proposed

Environmental element	Project phase	Impact ID	Control measures and management strategies	Proposed outcome	Draft outcome measurement criteria	Draft leading indicator
			Implementation of a Rehabilitation Management Plan. Land clearance undertaken in accordance with Approvals.			
Soil and land quality	Construction Operation Closure	SL2	**Design** Sequencing of overburden replacement to support selected landscape function and use. Topsoil types will be mapped and categorised for future use and mine closure planning. Topsoil and subsoil will be stockpiled separately to avoid working areas, areas of natural drainage and access tracks. If practical, topsoil will be directly returned to site rehabilitation works. **Control** Natural regeneration of vegetation cover on topsoil/subsoil stockpiles. Restricting access to stockpiles. **Management** Implementation of a Native Vegetation Management Plan. Implementation of a Dust & Air Quality Management Plan. Implementation of a Minerals Stockpile Management Plan. Implementation of a Rehabilitation Management Plan. Soil water and salt movement modelling undertaken in reconstructed soil profiles. Document the location and type of soils in each stockpile. Undertake survey scanning monitoring of topsoil and subsoil stockpiles for erosion, vegetation cover, weeds. Loams, soils and timber stockpiles to be included in annual soil balance and overburden inventories. Research program to clarify unknown characteristics of soils and vegetation.	The Tenement Holder must ensure that the soil function is capable of supporting the agreed land use.	**Construction and operation** Annual soil balance completed from year 1 of vegetation clearance / stockpiling and a soils balance and inventory is subject to annual documented reconciliation and audit. **Closure** Landscape Function Analysis (over a minimum of five years after the completion of rehabilitation) to show that the BSC profile (minimum age class 2) and function has been restored. As described in *Field guide for landscape function analysis for environmental monitoring and assessment, Minerals Regulatory Guideline 21 (MG 21)* (DMITRE 2013).	None proposed

Environmental element	Project phase	Impact ID	Control measures and management strategies	Proposed outcome	Draft outcome measurement criteria	Draft leading indicator
Soil and land quality	Operation Closure	SL3	**Design** Minimise potential erosion impacts through staged clearing and progressive rehabilitation where possible. **Control** Restricting access to stockpiles Prohibiting topsoil and subsoil stripping when winds exceed a defined threshold (note that the threshold will be defined in the relevant management plan) Surface water management infrastructure is designed to reduce loss of topsoil and subsoil through erosion and sedimentation for mine operational stockpiles and borrow pit stockpiles. Erosion and sediment control measures including vegetation cover or chemical application to minimise erosion. Bunding around stockpiles to contain sediment migration from rain events. Regular inspections and maintenance of sediment and erosion control devices during operations Natural regeneration of vegetation cover on topsoil/subsoil stockpiles **Management** Implementation of Erosion and Sediment Control Plan Implementation of Native Vegetation Management Plan, Rehabilitation Management Plan, Dust and Air Quality Management Plan, Surface Water Management Plan and stockpile monitoring program.	The Tenement Holder must ensure that the soil function is capable of supporting the agreed land use.	**Operation** Annual soil balance completed from year 1 of vegetation clearance / stockpiling and a soils balance and inventory is subject to annual documented reconciliation and audit. . **Closure** Landscape Function Analysis (over a minimum of five years after the completion of rehabilitation) to show that the BSC profile (minimum age class 2) and function has been restored. As described in *Field guide for landscape function analysis for environmental monitoring and assessment, Minerals Regulatory Guideline 21 (MG 21)* (DMITRE 2013).	Regular erosion and sediment controls inspection records indicate that surface water management infrastructure has been implemented and maintained for topsoil, subsoil and overburden stockpiles. Inspection within 24 hours of >10mm/12hr rainfall events as recorded in onsite rainfall gauge, indicate no additional evidence of increased erosion or sedimentation
Soil and land quality	Operation	SL4	**Management** Amend the current J-A Soil Management Plan Undertake further geochemical analysis of Marine sands to quantify ASS risk.	The Tenement Holder must ensure that the soil function is capable of supporting the agreed land use.	**Operation** Annual mine records demonstrate all areas of acid sulphate encountered were appropriately managed.	None proposed

Environmental element	Project phase	Impact ID	Control measures and management strategies	Proposed outcome	Draft outcome measurement criteria	Draft leading indicator
Soil and land quality	Construction Operation Closure	SL5	**Design** Progressive rehabilitation of disturbed area, commencing within first few years of operations, where possible. Operate stockpile returns in a first out – first replaced system wherever possible. **Control** Ensure, when establishing stockpiles that just enough moisture for erosion and sediment control processes- not excessive moisture added. Collect seedstock from alternate locations over the life of the mine. Topsoil and subsoil stockpiled to a maximum of 2 m and 4 m in height respectively, to preserve seed stock and micro-organism function. Use of temporary sediment and erosion controls (e.g., mobile booms) if required. Implement procedures for stockpiling and stockpile maintenance. Direct return of topsoil and subsoil where possible. Restricting access to stockpiles. Direct seeding of rehabilitated areas. Undertake survey scanning monitoring of topsoil and subsoil stockpiles for erosion, vegetation cover, weeds. Undertake weed management on stockpiles. **Management** Implementation of a rehabilitation management plan. Implementation of the Stockpile Management Plan (currently used at J-A).	The Tenement Holder must ensure that the soil function is capable of supporting the agreed land use.	**Construction and Operation** Annual soil balance completed from year 1 of vegetation clearance / stockpiling and a soils balance and inventory is subject to annual documented reconciliation and audit. **Closure** Landscape Function Analysis (over a minimum of five years after the completion of rehabilitation) to show that the BSC profile (minimum age class 2) and function has been restored. As described in *Field guide for landscape function analysis for environmental monitoring and assessment, Minerals Regulatory Guideline 21 (MG 21)* (DMITRE 2013).	None proposed.
Soil and land quality	Closure	SL6	**Management** Sample soil salt concentrations in areas required for dust suppression and remove salt contaminated soils prior to rehabilitation. Implementation of a Rehabilitation Management Plan. Implementation of Surface Water Management Plan which includes regular inspections of surface water drainage systems.	The Tenement Holder must ensure that the soil function is capable of supporting the agreed land use.	**Closure** Analysis of soil salinity (ECe) at soil test hole drilling within in-pit rehabilitated areas demonstrates no salinisation of rehabilitated soil profile compared to baseline.	None proposed

Environmental element	Project phase	Impact ID	Control measures and management strategies	Proposed outcome	Draft outcome measurement criteria	Draft leading indicator
Soil and land quality	Closure	SL7	**Design** Staging of pit excavation and clearing of vegetation to minimise the disturbed area at any time during the operation phase. Progressive rehabilitation of the site will be undertaken during the life of the mine in accordance with rehabilitation plan. **Control** Ongoing dust control during construction, operation and rehabilitation, implemented as discussed in Section 7.10. Rehabilitated areas ripped on the contour to increase surface roughness and slow wind speed at ground level. Replacement of vegetation debris to reduce wind and water erosion. **Management** Implementation of a Native Vegetation Management Plan. Implementation of a Minerals Stockpile Management Plan. Implementation of a Rehabilitation Management Plan. Implementation of Erosion and Sediment Control Plan. Erosion modelling of final landform design.	The Tenement Holder must ensure that the soil function is capable of supporting the agreed land use.	**Closure** Landscape Function Analysis (over a minimum of five years after the completion of rehabilitation) to show that the BSC profile (minimum age class 2) and function has been restored. As described in *Field guide for landscape function analysis for environmental monitoring and assessment, Minerals Regulatory Guideline 21 (MG 21)* (DMITRE 2013).	**Closure** Prior to closure dust deposition monitoring for 12 months demonstrates that fugitive dust emissions from the rehabilitated landscape is consistent with control sites. *[Prior to closure dust gauge sites will be established at agreed locations with DEM].*

8 MATTERS OF NATIONAL ENVIRONMENTAL SIGNIFICANCE ASSESSMENT

To be consistent with specified EPBC Act terminology, the Proposed Action instead of the Conceptual Footprint will be referred to in Section 8. This terminology has been used as there are key differences between the Conceptual Footprint (which was used for assessment within Section 7) and the Proposed Action Area (which will be used for assessment within this section). These differences are outlined in Figure 8-1.

This section provides a comprehensive assessment of potential impacts of the Proposed Action on MNES for disturbance occurring within the Project Area and on ML 6315.

8.1 Assumptions

The MNES impact assessment is based on the following assumptions:

- To ensure that all aspects of the Proposed Action are evaluated under the EPBC Act, all potential impacts will be considered for disturbance related to the Project which occurs within the Atacama Project Area and on ML 6315. As a result, a new area, the Proposed Action Area is discussed within this section.
- This assessment is based on the direct and indirect impacts (vegetation clearing) of 100% of the Proposed Action Area. It should be noted that this assumption is using the Precautionary Principle and presents the worst-case scenario. The likelihood is that not all of the Proposed Action Area will be subject to vegetation clearing (especially dune field areas which will not be disturbed wherever possible) and hence the impacts are likely to be less than discussed here.

The following terms are used within this section and as such defined/ redefined here:

Project Area: The area in which the Project will occur and the boundary of which has been used to study the environmental baseline (see Figure 1-1 for boundary).

Conceptual Footprint: The area within the Project Area in which native vegetation clearance will occur for the Project. This footprint has been used for the Mining Act Assessment.

Proposed Action Area: The area defined for the EPBC Act Assessment. It is inclusive of the direct impacts associated with the Conceptual Footprint (plus a 50 m buffer). It also includes areas of vegetation that may be impacted within ML 6315 resulting from changes to infrastructure at J-A that are required for the Proposed Action, including the proposed haul road (plus 50 m buffer) and the extension of the Jacinth sand stack (no buffer) (refer Section 4.9).

Figure 8-1shows the Proposed Action Area in relation to the Atacama Conceptual Footprint, the Atacama Project Area, and ML 6315.

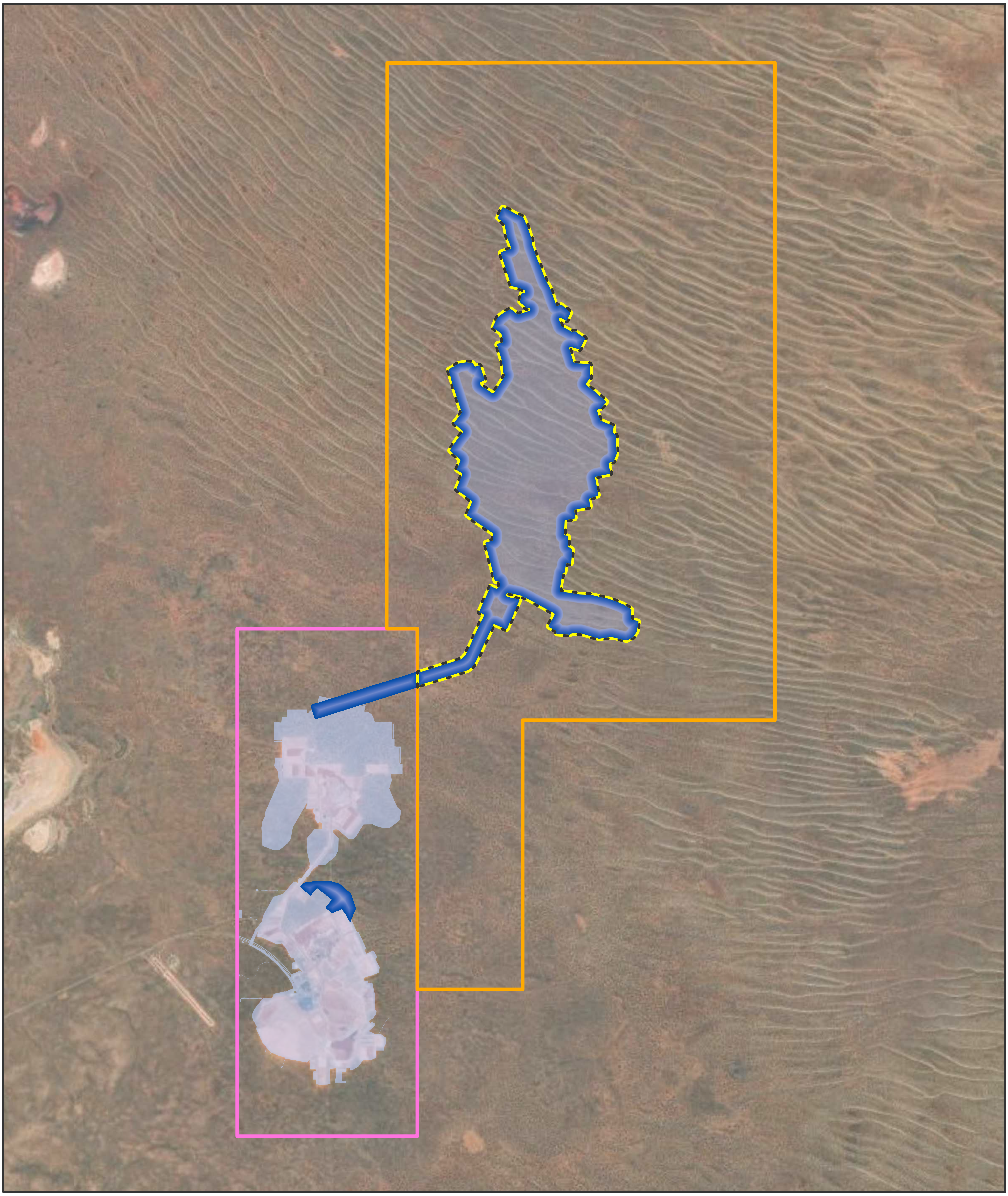

Figure 8-1 Proposed Action Area

8.2 Legislation

The EPBC Act provides a legal framework to protect and manage nationally and internationally important flora, fauna, ecological communities and heritage places. The purpose of the EPBC Act is to prevent significant impacts occurring to MNES through the assessment of Proposed Actions against the Significant Impact Guidelines 1.1 (DoE 2013).

As summarised in Section 2.2, the Proposed Action was referred to DCCEEW under the EPBC Act and the Minister for the Environment determined the Proposed Action to be a Controlled Action under Section 75 of the EPBC Act on 9 November 2022 [ref. EPBC 2022/09289]; therefore, it requires further assessment and approval under the EPBC Act before it can proceed. The relevant controlling provision of the EPBC Act is 'listed threated species and communities' (Section 18 and 18A of the EPBC Act). DCCEEW's decision on referral determined that the Proposed Action may have, or is likely to result in a significant impact to:

- *Leipoa acellata* (Malleefowl) (Vulnerable EPBC Act & Vulnerable NPW Act)
- *Sminthopsis psammophila* (Sandhill Dunnart) (Endangered EPBC Act & Vulnerable NPW Act)
- *Hibbertia crispula* (Ooldea Guinea-flower) (Vulnerable EPBC Act & Vulnerable NPW Act).

The State is assessing the Proposed Action as an Accredited Assessment on behalf of the Commonwealth under Section 87 of the EPBC Act. This assessment provides for a single environmental assessment process conducted by the State, with DCCEEW providing comment on the MLP during the public comment period and reviewing the Response to Submissions. At the completion of the assessment, the MLP report is provided to DCCEEW to assess the likely impacts of the Proposed Action on MNES.

The Commonwealth Minister for the Environment will make an approval decision. On approval, a Decision Notice will be issued, including implementation conditions to be applied to the Proposed Action.

This section addresses Sections 9, 10, 11, 12, 14, 15, 16 and 17 of the TOR Atacama – *Terms of Reference for the Atacama Mineral Sands Project Mining lease application in accordance with EPBC Act Accredited Assessment under the Mining Act 1971 (Notice under Section 36 of the Mining Act 1971)* by including:

- background description of the EPBC Act action and MNES (Section 8.2 & Section 8.3)
- assessment of potential impacts on MNES (Sections 8.3.5 and 8.5)
- discussion of avoidance, alternatives, mitigation and safeguards (Section 8.4)
- discussion of offsets (if required) (Section 8.6)
- environmental record of persons proposing to take the action (Section 8.8)
- ecologically sustainable development (Section 8.9)
- information relating to information sources (Section 8.10)
- MNES conclusion (Section 8.11)

8.2.1 Relevant policy and guidelines

The following policies and guidance have been considered in undertaking the impact assessment of significance on MNES from the Proposed Action:

- Significant Impact Guidelines 1.1.
- Environment Protection and Biodiversity Conservation Act 1999 Environmental Offsets Policy (2012).
- Environmental Management Plan Guidelines (2014).

8.2.2 Conservation advice, threat abatement and recovery plans

Additional conservation advice, recovery plans and threat abatement plans that have been considered in undertaking assessment of the significance on MNES from the Proposed Action are:

- DEWHA (2008) Approved Conservation Advice for *Hibbertia crispula* (Ooldea Guinea-flower).
- DoE (2015) Conservation Advice *Sminthopsis psammophila* Sandhill Dunnart.
- DEE (2016) Threat abatement plan for competition and land degradation by rabbits.
- DEH (2007) National Recovery Plan for Malleefowl.
- DoE (2015) Threat abatement plan for predation by feral cats.
- DEE (2017) Threat abatement plan for predation, habitat degradation, competition and disease transmission by feral pigs (*Sus scrofa*).
- DEWHA (2008) Threat abatement plan for competition and land degradation by unmanaged goats.
- DEWHA (2008) Threat abatement plan for predation by the European red fox.
- DEE (2016) Threat abatement plan for competition and land degradation by rabbits.

8.2.3 Other reference material

The following other reference material has also been considered in undertaking this assessment:

- SA DEH (2009) Threatened species – Sandhill Dunnart.
- Moseby *et al* (2016) How high is your hummock? The importance of Triodia height as a habitat predictor for an endangered marsupial in a fire-prone environment.
- NSW DECCW (2002) Malleefowl General Fact Sheet.
- NSW NPWS (1999) Malleefowl Threatened Species Information.
- Bensheesh, J.S. (2003) Flora and Fauna Guarantee Action Statement 59 – *Malleefowl Leipoa acellata.*

8.2.4 Significant impact guidelines

The Significant Impact Guidelines 1.1 (DoE 2013) assist in determining whether an action is likely to have a significant impact on a threatened species. In accordance with these guidelines the impact assessment of MNES is to address the following key concepts:

- Habitat critical to the survival of a species.

- Any population of a species that is listed as Endangered or Critically Endangered under the EPBC Act, and any 'important population' of a species listed as Vulnerable. 'Habitat critical to the survival of a species' refers to areas that are necessary:
    - for activities such foraging, breeding, roosting, or dispersal
    - for the long-term maintenance of the species or ecological community (including the maintenance of species essential to the survival of the species or ecological community, such as pollinators)
    - to maintain genetic diversity and long-term evolutionary development
    - for the reintroduction of populations or recovery of the species or ecological community.
- Such habitat may include, but is not limited to, habitat identified in a Recovery Plan for the species or ecological community as habitat critical for that species or ecological community, and/or habitat listed on the Register of Critical Habitat maintained by the Minister under the EPBC Act (DoE 2013).

An 'important population' is a population that is necessary for a species' long-term survival and recovery. Important populations may include populations identified as such in Recovery Plans, and/ or that are:

- key source populations either for breeding or dispersal
- populations that are necessary for maintaining genetic diversity
- populations that are near the limit of the species' range (DoE 2013).

8.3 MNES values of the Project Area

8.3.1 Surveys and survey effort

Several fauna surveys have been conducted within, and in proximity to, the Project Area over several years. Previous flora and fauna studies undertaken from 1992 include:

- A Biological Survey of the Yellabinna Region of South Australia (Copley & Kemper 1992).
- Report on Fauna Survey 2005: Part I - Iluka Resources Ltd Mineral Deposit Area, Yellabinna Regional Reserve, South Australia (SKM 2006) conducted in 2005.
- Eucla Basin Baseline Vegetation Survey Jacinth and Ambrosia Deposits (Badman 2006).
- Jacinth-Ambrosia Project: A Vegetation Survey of the Jacinth – Ambrosia Wellfield and Pipeline Corridor (Badman 2007).
- Vegetation Mapping and Data Recording for the Jacinth-Ambrosia Mine (EBS 2008a).
- Sandhill Dunnart Survey, Barton Regional Exploration Program (EBS Ecology 2009c).
- Jacinth-Ambrosia Fauna Monitoring ((EBS 2008b, 2009a, 2010e, 2012b, 2014b, 2015b, 2017) and Jacobs (2020)).
- Jacinth-Ambrosia Vegetation Monitoring (EBS 2010b, 2010c, 2011, 2012a, 2014a, 2015c).
- Predator Activity Monitoring, Barton Mineral Sands Drilling Program (EBS Ecology 2010a, 2010b).
- Sonoran Baseline Flora and Fauna Assessment (EBS 2013a).

These surveys provided baseline information that allowed the likely presence or absence of MNES to be considered.

Details of the more recent targeted survey efforts completed within the Project Area from 2014 - 2021 are discussed in shown in Table 8-1 and shown in Figures 8-1, 8-2 and 8-3. All surveys were undertaken by suitably qualified and experienced scientists and were compliant with the following guidance:

- Survey Guidelines for Australia's threatened birds: Guidelines for detecting birds listed as threatened under the EPBC Act (2010). Department of the Environment, Water, Heritage and the Arts.
- Survey Guidelines for Australia's threatened mammals: Guidelines for detecting mammals listed as threatened under the EPBC Act (2011). Department of Sustainability, Environment, Water, Population and Communities.

Whilst the age of some of the surveys is acknowledged, the condition of the vegetation assemblages within the Project Area has not changed significantly. During each survey the condition of the Project Area was assessed and compared with that reported in previous surveys.

Table 8-1 Summary of survey effort 2014-2021

Survey	Survey date(s)	Survey type	Survey effort	MNES species recorded
Atacama Project Baseline Flora and Fauna Assessment - 2014 (EBS Ecology 2015a)	23/9/14– 1/10/14 and 26/11/14– 4/12/14	Desktop and generalised survey	• vegetation association and condition mapping • flora ramble survey • five weed arc survey • fauna trapping. Eight trap sites each consisting of: - two lines each with six pitfall traps approx. 10m intervals - 15 baited Elliot traps at 10m intervals - one baited cage trap - eight un-baited funnel traps at 5m intervals - one anabat for one night at each trap site. • one three bank harp trap for one night in each of 4 locations • 20 sites (60 trenches) for Southern marsupial mole • 14 bird surveys using point count technique morning and evening including call playback • aerial survey - transects using a helicopter and five spotters covering over 278 linear km • two remote detection cameras were installed for 48hrs at six sites • spotlighting for one night in two locations with five observers • active searching at each of the eight fauna trap sites • opportunistic observations over nine days by five observers.	Flora Ooldea Guinea-flower. Recorded outside of Project Area – closest record 1.5 km northeast of northern boundary. Fauna Sandhill Dunnart – captured at 4 sites in Project Area Malleefowl – 2 inactive nests within Project Area. *Notoryctes typhlops* (Southern marsupial mole – Backfilled tunnels (moleholes) recorded at nine of the 20 trenching sites. **NOTE**: Southern marsupial mole is no longer listed under the EPBC Act and will not be considered further in this report.
Atacama Project Targeted Surveys (EBS Ecology 2019c)	11/09/2019 – 18/09/2019	Targeted threatened species survey	Total of 8 survey days and 9 survey nights which included: • targeted ramble search for Ooldea Guinea-flower across 32 dune crests with 200 m transects in areas of suitable habitat • ramble surveys over 8 days by two observers for Malleefowl and *Polytelis alexandrae (*Princess parrot) • returned to previously detected Malleefowl mounds • camera traps deployed opportunistically at sights with recent Malleefowl activity (e.g., tracks) • Autonomous Recording Units deployed in four locations for *Pezoporus occidentalis* (Night parrot) over total of 24 nights.	Flora No listed flora observed. Fauna Malleefowl – one new inactive mound within the Project Area. Feathers and tracks found in the Project Area (north).

Survey	Survey date(s)	Survey type	Survey effort	MNES species recorded
Atacama Project Targeted Malleefowl survey (EBS Ecology, 2019)	31/8/19–02/09/19 and 29/10/19–3/11/19	Targeted Malleefowl survey	• LiDAR survey across the whole Project Area (31/8/19 – 02/09/19) • LiDAR analysed using near-ground feature detection algorithms • ground-truthing of LiDAR data completed (29/10/19-3/11/19) after which all 'almost certainly a mound' and 'very likely a mound' were assessed in the field • opportunistic survey for signs of presence (e.g., feathers / tracks etc.).	<u>Flora</u> Not relevant to this survey. <u>Fauna</u> 15 (Malleefowl) mounds recorded (six of which were recorded by the LiDAR survey, and nine of which were not identified during LiDAR survey and were recorded during ground survey only: • 6 open inactive mounds • 6 old mounds • 2 mounds dug out • 1 likely to be active in 2019 breeding season. Malleefowl activity observed in 4 areas within Project Area

Atacama threatened species assessment (ELA 2021)	20/10/2021 – 28/10/2021	Targeted threatened species survey	Sandhill Dunnart (total 336 trap nights):
			• Six days and six nights at each of eight trap sites. Each trap site consisted of:
			  ○ Six deep pitfall traps (288 trap nights)
			  ○ One remote sensor camera at each of eight trap sites (48 trap nights).
			• Active searching for track, scats, burrows during the 6-day survey.
			
			Malleefowl:
			• return to nine previously detected Malleefowl mounds within the Project Area
			• one camera deployed at a Malleefowl mound for two days and one night (1 trap night).
			• four songmeters deployed across four sites for between two and four days (12 trap nights)
			• active searching in suitable habitat within Conceptual Footprint – 94.1 km.
			
			Ooldea Guinea-flower:
			• visit existing populations (outside of Project Area) to observed flowering examples
			• targeted searches of dune crests within Conceptual Footprint (4 km)
			• searches undertaken on dune crests during other survey (e.g., for Malleefowl) (94.1 km).
				<u>Flora</u>
				
				No listed flora observed within the Project Area.
				
				<u>Fauna</u>
				
				One inactive burrow potentially belonging to Sandhill Dunnart recorded within Conceptual Footprint, otherwise no observations of the species.
				
				One record of Malleefowl on a camera trap within Project Area but outside of the Conceptual Footprint.
				
				One active Malleefowl mound within Project Area but outside of the Conceptual Footprint.
				
				One recently (but not currently) active Malleefowl mound within Project Area but outside of the Conceptual Footprint.
				
				One old Malleefowl mound recorded within Conceptual Footprint.
				
				Malleefowl tracks recorded within Conceptual Footprint.

8.3.2 MNES species

Four fauna species, three flora species and seven migratory species listed as MNES were returned by the PMST search (2022) as potentially occurring within the Project Area (refer to Table 8-2). The baseline surveys listed above enabled the likely presence or absence of each listed species to be determined as shown in Table 8-2.

Table 8-2 Likelihood assessment

Species	EPBC listing	Record	Likelihood of habitat/ occurrence
Fauna			
Falco hypoleucos (Grey falcon)	V	Not recorded	**Unlikely** Grey Falcon has not been recorded within the Project Area despite four surveys being completed since 2014. There is only one record from 2007 in proximity to the Project Area (Atlas of Living Australia, 2022). The species is confined to arid areas and inhabits *Triodia* grassland, Acacia shrubland and lightly timbered arid woodland. The nest is usually an abandoned stick nest from another species of bird of prey in an upright fork at the top of a tall tree. Nests may be returned to for several years. Grey Falcon feeds on other birds and small mammals and eat out in the open making them easy to observe.
Leipoa ocellata (Malleefowl)	V	Nest mounds recorded within PA but outside of PAA Tracks and old nest mound recorded within PA	**Likely** Refer Section 8.10
Pezoporus occidentalis (Night parrot)	E	Not recorded	**Unlikely** Night Parrot is presumed extinct in South Australia. The Project Area is outside of the known range for Night Parrot (Leesberg et al.). The nearest historical records to the PA are from the Gawler Ranges approx. 350 km east southeast where there are records from the late 19th Century. The species utilizes *Triodia* that is typically complex in structure with an average hummock height around 40-50cm (EBS 2019) and requires key seed producing species such *Uranthoecium truncatum*. Whilst *Triodia* is present within the PA, it does not match the above specialised habitat requirements. Despite this, an acoustic survey was undertaken within the PA in 2019, no confirmed records of Night Parrot were recorded.

Species	EPBC listing	Record	Likelihood of habitat/ occurrence
Sminthopsis psammophila (Sandhill Dunnart)	E	4 records within PA but outside of PAA. 1 potential old nest within DA.	**Possible** Refer Section 8.10
Flora			
Hibbertia crispula (Ooldea Guinea-flower)	V	283 individuals in 5 patches recorded outside of the PA	**Unlikely** Refer Section 8.10
Pterostylis xerophila (Desert greenhood)	V	Not recorded	**Unlikely** This species was not recorded during any of the surveys between 2014-2021. *P. xerophila* is endemic to South Australia and is found in and near the Great Victoria Desert on granite or quartzite rock outcrops. Both flowering and non-flowering plants have a relatively large rosette of leaves making it relatively conspicuous through all parts of the lifecycle. The habitat within the Project Area is sub-optimal for the species as it does not contain rocky outcrops.
Swainsona pyrophila (Yellow swainson-pea)	V	Not recorded	**Unlikely** This species was not recorded during any of the surveys between 2014-2021, despite survey within a fire scar area (fire scar 2002). The plant is an erect perennial to 1 m high and would be easily identifiable. This species is found in the south-eastern half of South Australia along the Murray River valley, there are no records in proximity to the Project Area. *S. pyrophila* grows in mallee scrub on sandy or loamy soil and is usually only found after fire which may be stimulus for seed germination.
Migratory species			

Species	EPBC listing	Record	Likelihood of habitat/ occurrence
Apus pacificus (Fork-tailed swift)	MM	Not recorded	**Possible** This species breeds in Asia and winters in Australia. Fork tailed swift mostly occurs over inland plains and dry and open habitat including riparian woodland and tea-tree swamps, low scrub, heathland or saltmarsh treeless grassland, sandplains covered with Spinifex and coastal sand-dunes. Fork tailed swift feed exclusively on insects caught in flight and hunts at higher altitudes than most of its relatives.
Motacilla cinerea (Grey wagtail)	MT	Not recorded	**Unlikely** Grey wagtail has not been recorded in South Australia north nor west of the Gulf of St Vincent (Atlas of Living Australia, 2022). The species is always associated with running water which is not present within the Project Area.
Motacilla flava (Yellow wagtail)	MT	Not recorded	**Unlikely** Yellow wagtail has not been recorded in South Australia (Atlas of Living Australia, 2022). This species is always associated with running water which is not present within the Project Area.
Actitis hypoleucos (Common sandpiper)	MW	Not recorded	**Unlikely** Common sandpiper breeds in Europe and Asia and winters in Oceania. This species is found in coastal or inland wetlands which are not present within the Project Area.
Calidris acuminata (Sharp-tailed sandpiper)	MW	Not recorded	**Unlikely** Sharp-tailed sandpiper breeds in northeast Asia and winters in Australasia. This species forages mainly on mudflats which are not present within the Project Area
Calidris melanotos (Pectoral sandpiper)	MW	Not recorded	**Unlikely** Pectoral sandpiper breeds in northeast Asia and winters in Australasia. This species forages mainly on mudflats which are not present within the Project Area.
Charadrius veredus (Oriental plover)	MW	Not recorded	**Unlikely** Oriental plover breeds in Mongolia and China and migrates to Australia during the non-breeding season.

PA – Project Area; PAA – Proposed Acton Area

EPBC Listing: E – Endangered, V – Vulnerable, MM – Migratory Marine, MT – Migratory Terrestrial, MW – Migratory Wetland

Based on Table 8-2 and the results of the referral to the Commonwealth Government, the following species only will be considered further in this report when considering significant impacts to MNES from the Proposed Action:

- Ooldea Guinea-flower
- Malleefowl
- Sandhill Dunnart

The following sections summarise the survey effort and results for each of these targeted species.

8.3.2.1 Ooldea Guinea-flower

Ramble surveys targeted for Ooldea Guinea-flower were completed in suitable habitat (refer Section 8.6.2) across the Project Area in 2014. These surveys detected the species outside of the Project Area, recording 283 individual plants across five locations. The closest patch is approximately 1.5 km outside of the northern boundary of the Project Area, or approximately 5.5 km outside of the Proposed Project Area (refer to Figure 8-2).

Further targeted surveys were completed in 2019 (which included walking 32 dune crests covering approximately 6.4 km within Project Area) and 2021 (which included walking 4 km of dune crests within the Conceptual Footprint looking specifically for Ooldea Guinea-flower and a further 94.1 km of ramble survey within Conceptual Footprint looking for Malleefowl, but also observing for Ooldea Guinea-flower (Figure 8-2).

No Ooldea Guinea-flower have been recorded in the Proposed Action Area or the Project Area during any of the surveys undertaken to date.

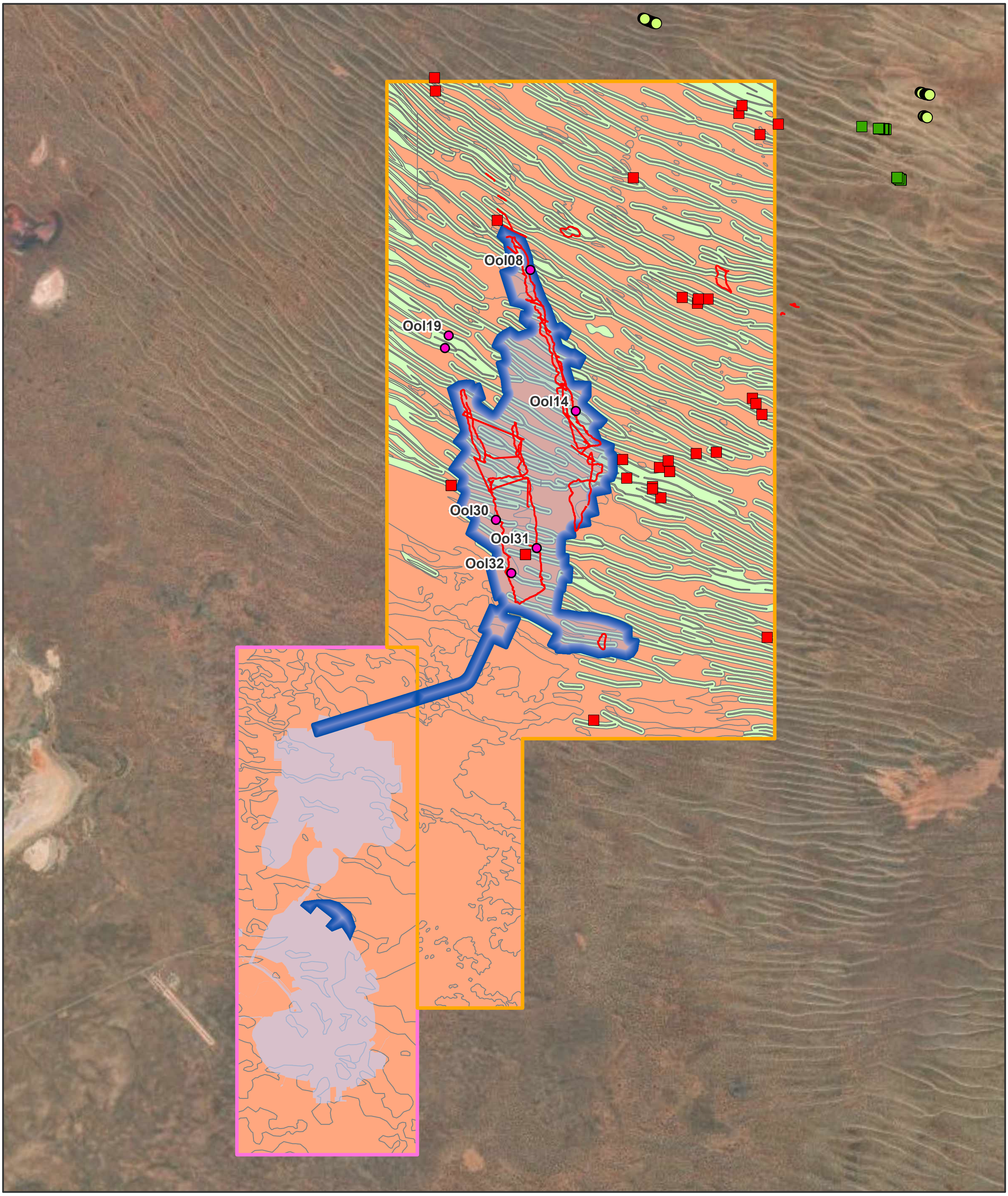

Figure 8-2 Potential Ooldea Guinea-flower habitat and survey results

Project Area

ML 6315

Proposed Action Area

ML 6315 Disturbance Footprint

Ooldea Guinea-Flower Records (BDBSA)

Ooldea Search Effort (2021)

Ooldea Guinea-flower rapid search (absent)

Ooldea Guinea-flower and Mallefowl track log (absent)

Historic Ooldea Guinea-flower Search Effort

Absent

Present

0 2 4

Kilometres

Datum/Projection:
GDA 1994 MGA Zone 53

Project: 20409-SH/OK Date: 2/20/2023

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8.3.2.2 Malleefowl

Malleefowl have been surveyed within suitable habitat (refer Section 8.6.2) within the Project Area using a variety of methods since 2014.

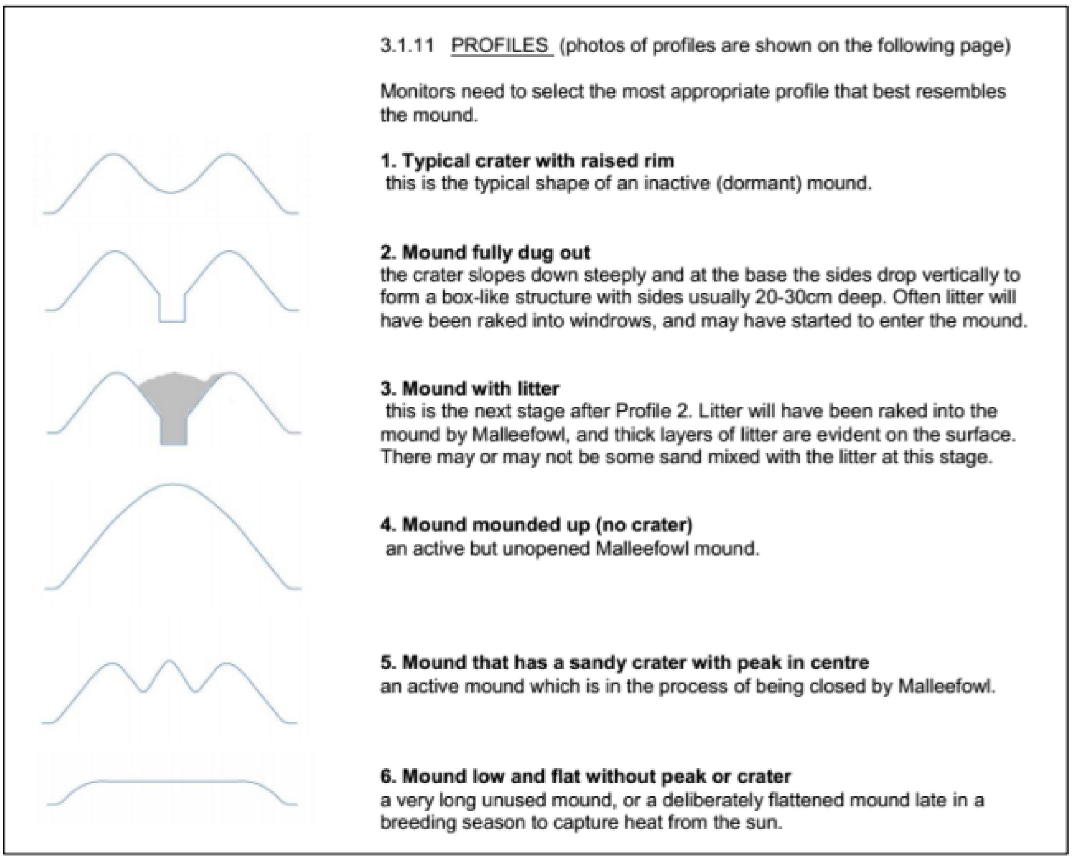
Standard bird counts were completed in 2014 across 14 sites with no sightings of Malleefowl. However, the species is known to be generally wary of humans and their cryptic plumage makes them difficult to detect despite their large size. They are known to occasionally utter distinctive calls (EBS, 2019), hence song meters were used for 12 trap nights in 2021, and 24 nights in 2019, but there were no records of Malleefowl via the song meters.

Remote detection cameras have also been used during the 2014, 2019 and 2021 surveys (a total of 18 trap nights) targeting a variety of species including Malleefowl. Across the 18 trap nights there was only one photograph of one individual recorded in 2021 by a camera located within the Project Area but outside of the Proposed Action Area (refer to Figure 8-4).

Malleefowl make large and distinctive nests (mounds) and the presence of these nests was used to determine presence of the species. In 2014 two active nests were recorded within the Project Area but outside of the Proposed Action Area (refer Figure 8-4) during baseline habitat mapping.

A targeted LiDAR survey for Malleefowl mounds was undertaken in 2019. This consisted of using LiDAR technology to survey the entire Project Area for potential Malleefowl mounds to create a very accurate Digital Elevation Model (DEM) of the entire Project Area. The DEM was analysed to detect Malleefowl mounds using patented near-ground feature detection algorithms to locate potential sites. The potential mounds were ranked depending on the degree of certainty as either 'almost certainly a mound', 'very likely to be a mound' and 'low chance of being a mound'. Each of the 12 objects in the 'almost certainly a mound' and 'very likely to be a mound' and 67 'low chance of being a mound' were ground-truthed as per the Survey Guidelines for Australia's Threatened Birds: Guidelines for Detecting Birds Listed as Threatened under the EPBC Act (DEWHA, 2010). The ground truthing survey was undertaken in early November to comply with the National Malleefowl Manual (National Malleefowl Recovery Team, 2019). Of the 79 mounds ground-truthed, 15 were confirmed in the field to be Malleefowl mounds. 14 mounds were within the Project Area but outside of the Proposed Action Area, whilst one mound was located within the Proposed Action Area adjacent to the north-eastern boundary (refer Figure 8-3). Each mound was assigned a status using the mound profiles described in the National Malleefowl Monitoring manual as shown in Figure 8-3.

- Profile 1 – Typical crater with raised rim.
- Profile 2 – Mound fully dug out.
- Profile 3 – Mound with litter.
- Profile 4 – Mound mounded up (no crater).
- Profile 5 – Mound that has sandy peak with peak in centre.
- Profile 6 – mound low and flat without peak or crater.



3.1.11 PROFILES (photos of profiles are shown on the following page)

Monitors need to select the most appropriate profile that best resembles the mound.

1. Typical crater with raised rim
this is the typical shape of an inactive (dormant) mound.

2. Mound fully dug out
the crater slopes down steeply and at the base the sides drop vertically to form a box-like structure with sides usually 20-30cm deep. Often litter will have been raked into windrows, and may have started to enter the mound.

3. Mound with litter
this is the next stage after Profile 2. Litter will have been raked into the mound by Malleefowl, and thick layers of litter are evident on the surface. There may or may not be some sand mixed with the litter at this stage.

4. Mound mounded up (no crater)
an active but unopened Malleefowl mound.

5. Mound that has a sandy crater with peak in centre
an active mound which is in the process of being closed by Malleefowl.

6. Mound low and flat without peak or crater
a very long unused mound, or a deliberately flattened mound late in a breeding season to capture heat from the sun.

Figure 8-3 Malleefowl mound profiles (Source: National Malleefowl Monitoring Manual – National Malleefowl Recovery Team (2019))

Of the 15 mounds, six were open inactive mounds (Profile 1), six were old mounds (Profile 6), two mounds were dug out (Profile 2), and only one was considered as likely to be active in the 2019 breeding season (Profile 3).

In 2021, surveyors returned to nine of the mounds recorded in 2019 and recorded one active mound and one recently (but not currently) active mound, bringing the total number of Malleefowl mounds to 16. Only one very old inactive mound (Mound Profile 6) recorded in 2019 was located within the Proposed Action Area (Figure 8-4).

Malleefowl nests mounds are not a reliable indicator of breeding success. Malleefowl can abandon nest sites for a variety of reasons including those established in less-than-ideal conditions that may never be successful, those partially constructed and abandoned for a more ideal location, those abandoned in years of lower rainfall and those built by young birds who then abandon them as they are not suitable. Hence the presence of old or abandoned nests does not necessarily correlate with habitat suitable for successful breeding.

It is known that sufficient leaf litter is critical in maintaining nest temperatures and successfully producing offspring (Merchant and Higgins 1993), as they use the accumulated leaf litter to line the nest chamber within their mound as the breakdown of the organic matter generates heat that incubates their eggs (Parsons and Gosper, 2011). The 2021 targeted survey recorded active mounds only where leaf litter cover was highest (30% and 50% respectively and to approximately 5cm in depth) outside of the Proposed Action Area. Within the Proposed Action Area the leaf litter depth varied significantly, was patchy and there was an absence of the required deep rafts of litter, hence no active nests were recorded (ELA, 2021).

Opportunistic sightings of tracks, scats and feathers were completed across all the surveys and returned signs of recent activity in both the 2019 and 2021 surveys, including tracks inside the Proposed Action Area in 2021 (Figure 8-4).

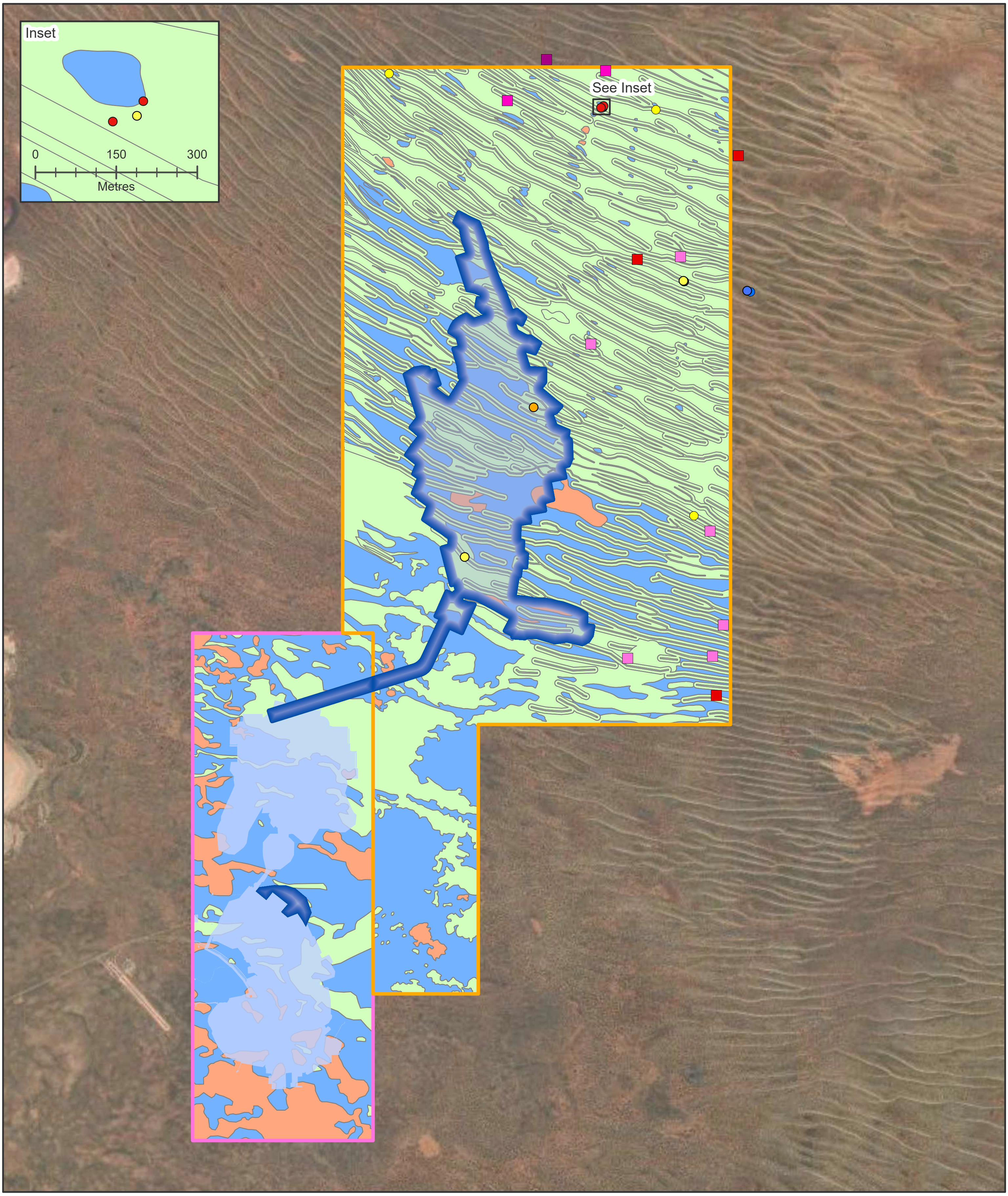


Figure 8-4 Potential Malleefowl habitat and survey results

Project Area
ML 6315
Proposed Action Area
ML 6315 Disturbance Footprint

Potential Habitat
Yes
Yes (marginal)
No

Malleefowl Evidence 2021
Bird
Nest (old)
Feather
Tracks

Malleefowl Mound Profile (2014, 2019)
Inactive - Long (5 year) unused mound
Inactive - Typical crater with raised rim
Inactive - Mound fully dug out
Active - Mound with litter
Potentially Active - LiDAR detected (not ground-truthed)

0 2 4
Kilometres

Datum/Projection:
GDA 1994 MGA Zone 53

Project: 20409-OK/SH Date: 2/20/2023

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8.3.2.3 Sminthopsis psammophila (Sandhill Dunnart)

Targeted survey for Sandhill Dunnart were undertaken within suitable habitat (refer Section 8.6.2) in 2014 and 2021. In 2014, a variety of mammal traps were used including pitfall traps, baited Elliot traps, baited cage traps, and un-baited funnel traps. In 2021, deep pitfall traps were used for six days and nights which is longer than the minimum trap duration required by the SA Vertebrate Guidelines (Owens, 2000), but reflective of the longer trapping times suggested when targeting Sandhill Dunnart which is a trap shy species (DPW, 2016 & DSEWPaC, 2011). Remote detection cameras were also deployed in 2021. When combined (i.e., the 2014 and 2021 survey efforts), there have been 1,666 trap nights targeted for Sandhill Dunnart within the Project Area.

Results show that only four individuals of Sandhill Dunnart were recorded in 2014 (two males and two females) with all records located within the Project Area, but outside of the Proposed Action Area (refer to Figure 8-5). No Sandhill Dunnart were recorded in 2021, however an old unused nest that may belong to the species (unconfirmed) was recorded within the Proposed Action Area in 2021 (refer Figure 8-5).

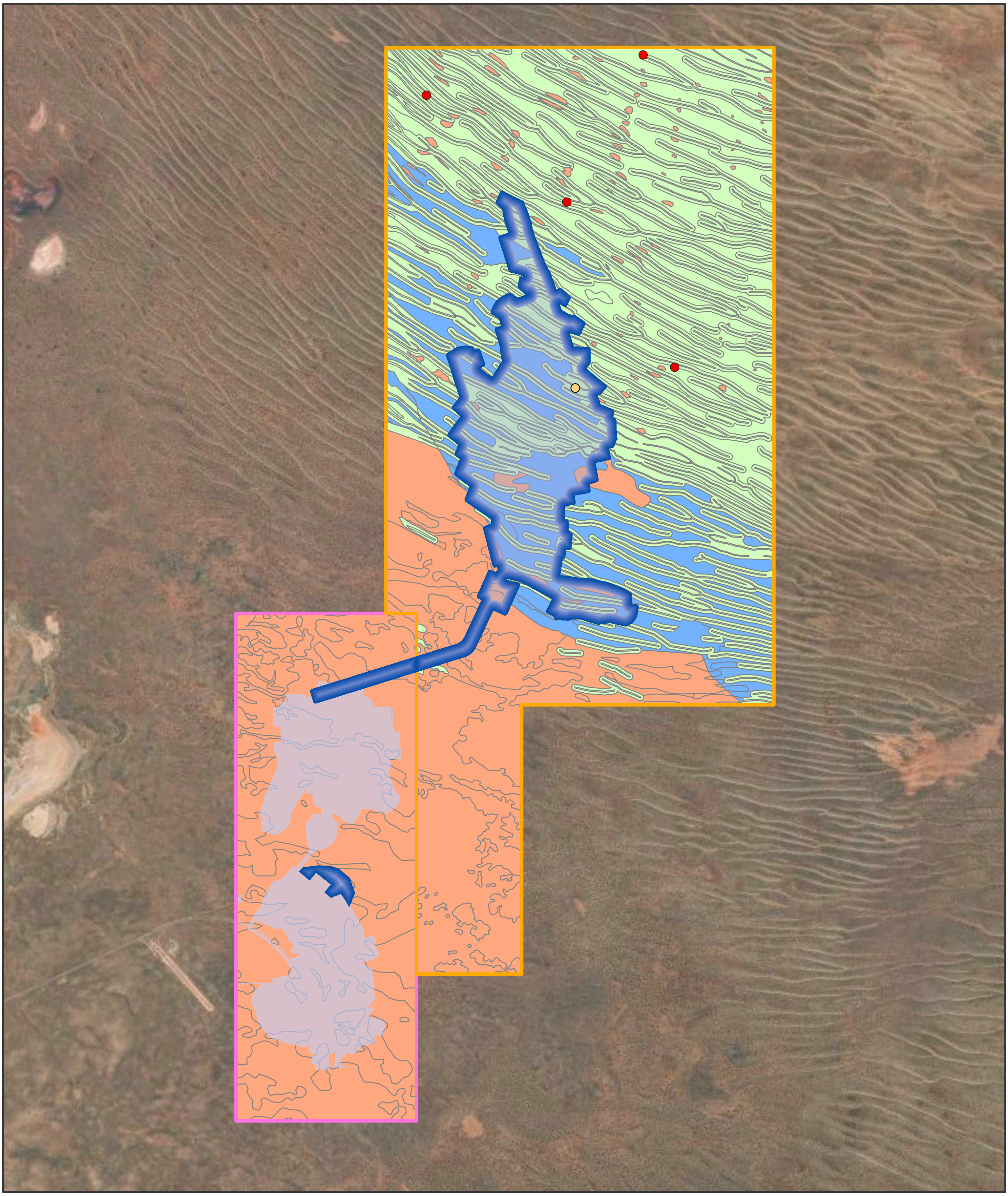


Figure 8-5 Potential Sandhill Dunnart habitat and survey results

8.3.3 MNES habitats and values

There are nine Vegetation Associations (VA) recorded, and ground-truthed, as occurring within the Proposed Action Area. Each vegetation association is grouped into a habitat type and the value of each habitat type to each of the potentially occurring MNES is shown in Table 8-3.

The value of each VA to MNES species as a whole has been determined based on the suitability of each habitat for use by individual MNES species (e.g., Potential suitable habitat vs. marginal habitat) as shown in Table 8-4.

Table 8-4 Classification of VA value to MNES

Value classification	Definition
Potentially suitable habitat	**Potentially suitable** habitat for two or more MNES species.
Marginal habitat	Potentially suitable **or marginal habitat** used by one or more species of MNES.
Unsuitable habitat	Habitat not known to support MNES species or used for movement only.

Table 8-3 Project Area VA's in relation to MNES

Veg association	Habitat type	Distribution	Importance to MNES	Extent within Conceptual Footprint (ha)	Extent within ML6315 (ha)	Total extent within Proposed Action Area	Value to MNES
#1 - Eucalyptus spp. / *Hakea francisiana* (Bottlebrush hakea) / *Grevillea stenobotrya* (Rattle-pod grevillea) tall open shrubland.	Tall shrubland	One patch on southwest of Proposed Action Area	Malleefowl – potentially suitable habitat Sandhill Dunnart – potentially suitable habitat	159	0	159	Potentially suitable habitat

Veg association	Habitat type	Distribution	Importance to MNES	Extent within Conceptual Footprint (ha)	Extent within ML6315 (ha)	Total extent within Proposed Action Area	Value to MNES
#2 - *Acacia papyrocarpa* (Western myall) open woodland +/- *Cratystylis conocephala* (Daisy bluebush and *Maireana sedifolia* (Bluebush)	Open woodland	Throughout Proposed Action Area except for dune crests. Within ML6315 haul road and sand stack areas	Malleefowl – marginal habitat Sandhill Dunnart – marginal habitat	610	76	685	Marginal habitat
#3 - Eucalyptus oleosa spp. Mixed mallee over *Triodia spp*.	Mixed mallee over *Triodia* on deep sand dunes	North and northeast of Proposed Action Area. Central west Conceptual Footprint. Found on steep / deep dunes but not on dune crests	Malleefowl – potentially suitable habitat Sandhill Dunnart – potentially suitable habitat	223	0	223	Potentially suitable habitat

Veg association	Habitat type	Distribution	Importance to MNES	Extent within Conceptual Footprint (ha)	Extent within ML6315 (ha)	Total extent within Proposed Action Area	Value to MNES
#4 - *Eucalyptus yumbarrana* (Yumbarra mallee) mixed mallee	Mixed mallee	Dune crests	Malleefowl – potentially suitable habitat Ooldea Guinea-flower – potential habitat Sandhill Dunnart – potentially suitable habitat	797	0	797	Potentially suitable habitat
#5 - *Alectryon oleifolius* (Bullock bush) shrubland	Shrubland	Too small to map	Malleefowl – marginal habitat for movement only	<1ha	0	<1ha	Unsuitable habitat
#6 - *Atriplex vesicaria* (Bladder saltbush) low open shrubland	Low shrubland	Patchy distribution. Largest patches at southern extent of PA (outside of Conceptual Footprint)	-	1	0	1	Unsuitable habitat
#7 - *Casuarina pauper* (Black oak) +/- *Acacia papyrocarpa* (Western myall) woodland	Woodland	Four patches spread through the southern half of the Conceptual Footprint	-	69	0	69	Unsuitable habitat

Veg association	Habitat type	Distribution	Importance to MNES	Extent within Conceptual Footprint (ha)	Extent within ML6315 (ha)	Total extent within Proposed Action Area	Value to MNES
#8 - *Eucalyptus oleosa spp*. (red mallee) / *Acacia papyrocarpa* (Western myall) +/- *Myoporum platycarpum* (False sandalwood) open woodland	Open woodland	Southern third of Conceptual Footprint and within ML6315 haul road and sand stack areas, occurring where the dunes are less steep and deep.	Malleefowl – potentially suitable habitat Sandhill Dunnart – marginal habitat	191	52	243	Marginal habitat
#9 - Senna spp. Open shrubland	Open shrubland	Very small patches on the north-eastern extent of Conceptual Footprint.	Malleefowl – marginal habitat for movement only	7	0	7	Unsuitable habitat
Total				2,057	128	2,185	

*All total areas subject to rounding errors.

From Table 8-3 the most valuable habitats for listed MNES species are VA's 1, 3 and 4, marginal habitats are 2, 5 and 8 and unsuitable value habitats are 6 and 7. These habitat values for MNES are mapped in Figure 8-6.

It should be noted that each of the VAs is heterogeneous and that there will be variations across ecotones (e.g., different age profiles of the *Triodia* groundcover) which make some parts of each VA more or less suitable for each MNES species. The mapping in Figure 8-5 is necessarily on a macro level and the suitability of sections within each VA for each MNES will be discussed in more nuanced detail in Section 8.6.

The most significant habitat for MNES is mallee vegetation on sand dunes, and tall shrubland, both of which are generally found in the northern extent of the Proposed Action Area and are not found within ML 6315. Moderate values for MNES are associated with mallee over *Triodia*, open shrubland and open woodland habitats in the central to southern parts of the Proposed Action Area. Lower values are associated with Casuarina woodland and low shrubland that are recorded mostly in the southern extent of the Proposed Action Area.

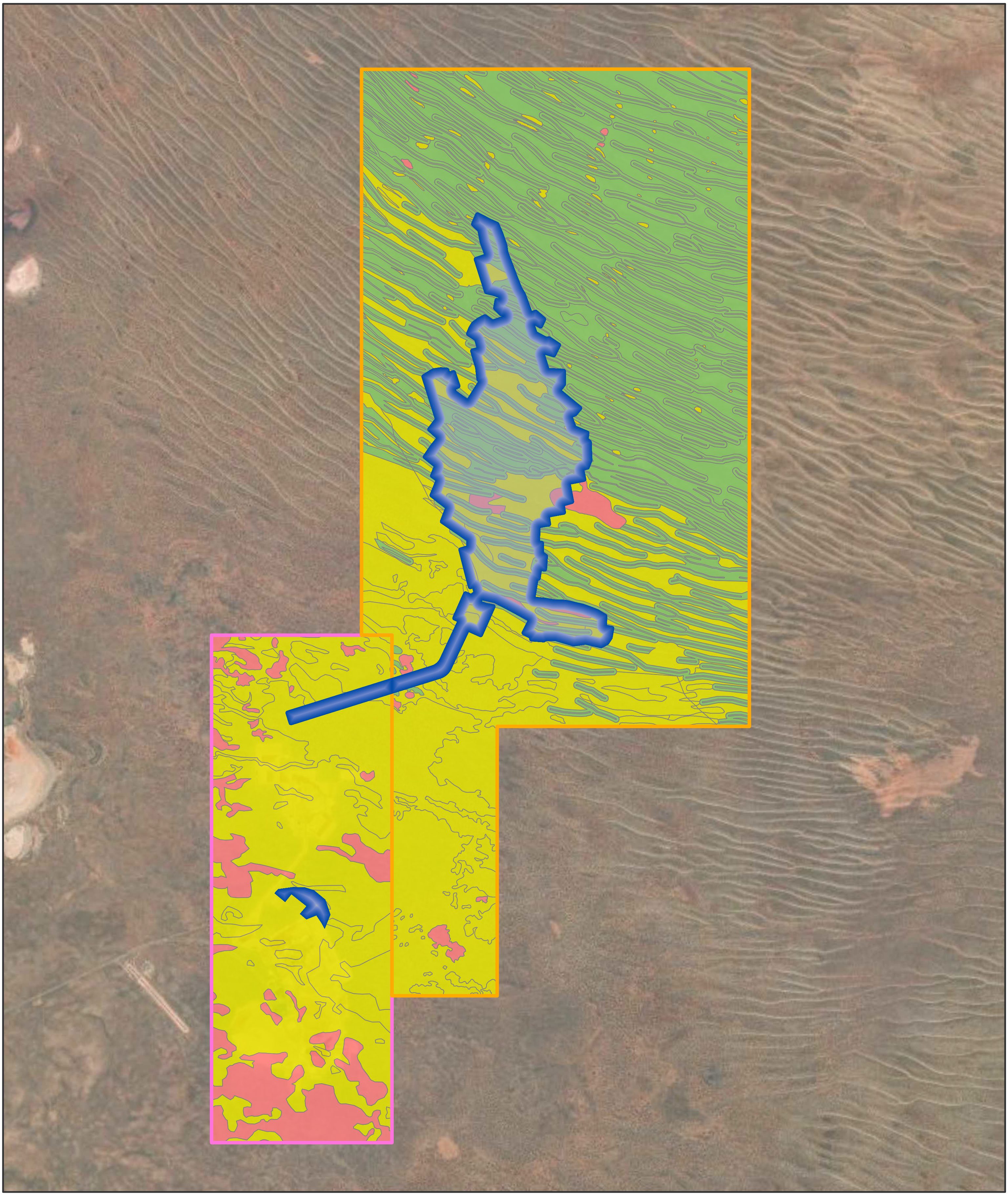


Figure 8-6 MNES habitat values

8.3.4 Regional context

Whilst detailed surveys have been completed for the vegetation types within the Project Area, similar detailed surveys have not been completed for the surrounding areas. Broader scale vegetation mapping is available from Department for Environment and Water (DEW) based primarily on aerial and satellite imagery. Due to the different scale and methods of survey, the resulting vegetation maps differ significantly, making a correlation between the two map layers unfeasible. As a result, when discussing the regional context of the Project Area within the surrounding landscape, the site-specific vegetation mapping will not be used. This will ensure consistency in the categorisation of the habitat types within the Project Area to that outside of the Project Area.

8.3.4.1 Regional overview

Although formally within the Yellabinna subregion, the Atacama Project is situated in the transition zone between two biological subregions: the Yellabinna dunes to the east and the shrublands of the Nullarbor subregion to the west. The Nullarbor Plain is predominately a karst plain with low shrubland and occasional areas of taller vegetation where depressions occur and allow for deeper soils. Low open woodland dominated by *Acacia papyrocarpa* is present towards the east where the Nullarbor meets the Yellabinna dunes, which comprise predominately of mallee woodland.

Yellabinna Regional Reserve (YRR) abuts the Nullarbor Regional Reserve on its western boundary. The Yumbarra Conservation Park and Pureba Conservation Park borders the YRR on its southern boundary. These areas combined cover 3 million ha of predominantly mallee vegetation that is largely undisturbed from human activity and its secondary effects including weed infestation (DEWNR 2013).

8.3.4.2 Regional extent of vegetation communities

The dominant vegetation types within the Proposed Action Area are also available within the surrounding area. The Proposed Action Area is located across an ecotone transitioning between mallee woodland/Atriplex mixed shrubland on dune landforms to the north and east, Casuarina woodland and acacia woodland to the south, and Casuarina woodland and chenopod shrubland of the Nullarbor Plain to the west.

Five NVIS vegetation types are shown as occurring within the Proposed Action Area, however one (GV0004 – Alectryon (mixed) mid open woodland) occurs in such a small area that it is immaterial to the discussion and will not be considered further. The extent of each of the four remaining NVIS vegetation types within both the Proposed Action Area and within the YRR is shown in Table 8-5. It can be seen that only a small percentage of each vegetation type is located within the Proposed Action Area.

Table 8-5: Extent of each regional vegetation type available

Vegetation community	Description	Extent within Proposed Action Area	Extent in YRR	Extent within Proposed Action Area as % of YRR extent
GV005 – Casuarina / acacia low woodland. Casuarina +/- Acacia low woodland, over Senna / Triplex shrub	*Casuarina pauper, +/-Acacia papyrocarpa* low woodland over *Senna artemisioides ssp. petiolaris, +/-Senna cardiosperma ssp. gawlerensis* mid sparse shrubland over *Atriplex vesicaria ssp., +/- Maireana sedifolia, +/-Cratystylis conocephala* low open shrubland. Plain; sandy loan; plain to dunefield	259	83,155	0.31%
GV0010 - Eucalyptus mid mallee woodland. Eucalyptus mid mallee woodland\Dodonaea shrub\Triodia hummock grass	*Eucalyptus concinna+/-Eucalyptus socialis ssp.+/-Myoporum platycarpum ssp. platycarpum*\tree mallee, tree *Dodonaea viscosa ssp. angustissima+/-Senna artemisioides ssp. petiolaris+/-Acacia ligulata+/-Acacia colletioides+/-Bossiaea walkeri*\shrub *Triodia sp.+/-Lomandra leucocephala ssp. robusta+/-Aristida contorta*\hummock grass, forb+/-tussock grass. Sandy plain; sand; sand plain	1,481	1,368,415	0.11%
GV0011 – Eucalyptus mid mallee woodland Eucalyptus mid mallee woodland / Acacia shrub / Atriplex (mixed) shrub	*Eucalyptus oleosa ssp. oleosa, +/- Eucalyptus brachycalyx, +/- Eucalyptus concinna* mid mallee woodland over *+/-Acacia nyssophylla, +/-Cratystylis conocephala* mid sparse shrubland over *Atriplex vesicaria ssp., Maireana radiata, Maireana pentatropis* low sparse shrubland. Dune / consolidated dune to swale; sand; dunefield	101	165,667	0.06%
GV0015 – Acacia / Dodonaea tall open shrubland Acacia tall open shrubland over Aristida tussock grass	*Acacia ligulata, +/- Dodonaea viscosa ssp. Angustissima, +/- Acacia ramulosa var tall open shrubland over +/- Aristida holathera var. holathera, +/- Aristida contorta* low sparse tussock grassland. Plain; skeletal soil; dunefield	343	137,459	0.25%

The use of each of the four vegetation types by each MNES species is shown in Table 8-6. This enables the potential loss of potential habitat for each species to be considered in a regional context (refer Table 8-6).

Table 8-6: Use of regional habitat by MNES

MNES species	Vegetation communities	Likely use of vegetation	Extent cleared (100% of Proposed Project Area)	Extent in YRR
Sandhill Dunnart	GV0005	Unlikely	N/A	N/A
	GV0010	Possible	1,481	1,368,415
	GV0011	Unlikely	N/A	N/A
	GV0015	Possible	343	137,459
Totals			**1,824**	**1,505,874**
Extent of suitable habitat cleared (as a % of YRR habitat)			**0.12%**	
Malleefowl	GV0005	Unlikely	N/A	N/A
	GV0010	Possible	1,481	1,368,415
	GV0011	Possible	101	165,667
	GV0015	Unlikely	N/A	N/A
Totals			**1,582**	**1,534,082**
Extent of suitable habitat cleared (as a % of YRR habitat)			**0.10%**	
Ooldea Guinea-flower	GV0005	Unlikely	N/A	N/A
	GV0010	Possible	1,481	1,368,415
	GV0011	Possible	101	165,667
	GV0015	Possible	343	137,459
Totals			**1,925**	**1,671,541**
Extent of suitable habitat cleared (as a % of YRR habitat)			**0.12%**	

Table 8-6 shows that all three species have a very small percentage (between 0.10% and 0.12%) of their available habitat located within the Proposed Project Area.

8.3.5 Potential environmental impact to MNES

The State assessment methodology is used here (Source-Pathway-Receptor) and then the Commonwealth significance assessment methodology is applied, as agreed between DEM and DCCEEW (meeting 14 December 2022).

8.3.6 Source – Pathway – Receptor

The source – pathway – receptor connection for each impact has been discussed in Section 6.

8.3.7 Direct impacts to MNES

Potential direct impacts of the Proposed Action on MNES recorded or likely to occur in the Project Area include:

- disturbance or loss of individual flora or fauna as a result of clearing
- direct loss of habitat for flora or fauna potentially leading to reduction in area of occupancy, habitat degradation, fragmentation, edge effects and species disturbance
- loss or injury of fauna individuals due to construction and operational activities.

8.3.7.1 Loss of individual flora or fauna due to vegetation clearing

Despite extensive surveys within the Project Area since 2014, there are no records of MNES flora and no MNES fauna records within the Proposed Action Area, hence no known individuals will be lost due to vegetation clearing.

However, tracks and old disused burrows / mounds attributed to Sandhill Dunnart and Malleefowl have been recorded within the Proposed Action Area and it is acknowledged that these species are mobile species that may infrequently and transiently utilise small parts of the Proposed Action Area.

Despite extensive surveys within suitable habitat, using the precautionary principle there is a low risk that individuals of Ooldea Guinea-flower may be present within the Proposed Action Area within sections that have not been surveyed.

8.3.7.2 Direct loss of habitat for flora or fauna

This section discusses the approximate loss of habitat based on the assumption that 100% of the vegetation within the Proposed Action Area will be cleared. This uses the Precautionary Principle as not all of the Proposed Action Area (including buffers) will be cleared for the Proposed Action. The area of disturbance will be minimised during final detailed design.

Table 8-7 shows the potential habitat loss for MNES flora and fauna species based on the associations of MNES species to the vegetation types mapped within the Proposed Action Area.

Table 8-7 Potential habitat loss for MNES

Aspect	Ooldea Guinea-flower	Sandhill Dunnart	Malleefowl
Potentially suitable habitat	797 ha	1,179 ha	1,422 ha
Marginal habitat	-	929 ha	693 ha
Total	**797 ha**	**2,108 ha**	**2,115 ha**
% MNES habitat as total of Proposed Action Area (2,185 ha)	36%	96%	97%
% MNES habitat as total of Yellabinna Regional Reserve (using NVIS vegetation mapping)	0.12%	0.12%	0.10%

The loss of this habitat is considered temporary (short to medium term (1-25 years)) for most of the vegetation types currently within the Proposed Action Area. Revegetation using a combination of techniques will aim to recreate these vegetation communities post planting. There is some uncertainty as to the likelihood of recreating similar communities to those cleared as this has not been successfully accomplished within the region.

8.3.7.3 Loss or injury of fauna individuals as a result of construction and operational activities

The use of vehicles and machinery for construction and operation of the Proposed Action has the potential to result in collision with MNES fauna species that may be present in the Proposed Action Area. This may result in injury or mortality to individuals, particularly at night when nocturnal fauna actively forage.

During operation, mining will be undertaken on a 24-hour basis, seven days per week. However, light vehicle movements beyond the mine will occur mostly during the day. While there is potential for night-time vehicle and machinery movements to result in interaction, this is not expected to occur to the extent that it represents a significant impact to any of the MNES fauna species as they are all highly mobile species.

8.3.8 Indirect impacts to MNES

Potential indirect impacts of the Proposed Action on MNES recorded or likely to occur in the Proposed Action Area include:

- Degradation or alteration of habitat as a result of altered hydrological regimes.
- Disturbance to fauna individuals from noise, vibration and light.
- Habitat degradation associated with construction or mining activity, including transmission of weeds, dust or increased abundance of introduced fauna species.

8.3.8.1 Degradation or alteration of habitat due to altered hydrological regimes

8.3.8.1.1 Groundwater

Groundwater is known to discharge at Lake Ifould, a terminal salina via evaporative flux. Potential terrestrial GDEs within the Project Area include Mallee forest and Mallee woodland, however due to the lack of shallow groundwater (>75m BGL) these ecosystems are more likely to rely on episodic rainfall and soil moisture rather than groundwater. There will be no dewatering required for the Project as the target ore is located above the local groundwater level, and there will be no tailings deposited within the Project Area for the Proposed Action.

Deposition of Atacama tailings will occur at J-A, impacts to groundwater have been considered as part of the J-A MLP and there are no further impacts to groundwater as a result of the additional storage of Atacama tailings at J-A (refer to Appendix D).

There are no groundwater related impacts to ecology due to the Proposed Action within the Proposed Action Area and no increase in impacts to groundwater associated with the Atacama processing at J-A than have previously been assessed.

Refer Section 7.7 for further detail.

8.3.8.1.2 Surface water

There are no large watercourses within the Project Area. Instead, ephemeral drainage occurs along dune swales into terminal pans, with no defined watercourses present throughout much of the area.

The northern section of the Project Area lies to the northeast of the J-A catchment (EMM, 2022). The southern section of the Project Area lies in the upper J-A catchment (Figure 3-26). The J-A catchment drains west towards various unnamed salt pans and Lake Ifould (EMM, 2022). These upland ephemeral watercourses form part of a dendritic network but are largely undefined in these upper reaches. Several defined reaches of Jacinth North Creek and Ambrosia South Creek lie within the south-western portion of the Project Area.

Water from rainfall events is likely to be short lived with high evapotranspiration rates and would not impact significantly on existing vegetation communities within the Project Area. To prevent flow or collection of surface water around or within the Proposed Action Area the surface water flows may be redirected. The disruption of these flows due to infrastructure siting is unlikely to pose a significant risk to the abundance and diversity of flora and fauna. When rainfall runoff occurs, mining influences on runoff would be contained to dune swales in the immediate vicinity of the activity. Hence there are expected to be no surface water impacts as a result of the Proposed Action.

Refer Section 7.8 for further detail.

8.3.8.2 Disturbance to fauna from noise, vibration and light

8.3.8.2.1 Light

During the operational phase of the Proposed Action, operation will be 24 hours per day, seven days a week. Operation will require constant light sources. This may have impact on native fauna species through increased risk of predation, disruption of circadian rhythms, disorientation, attraction to light sources increasing injury and mortality risk and may have negative impacts on breeding and migration.

8.3.8.2.2 Noise and vibration

Noise emissions arising from the construction and operation of the Proposed Action have the potential to disturb some MNES species present in the Project Area.

Noise within the Project Area is expected to increase from current ambient noise levels during the construction and operation phases of the mine. During these phases, increased noise is likely to occur in short, intense pulses from mobile plant equipment as well as in the form of more prolonged noises with consistent vibration, pitch and volume due to generators, excavators, pumps and vehicles. During operation mining activities will occur 24 hours per day, which may cause avoidance of the Proposed Action Area, interference with species' calls, increased risk of predation and interference with circadian rhythms.

8.3.8.3 Habitat degradation associated with construction or mining activity, including transmission of weeds, dust or increased abundance of introduced fauna species

8.3.8.3.1 Weeds

There are few serious weeds that invade spinifex grasslands, with the exception of *Cenchrus ciliaris* (Buffel grass). Buffel grass is considered one of Australia's worst environmental weeds (Humphries et al. 1991). It is a perennial tussock grass native to Africa, India and Asia and was introduced into Australia for pasture and dust control. It has spread widely across Australia (Marshall et al. 2012) including arid areas of Western Australia, South Australia and the Northern Territory (Lawson et al. 2004). In locations where it has established and displaced native species, it is among the list of novel biota which act as a Key Threatening Process (as listed under the EPBC Act).

Buffel grass is known to be present within the Great Victorian Desert and the species has been subject to a control program undertaken by Alinytjara Wilurara Landscape Board and Aboriginal ranger groups for the last ten years. Figure 8-7 shows the distribution of Buffel grass and the most recent efforts to contain its spread.

Buffel grass was recorded within the J-A MPL in 2023 during routine monitoring. Iluka are working in conjunction with Landscape South Australia on a new treatment to control and eradicate the species from the MPL.

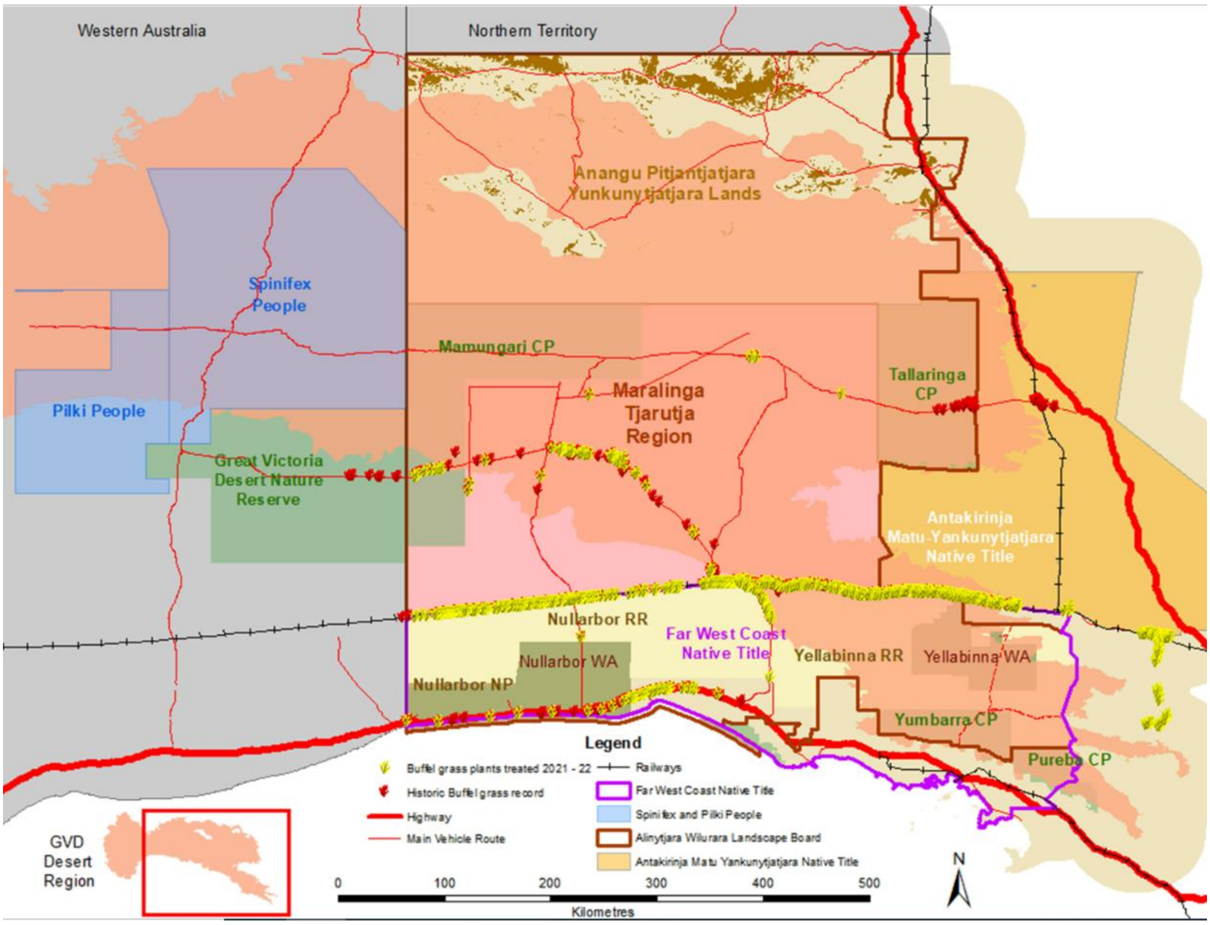


Figure 8-7 Buffel grass infestation and control in the Great Victorian Desert (Source Landscape SA, 2022)

Buffel grass can increase the intensity and frequency of fire events, threatening plant and animal communities that are not adapted to these modified fire regimes (Adair and Groves, 1998). Buffel grass dries quickly and produces a more combustible and contiguous flammable fuel than native grasses, resulting in hotter and more intense fires (Humphries et al. 1993). It regenerates rapidly after fire suppressing the regeneration of native species (Paltridge et al. 2009) and forms dense monocultures, reducing diversity (Clarke et al. 2005) and productivity of some vegetation types (Humphries et al.1993). It has several qualities that enable it to survive and persist in arid conditions including prolific seed production and opportunistic germination, Buffel grass accumulates carbohydrates at the base of its stems for slow release when needed and has a deep root system that enables it to access water supplies faster and for longer than most native herbs and forbs (Biosecurity SA, 2019).

Buffel grass is an acknowledged threat to Ooldea Guinea-flower and may also indirectly impact Malleefowl and Sandhill Dunnart by its habitat altering properties. Pest fauna species

8.3.8.3.1.1 Foxes

Vulpes vulpes (European red fox) prey on small to medium-sized ground-dwelling and semi-arboreal mammals and ground-nesting birds. Foxes are known to have colonized the Proposed Action Area and the surrounding Yellabinna Reserve; however they are present only transiently and in very low numbers within J-A, and hence they are unlikely to be a significant threat at Atacama. This may be a result of interaction with dingoes that are known to inhabit the Proposed Action Area (refer 8.3.8.3.1.2) and are likely to control the fox population. Where present, foxes are likely to prey on species including the EPBC listed Sandhill Dunnart and Malleefowl. Foxes are so widely established in Australia that the focus is on abating impacts by established populations (DEWHA, 2008). As the species is so widespread, control is problematic due to rapid population recovery and reinvasion (DEWHA, 2008). The interaction between foxes and *Oryctolagus cuniculus* (rabbits) also needs consideration as a reduction in fox numbers is likely to cause an increase in rabbit numbers due to their predator prey relationship. As rabbits are also a threat to threatened species within the Proposed Action Area, a balance is required. Of note is that in one trial, extended fox baiting has not yet been shown to increase Malleefowl numbers (Benshemesh et al. 2007, Walsh et al. 2012).

8.3.8.3.1.2 Dingoes

The Project Area is north of the Dingo Fence, and *Canis familiaris / Canis familiaris dingo / Canis dingo* (Dingo) are present within the area. Dingoes are known to prey on mammals, birds, vegetation, reptiles and amphibians (Corbett, 1995). Whilst dingoes may prey on the EPBC listed Sandhill Dunnart and Malleefowl, they may also play an important role in reducing the populations of other threatening pest species. Research undertaken in the Nullabor Plains area shows that rabbits and red kangaroos dominate dingos' diet, with twice as much rabbit eaten as red kangaroo (Corbett, 1995). Research has shown that the presence of dingoes has a positive impact on biodiversity in areas where feral foxes are present (Letnic et al. 2013).

8.3.8.3.1.3 Wild cats

Felis catus (cat) are carnivores and can survive with limited access to drinking water because they can consume adequate moisture from their prey: small and medium-sized mammals, birds, reptiles, amphibians, fish and invertebrates. Feral cats will also consume carrion when live prey is scarce, and some smaller amounts of vegetation (DEWHA, 2015). They occupy home ranges that vary from less than one square kilometre up to 20–30 square kilometres in areas of scarce resources (Molsher et al. 2005; Moseby et al. 2009; Buckmaster 2011). Feral cats are also known to host disease-causing agents including *Toxoplasma gondii* (Pam et al., 2014). Feral cats are a known threat to Sandhill Dunnart and may predate on Malleefowl to a lesser degree.

8.3.8.3.1.4 Rabbits

Rabbits have been described as Australia's most costly vertebrate pest (Cooke et al. 2013) and are commonly found across all states of Australia including within the Project Area and surrounding Yellabinna Reserve. Known impacts of rabbits include:

- competition with native wildlife for resources (food and shelter)
- preventing plant regeneration
- overgrazing and general damage to plant species
- altering ecological communities and changing soil structure and nutrient cycling leading to erosions

- removal of critical habitat for arboreal mammals and birds leading to increased predation.
- supporting elevated population densities of pest predators such as foxes and feral cats
- promoting growth of introduced and unpalatable species such as weeds.

Rabbits are known to be a key threat to both Malleefowl and Sandhill Dunnart as they compete for food, overgraze and prevent the regeneration of plants that the threatened species rely on. Grazing by rabbits is also listed as a key threat for Ooldea Guinea-flower.

8.3.8.3.1.5 Feral camels

Camelus dromedarius (Camels) are common across northern South Australia, including within the Project Area. Whilst camels are not on the list of threatening processes for the three listed MNES species, they are known to degrade the environment where they occur. The National Feral Camel Action Plan (2010) states that the species "causes broad landscape damage including damage to vegetation through foraging behaviour and trampling, suppression of recruitment of some plant species and selective browsing on rare and threatened flora".

8.3.8.3.1.6 Feral goats

As generalist herbivores, *Capra hirus* (feral goats) can colonise a wide range of habitats. With two breeding seasons a year, and twins and triplets common, goat populations can increase by up to 50 per cent a year under favourable conditions (DEWHA, 2008).

As with other grazing animals, unmanaged goats can affect native flora and fauna by grazing on native vegetation, thereby preventing; by overgrazing, which causes soil erosion; by competing for food and shelter; by introducing weeds through seeds carried in their dung; and by fouling waterholes (DEWHA, 2008). Feral goats may be a threat to both Malleefowl and Sandhill Dunnart as they compete for food, overgraze and prevent the regeneration of plants that the threatened species rely on. Grazing by goats may also impact on the Ooldea Guinea-flower. Goats have not been recorded within the J-A or Atacama Project areas and hence this species is unlikely to be a threat to MNES.

8.3.8.4 Dust

Significant quantities of dust have the potential to smother plants, affecting photosynthesis, respiration, transpiration and allow the penetration of phytotoxic gaseous pollutants (Farmer, 1993). Research into dust deposition at J-A have provided anecdotal results of non-fatal impacts on some flora species within 500m of ground disturbance. The closest known population of Ooldea Guinea-flower is located approximately 5.5 km north-east of the Proposed Action Area. Dust modelling completed for the Proposed Action (refer Section 7.10) shows that there are no expected dust impacts outside of the Project Area, and hence dust is unlikely to impact on Ooldea Guinea-flower located a further 2.5km from this boundary.

Dust has the potential to impact on some species within the habitat that support MNES fauna species. However, the monitoring at J-A has shown that there has been no significant flora die-back events as a result of dust.

8.3.8.5 Fire

It is acknowledged that should the Project Area suffer an invasion of Buffel grass then the intensity and frequency of fire events may increase as a result of the ecosystem transforming properties of this weed as discussed in Section 8.7.1.6.1. Inappropriate fire regimes may cause direct loss of individuals and cause habitat loss or change for MNES species. There has been no increase in the incidence or intensity of fire as a result of the adjacent J-A mine.

8.3.9 Cumulative impacts

The Proposed Action will be undertaken adjacent to, and in conjunction with the current J-A mining operation. Note that the J-A Project was referred on the 23 November 2007 [ref EPBC 2007/3864] and was determined to be Not a Controlled Action.

The J-A mine is owned by Iluka and has been operating on ML 6315 since 2008. The Proposed Action is located 5 km north-east of J-A and the two mines will co-exist with processing and tailings from the Proposed Action to be undertaken at J-A (as discussed in Section 8.8). As discussed in Section 8.1, the Proposed Action Area includes 128ha of additional proposed vegetation clearing at J-A required as a result of the Atacama Project.

The J-A project has a disturbance footprint of approximately 1,472 ha prior to the additional clearing for the Proposed Action. Of this, none of the habitat that was cleared was considered suitable habitat for Sandhill Dunnart, or Ooldea Guinea-flower, hence there are no cumulative impacts for these species to consider. However, some of the vegetation that was cleared is considered potentially suitable for Malleefowl. Table 8-8 shows the cumulative impacts on Malleefowl habitat across J-A and the Proposed Action.

Table 8-8 Cumulative impacts to Malleefowl

Aspect	Potentially suitable habitat (ha)	Marginal habitat (ha)
J-A (potential habitat previously cleared)	262	1,101
Proposed Action	1,422	692
Total	**1,684**	**1,793**

Progressive rehabilitation and revegetation is being undertaken at J-A, with 450 ha of habitat being actively rehabilitated at the time of writing. However, it is known that Malleefowl are most likely to breed in mallee habitats that have been undisturbed for up to 30 years as they require a density of ground and shrub cover, and an accumulation of leaf litter that this provides. Hence the revegetated land at J-A cannot be determined as potential breeding habitat at this time.

Similarly, Malleefowl require sufficient shrub layer density for dispersal and a wide variety of flowering and seeding shrubs that produce seed across the seasons for foraging. The revegetated land at J-A cannot yet provide this habitat and cannot yet be determined as suitable habitat or marginal habitat for foraging.

Using the precautionary approach, all further assessment for impacts on Malleefowl within this report will be undertaken on the cumulative impact of the clearing of 1,684 ha of potentially suitable habitat and 1,793 ha of marginal habitat for this species. Noting that some of this clearance has already occurred (i.e., that for the development of J-A prior to the Atacama Project).

8.4 Avoidance, minimization and alternatives

8.4.1 Avoidance and minimization

Refer to Section 7.3.

8.4.2 Alternatives

Refer to Section 4.2.

8.4.3 Mitigation

General mitigation measures for impacts on non-listed species are discussed in Section 7.3. The following discussion focuses on the mitigation measures as they relate to the three MNES.

8.4.3.1 Pre-mining

8.4.3.1.1 Mine planning

A conceptual life of mine plan has been completed which includes buffer areas between disturbance and retained vegetation with the location of retained habitat suitable for MNES shown. As discussed in Section 8.1, the Conceptual Footprint and haul road include a 50 m buffer, whilst the sand stack does not include a buffer. Progressively more detailed plans will be developed within annual mine plans including rehabilitation works.

8.4.3.1.2 Pre-clearance inspection

Vegetation clearing will be limited each year to the minimum that is required for the following year's operations. Prior to vegetation clearing, a pre-clearance inspection would be undertaken. Suitably trained staff would undertake these inspections. If threatened flora and/ or fauna species or their breeding place are found, then work would be stopped whilst the requirements of the Fauna Management Plan or Vegetation Clearing Management Plan are implemented. Inspection will target Malleefowl nesting mounds, Sandhill Dunnart burrows, and individuals of Ooldea Guinea-flower within the clearance area.

8.4.3.1.3 Cleared vegetation and topsoil management

All trees within the disturbance area will be felled and windrowed near the pits then pushed over rehabilitation areas for habitat and seed source once topsoil and seeding has occurred.

The majority of seed readily able to germinate is present in the upper 50 mm of soil. Where possible, topsoil would be placed directly into rehabilitation areas and so the height of the stockpiles would be minimised. Stockpiles will be profiled as per agreed designs and once a crust is applied (potable water +/- Crustex/ dust suppressant), the seed bank within the topsoil will germinate and naturally provide vegetation cover. The stockpiles would be inspected regularly for erosion and weeds.

8.4.3.2 During mine operation

8.4.3.2.1 Direct impact on listed fauna species

It is considered unlikely that a significant or well-established population of threatened fauna species are located within the Proposed Action Area. However, using the Precautionary Principle, the following mitigation measures will be utilized:

- Vegetation clearing will commence from a disturbed edge to an undisturbed area, where practicable, to encourage mobile fauna such as Malleefowl and Sandhill Dunnart to naturally relocated into adjacent areas.
- Vehicle strike will be minimized by enforcing speed limits within the Proposed Action Area.
- Personnel and visitors will undergo inductions and fauna awareness training.
- Any sightings or interaction with MNES species will be reported to management immediately.
- Fauna entrapment and attraction of pest species within mine infrastructure will be minimised through implementation of the following measures:
    - all bins storing putrescible waste will have secure lids
    - skip bins will have access/ egress ramps
    - domestic waste facilities will be fenced
    - operational water resources will be fenced and/ or have fauna access/ egress mats.
- All excavations will be covered and in-filled as soon as is practicable.

8.4.3.2.2 Direct impacts on listed flora species

Due to the significant survey effort, it is considered unlikely that Ooldea Guinea-flower is present within the Proposed Action Area. However, using the Precautionary Principle, a pre-clearance inspection prior to commencement of clearing will target this species.

8.4.3.2.3 Exotic species (weeds)

Mitigation of this threat includes preventing the spread of Buffel grass and controlling Buffel grass where it establishes, including along incursion pathways e.g., access tracks and roads, and along adjacent watercourses. A South Australian Buffel Grass Strategic Plan (Biosecurity SA 2019) provides options for controlling the spread of Buffel grass during the early stages of invasion; however, there is currently no feasible control method available once it is well established over an extensive area.

Actions to control this weed are likely to be three-fold including exclusion, monitoring and control if required:

- Exclude the entry of Buffel grass into the Project Area. This would include the requirement for all machinery, vehicles and equipment to undertake a washdown process and/ or be inspected before being accepted onto the site.
- Regular monitoring of the Project Area with focus on disturbed areas and high vehicle access areas (such as access tracks) to ensure that any outbreaks are recognized in a timely manner. Undertake staff training during site inductions so that there is an awareness of the species and the need to report any sightings to the site management.
- Any outbreaks would be immediately controlled using targeted herbicide chemicals ().

Weed control has been undertaken by Iluka at the adjacent J-A site since 2009. The site is generally compliant with the required criteria that there is 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 (Iluka, 2020). However, in 2023 a small outbreak of Buffel Grass was recorded during a routine inspection. Iluka are working with Landscape SA to control and eradicate this species from the ML.

8.4.3.2.4 Pest species (fauna)

Control of pest species has been undertaken by Iluka at the adjacent J-A site since 2009. The site is currently compliant with the required criteria that there is no increase in abundance of pest animal species in the lease area and adjacent areas caused by mining operations (Iluka, 2020).

8.4.3.2.4.1 Vulpes vulpes (European red fox) and Canis spp (Dingo)

Mitigation of predation by foxes will not consist of attempts to eradicate foxes from the Proposed Action Area, as this would be impractical and likely to cause an increase in rabbits with their own associated impacts on the threatened species (see below).

Instead, mitigation will consist of preventing encouragement of the species into the Proposed Action Area by using good waste management practices and managing accessibility to water, monitoring fox numbers within the Proposed Action Area and using control techniques should these numbers increase. The aim is to keep the fox population stable and prevent any increase in population size.

Dingoes were recorded during surveys within the Project Area. As the Proposed Action Area is approximately 40km to the north of the dog fence, dingoes are considered naturalized and active control is not required. Passive control strategies such as good waste management and managing access to artificial water supply will be instigated.

8.4.3.2.4.2 Felis catus (Wild cat)

Wild cats have been recorded within the Proposed Action Area and are established in the wider region. They are so widely established and abundant that they are not able to be eradicated. Instead, mitigation will consist of preventing encouragement of the species into the Proposed Action Area by using good waste management practices and managing accessibility to water, monitoring wild cat numbers within the Proposed Action Area and using control techniques should these numbers increase. The aim is to keep the wild cat population stable and prevent any increase in population size.

8.4.3.2.4.3 *Oryctolagus cuniculus (rabbit)*

Rabbits are so widely established and abundant that they are not able to be eradicated. Instead, mitigation will consist of monitoring rabbit numbers within the Proposed Action Area and using control techniques should these numbers increase. The aim is to keep the rabbit population stable and prevent any increase in population size. This has been achieved in the neighbouring J-A site using rabbit baiting techniques.

8.4.3.2.4.4 *Camel*

Camels are widely established and abundance and are not able to be eradicated without fencing of the exclusion area. Instead, mitigation will consist of monitoring camel numbers within the Proposed Action Area and using control techniques should the population increase.

8.4.3.2.4.5 *Capra hirus (feral goats)*

Feral goats have not been recorded during site-specific studies from 2014 – 2021 within the Proposed Action Area and have not been recorded since 2009 at the adjacent J-A mine. Mitigation for this species will entail monitoring for their presence, and control of any ingress into the Proposed Action Area by this species. Control measures may include trapping or shooting.

8.4.3.3 Landform reinstatement

Rehabilitation of the landform will avoid post closure mine voids and will reinstate natural contours outside of mine pits and minimise impacts to dunal vegetation. Upon rehabilitation a swale landform will be reinstated in place of the pit and the batters to the dune crests softened and stabilised with woody debris. Additional overburden will be used where available to reinstate a 'saddle' between cut dunes with the swales and dune crests reinstated with topsoil to depths of 10 cm and 30 cm, respectively. Figure 4-16 presents the conceptual final landform.

8.4.3.4 Revegetation

General revegetation strategies are discussed in Section 4.5.9, 4.5.10 and 7.3..

Revegetation of disturbed areas will be targeted for the habitat requirements for MNES listed species. The key habitat requirements for each species and how they will be addressed are shown in Table 8-9.

Table 8-9 Targeted revegetation for MNES

Species	Key habitat factors	Revegetation concept
Ooldea Guinea-flower	Crests of large steep dunes Presence of fire scars Presence of *Leptospermum coriaceum* (Green tea-tree) and *Eucalyptus capitanea* (Desert ridge-fruited mallee)	Dune crest cannot be reinstated in disturbed areas
Malleefowl	Foraging: Diversity of seed resources available over different seasons	Ensure a diverse mix of *Acacia* spp and other low shrubs are regenerated. Seed collection from local population to ensure seeds are of local provenance. Seed broadcast in suitable weather pattern (rainfall dependent) to increase likelihood of revegetation success.
Sandhill Dunnart	At least 25% *Triodia* cover Vertical habitat complexity Sandy burrowing substrate	Careful management of seedbank in topsoil. Investigate options for *Triodia* revegetation. .

8.4.3.4.1 Revegetation for Sandhill Dunnart

A feasibility study has been completed that considers the likely success of restoration of suitable habitat within the disturbed area (ELA 2020). This report concludes that although recreating suitable habitat for Sandhill Dunnart is technically feasible, it is complex and has risk attached. The risk relates to achieving the >25% *Triodia* species cover as it is limited by low and variable seed fill, seed dormancy and low rates of germination (Erickson 2015). Furthermore, the age structure of *Triodia* species is important to Sandhill Dunnart and hence staged plantings may be an effective option for maximizing habitat value and increasing the length of time that suitable habitat is available within the Proposed Action Area. There are opportunities for further study into the re-creation of this habitat type and the timeframe for the habitat to reach suitable maturity and complexity for use by Sandhill Dunnart. Iluka have undertaken research trials and successfully transplanted sensitive flora species as mitigation of impacts on mine sites in other locations and are committed to investigating options for *Triodia* revegetation including translocation / clump splitting and any other potential solutions. However currently there is significant risk associated with attempting to recreate this habitat type and low confidence that it can be reliably achieved over a large area. Hence using the precautionary principle, until further research has been completed and a reliable revegetation strategy has been proven, revegetation cannot be relied upon as a mitigation measure for loss of habitat for Sandhill Dunnart.

8.4.3.4.2 Revegetation for Malleefowl

It is likely that currently the area within the Proposed Action Area is primarily used by Malleefowl for foraging as the habitat is suboptimal for nesting and breeding for Malleefowl. For foraging, Malleefowl transiently uses patches of a variety of shrubs utilising a wide variety of seeds across the seasons. To recreate habitat that is similar (or better) for this species, seeds will be collected from a range of *Acacia* spp. shrubs local to the Project Area. These seeds will be collected across the seasons to ensure that a diverse variety of seed resources are collected. The use of tube stock to supplement seed-based revegetation has been considered, however trials at the adjacent J-A site have shown limited success (survival of 1 individual to maturity out of 50 tube stock) due to plant shock when planting out in a semi-arid region. Furthermore, comparisons between revegetation methods including ‘top down’ (line seeding / tube stock) and ‘ground up’ (broadacre seeding) for revegetation of a mine site in an arid zone showed that revegetation with ‘top down’ tube stock was least effective and the ‘ground up’ approach using broadacre seeding was most effective (Christie et al, 2019). Specific factors in which the ‘ground up’ approach outperformed the ‘top down’ approach included increased site stability, plant survivorship, vegetation structure and complexity, system function, decreasing weeds, cost and risk (Christie et al, 2019).

However, by using primarily a ‘ground up’ approach of broadacre seeding, a combination of the time between clearing and commencement of rehabilitation within each mine section, and the time taken for the development of mature vegetation from seed stock means that it is likely to take approximately 30 years for suitable habitat for Malleefowl to become available.

8.4.3.4.3 Revegetation for Ooldea Guinea-flower

Ooldea Guinea-flower have been found on crests of deep and high dunes. It is acknowledged that this landform cannot be reinstated where dune crests are directly impacted by the Proposed Action (e.g., within the pit shell areas and for any associated infrastructure such as access tracks).

8.4.3.5 Light

Artificial light can disrupt critical behaviour patterns and cause physiological changes in wildlife. It can also have the indirect effect of changing the availability of habitat or food resources and attract predators and invasive pests (DCCEEW, 2020).

As the Proposed Action will be continued 24 hours a day, there is a need for outdoor artificial lighting. Best practice lighting design will be used incorporating the following principles:

- start with natural darkness and only add light for specific purposes
- use adaptive light controls to manage light timing
- light only the object area intended – keep lights as close to the ground as practicable, directed and shielded to avoid light spill

- use the lowest intensity lighting appropriate for the task.

The Proponent commits to managing light spill by the use of directional lighting to ensure that light emissions are focused towards active construction and operational activities and away from areas of retained habitat.

8.4.3.6 Dust

Known populations of Ooldea Guinea-flower and critical habitat has been observed at 5.5 km from the Proposed Action Area. The following mitigation will be undertaken to minimize the impact of dust generation on these individuals.

- clearing will not be undertaken during adverse weather conditions e.g., strong winds
- progressive clearing and rehabilitation to minimise the total uncovered areas of disturbance
- water trucks for dust suppression.

Monitoring is being undertaken by Iluka at the adjacent J-A mine in relation to the impacts of dust on vegetation Pearl bluebush (*Maireana sedifolia*) was identified as the most appropriate species to use for monitoring as it is commonly distributed at J-A and the leaves and stems are covered with trichomes that readily trap dust.

Results show that there is no direct correlation between the percentage dieback of *M. sedifolia* (used as an indicator of a deleterious effect of dust deposition) and distance from the mine operation (refer Figure 8-8) (Iluka, 2021). No monitoring of potential dieback as a result of dust deposition has been undertaken at a distance greater than 500m from the operational mine. Hence it is unclear at what distance dust deposition as a result of mining operations ceases.

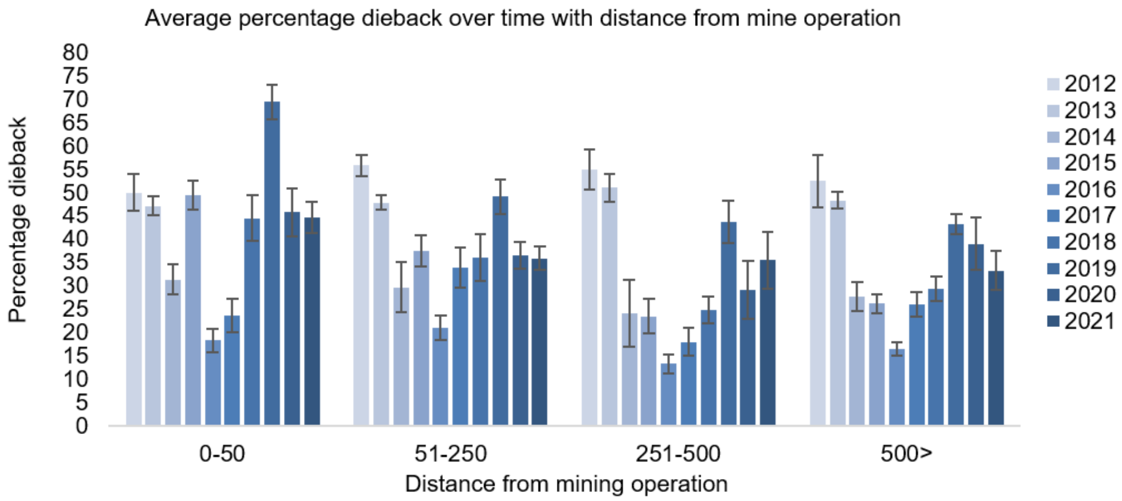


Figure 8-8: Dieback of M. sedifolia vs distance from mining operation (Iluka, 2021)

The dust modelling completed for Atacama (refer Section 7.10) shows that modelled dust deposition drops to zero within the Proposed Action Area, which shows that there are unlikely to be any effects of dust on the Ooldea Guinea-flower individuals located approximately 2.5km beyond the edge of the Project Area (and 5.5km from the Proposed Action Area). Hence it is considered unlikely that there will be any impacts on Ooldea Guinea-flower as a result of dust deposition and no mitigation measures are required.

8.4.3.7 Sound and vibration

Noise mitigation equipment will be used to mitigate noise at the source by ensuring all plant and equipment is maintained in accordance with supplier specifications.

8.4.3.8 Fire

During the operation of the Project, the risk of fire is likely to be decreased as the flammable low shrub vegetation would be removed to expose sand resource and the site will be attended such that fire control is possible. There has been no incidences of increased fire frequency or intensity as a result of the adjacent J-A mine.

8.4.3.9 Costs

The majority of the mitigation measures proposed within this document are considered as a continuation of business as usual for Iluka, in that they are already being implemented at nearby J-A and would be extended for the Project. Planning level cost estimates for mitigation measures are presented in Table 8-4.

Table 8-4 Planning level cost estimates for mitigation measures

Mitigation measure	Summary
Mine planning	Design to avoid
Pre-clearance inspections	$40,000 pa
Control of cleared vegetation and topsoil management	Included in OPEX consistent with J-A
Waste management	Included in OPEX consistent with J-A
Traffic control	Included in OPEX consistent with J-A
Pest and weed control	$67,000 pa
Landform reinstatement	Included in OPEX consistent with J-A
Triodia translocation trials, seed germination efficacy research and soil stabilisation trials	$250,000
Light and noise/vibration controls	Included in OPEX consistent with J-A
Dust impacts monitoring	$30,000 pa
Fire	Included in OPEX consistent with J-A
Total	**$137,000 pa for LOM** **$250,000 R&D[17]**

[17] Includes broader weed control over and above Buffel Grass. Does not include implementation of translocation during rehabilitation if successful

Notes OPEX = operating expenditure, pa = per annum, R&D = research and development.

8.5 Significant residual impact assessment

8.5.1 Malleefowl

8.5.1.1 Ecology

Malleefowl occur primarily within mallee associations, however, they have also been recorded within other Eucalypt dominated habitats as well as scrubs featuring *Melaleuca*, *Calitris* and *Acacia* species (Benshemesh, 2007). The suitability of habitat is largely driven by the time since last fire as the vegetation structure, floristic composition and quantity of leaf litter are key parameters of habitat quality (Parsons and Gosper, 2011). Mallee habitats that support that highest breeding densities of Malleefowl have not suffered a burn for over 40 years (Benshemesh, 2007). Habitat that has not been burnt for over 40 years provides greater food resources, including seed, herbage and invertebrates, as seed-bearing shrubs and leaf litter require many years to re-colonise and accumulate following fire (Benshemesh, 2007; Parsons and Gosper, 2011). Accumulated leaf litter is important to Malleefowl, which they use to line the nest chamber within their mound, as the breakdown of the organic matter generates heat that incubates their eggs (Parsons and Gosper, 2011).

Malleefowl are generalist feeders with a diet consisting of seeds, flowers and fruits of shrubs (especially legumes), herbs, invertebrates, tubers and fungi (Benshemesh, 2007). This suggests that the diet is characteristically variable and that differed foods are important at different times and locations. Food resources are typically varied, transient and patchily distributed (Harlen & Priddle, 1996), in particular, a diversity of food shrubs rather than an abundance of any one species is probably critical to ensure continuity of food during lean times such as drought (Harlen & Priddle, 1996).

8.5.1.2 Distribution

Malleefowl are known to occur within the wider region surrounding the Proposed Action. There is a cluster of 15 records within 40 km of the Project Area boundary. These are part of a broad band of records stretching from the eastern and central coast of South Australia, across to the border with Western Australia and Northern Territory (refer Figure 8-9). There have been 3,628 records within South Australia, with 850 of these recorded since 2010 (ALA, 2022).

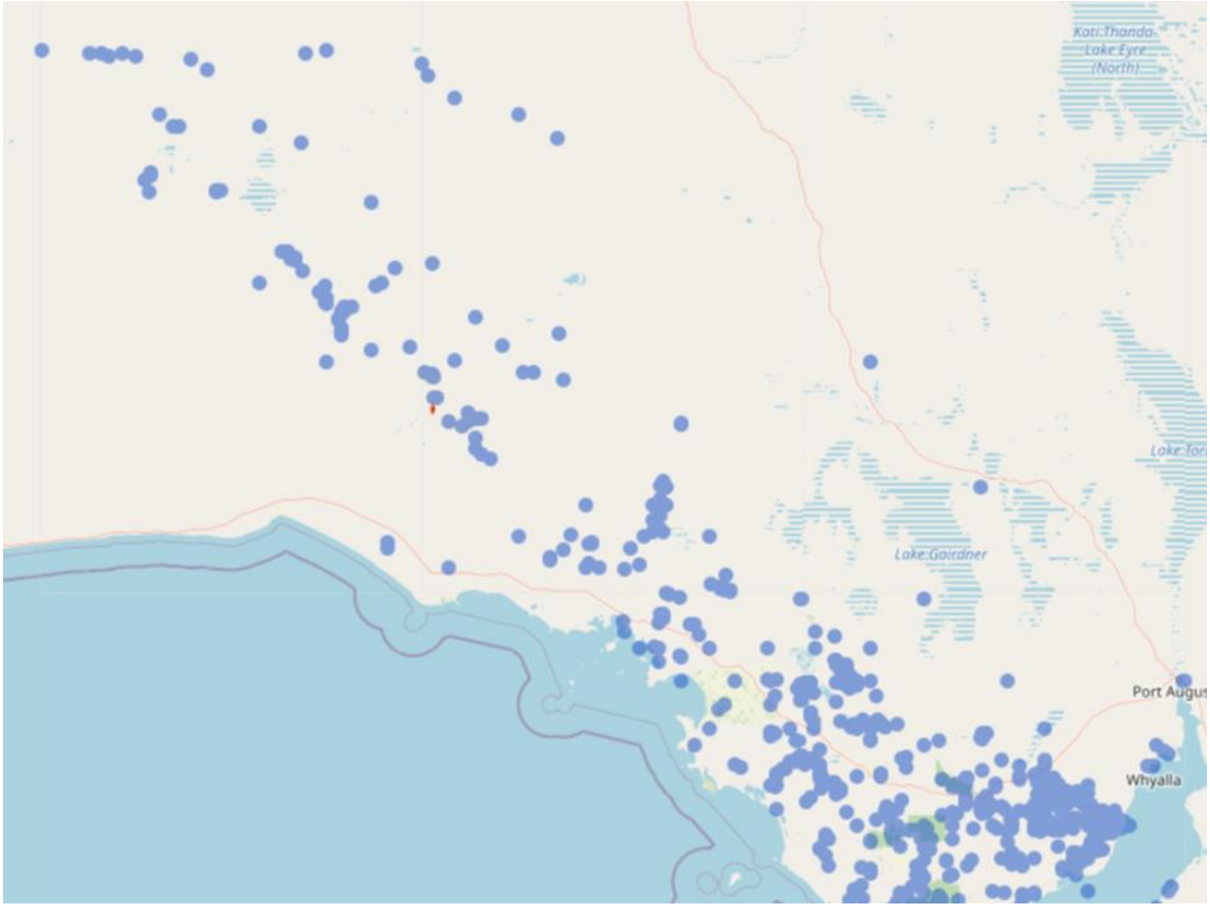


Figure 8-9 Regional Malleefowl records (Project Area shown in red) (ALA, 2022)

8.5.1.3 Occurrence within the Project Area

The survey effort for Malleefowl within the Project Area has been significant, with targeted fauna surveys using a multitude of methodologies including bird counts, helicopter survey, LiDAR survey, targeted habitat surveys, songmeter surveys, camera trapping and searches for scats and tracks.

Within the Project area, particularly within the dune complex to the north and east of the Proposed Action Area 16 Malleefowl mounds have been recorded. Of these, two were recorded in 2014, an additional two in early 2019, an additional 11 in late 2019 and an additional one in 2021. However, only one inactive mound has been recorded within the Proposed Action Area. Evidence of Malleefowl presence (track) has been recorded within the south of the Project Area, but there is no evidence of breeding activity in this area.

The Proposed Action Area was noted to lack the deep rafts of leaf litter that are strongly associated with the active nests located outside of the Proposed Action Area.

The results show that the breeding mounds for this species show a strong association with the more defined dune and mallee systems within the northeast of the Proposed Action Area (which will not be disturbed). Malleefowl have a home range of up to 5 km^2 and habitat suitable for foraging and traversing are likely to be found across the northern section of the Proposed Action Area.

The Proposed Action Area is located on the ecotone between Mallee dominated sand dunes, and the casuarina woodland and shrubland of the Nullarbor plains. Most of the records from ground surveys undertaken for the Proposed Action, and publicly available records are located to the northeast of the Proposed Action Area in the large extent of higher quality habitat. Hence the habitat for Malleefowl within the Proposed Action Area is marginal and likely to be of lower value for the species.

Within a 40 km buffer of the Proposed Action Area, the Area of Occupancy (AOO), based on records of sightings of individual Malleefowl (not based on tracks, scats or breeding mounds), is approximately 4,800 ha (refer to Figure 8-10), whilst the Extent of Occurrence (EOO) is calculated as approximately 54,400 ha. Neither the AOO nor the EOO are shown to intersect the Proposed Action Area.

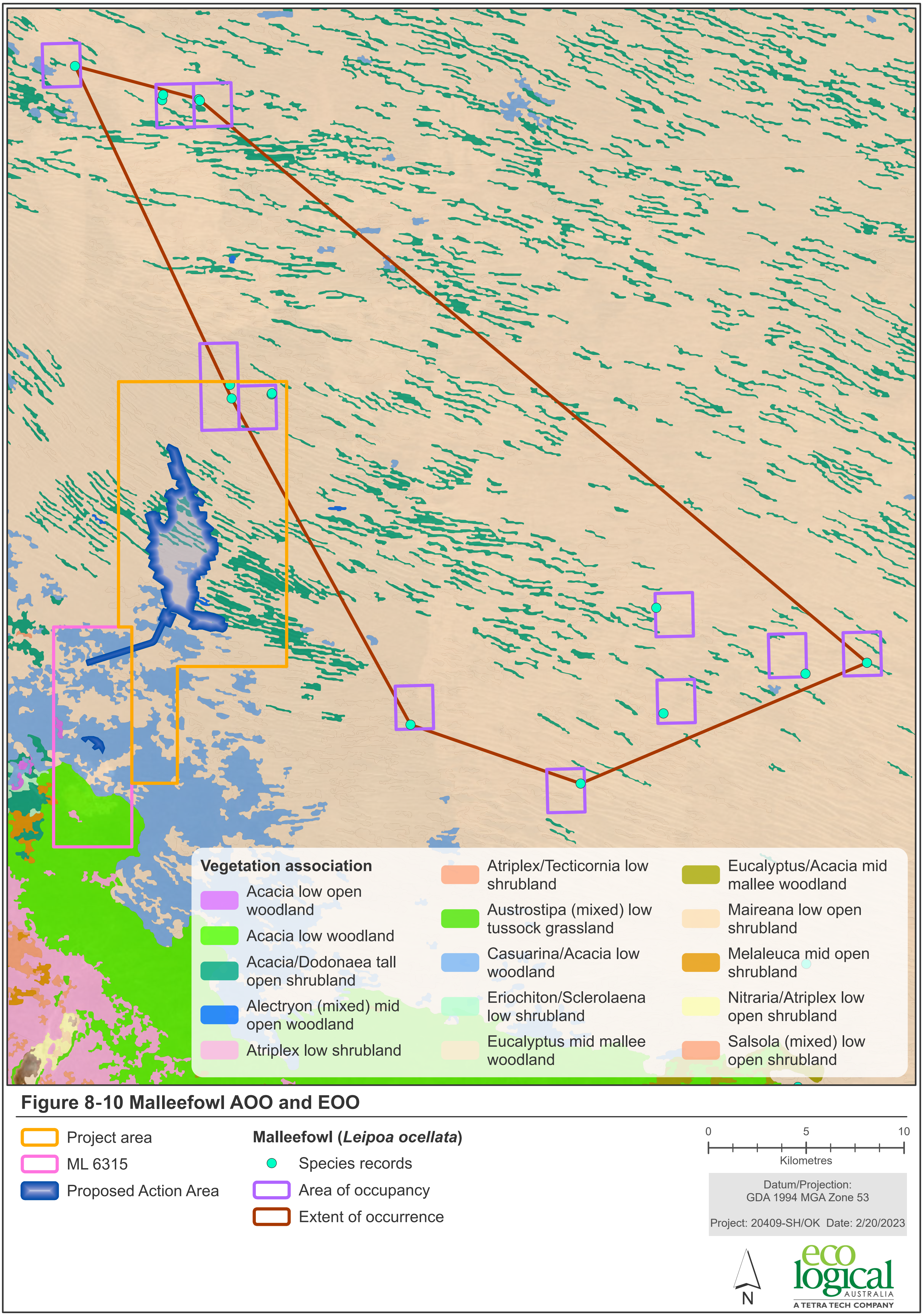


Figure 8-10 Malleefowl AOO and EOO

8.5.1.4 Key Threats

Threats to Malleefowl are well understood and consist of the following key threatening processes (DCCEEW, 2018):

- **Agro-industry farming, livestock farming, ranching and sand mining**: Since 1981 the species range has decreased by 26% in South Australia (Benshemesh 2007). In areas grazed by sheep, Malleefowl breeding densities are reduced (by up to 90%) compared to similar ungrazed habitats. Other native herbivores may also compete for food and damage shrubs that are important as seed sources for birds. As well as removing habitat for the species, the clearing has fragmented the distribution of Malleefowl, and over much of its range the species now persists in small patches of habitat that are inadequate for its long-term conservation without careful planning and management (Benshemesh 2007).
- **Inappropriate fire regimes:** Large fires may eliminate populations from vast areas that are burnt, and even if there are nearby sources of recolonization, recovery in burnt areas to densities that occurred pre-fire appears to be very slow (30-60 years). Fragments may never be recolonised after fire if isolated (Benshemesh 2007).
- **Predation:** Predation by foxes, and to a lesser extent feral cats, is a major cause of mortality of Malleefowl. Foxes are known to take Malleefowl at all stages of the birds' life cycle and are the only documented predators of Malleefowl eggs (apart from humans). However, extended fox baiting has not yet been shown to increase Malleefowl numbers (Benshemesh et al. 2007, Walsh et al. 2012).
- **Native and feral herbivores:** Overabundant native herbivores, particularly kangaroos, as well as feral goats and rabbits compete for food and prevent regeneration of plants, greatly slowing recovery after fire.
- **Climate change:** The number of breeding Malleefowl is lower after years with low winter rainfall and during severe droughts because there is too little food or moisture to generate warmth within nest mounds. Given that climate change modelling suggests winter rainfall will decline across much of the species' range, this possibly represents the greatest threat to the species in the long term.

8.5.1.5 Targeted mitigation

Mitigation of impacts to Malleefowl consist of:

- pre-clearance inspections to ensure no direct impact on individuals during vegetation clearing (refer Section 8.4.3.2.2)
- monitoring and control of predator populations within the Project Area including fox and wild cat (refer Section8.4.3.2.4)
- monitoring and control of feral herbivore populations within the Project Area including rabbits (refer to Section 8.4.3.2.4)
- measures to ensure that the risk of fire is not increased as a result of the Proposed Action (refer to Section 8.4.3.8)

- education and awareness raising with staff (refer to Section8.4.3.2.1)
- maintaining site speed limits and a register of fauna sightings / interaction to identify any road crossing hotspots (refer to Section8.4.3.2.1)
- fauna friendly lighting planning, design and usage (refer to Section 8.4.3.5)
- revegetation targeted towards habitat suitable for the species (refer to Section8.4.3.4.2).

8.5.1.6 Assessment and significance of residual impact

8.5.1.6.1 Definition of 'critical habitat' and 'important populations'

Habitat requirements of Malleefowl are poorly understood (DCCEEW, 2022). A sandy substrate and abundance of leaf litter are clear requirements for the nests. Whilst densities are higher where there is high rainfall, more fertile soils and where shrub diversity is greatest, the floristic and structural requirements of the species are not well understood (Benshemesh, 2007). Habitat modelling undertaken in the Murray mallee of NSW, SA and Victoria has shown that habitats on sandy substrates that support *Triodia* were of greatest importance (Clarke 2005).

However no particular populations or general areas are deemed of greater importance for the long-term survival of Malleefowl than any other at this stage (Benshemesh, 2007).

8.5.1.6.2 Significant Residual Impact Assessment

Table 8-10 shows a significant residual impact assessment for Malleefowl using the guidance within the EPBC Significant Impact Guidelines for assessing potential impacts on MNES.

Table 8-10 Malleefowl significant residual impact assessment

Significant impact criteria for a Vulnerable species	Assessment of impact to Malleefowl
Lead to a long-term decrease in the size of an important population of a species?	**No.** As discussed above, there are no particular populations of Malleefowl that are considered to be more important than others for this species (Benshemesh, 2007). Targeted surveys have shown a low density of breeding mounds to the northeast of the Proposed Action Area in the mallee dominated sand dunes. The only record of historical breeding within the Proposed Action Area is one inactive nest at the north-eastern extent (close to the better-quality habitat outside of the disturbance area). The only record across the rest of the disturbance area is a track in marginal habitat towards the south of the Conceptual Footprint. Assuming that breeding habitat suitable for this species can be recreated during rehabilitation, the clearing of the vegetation within the Proposed Action Area (and when including cumulative impacts from JA) would cause the medium term (up to 30 years) loss of 1,684 km^2 of habitat potentially suitable for nesting Malleefowl, and 1,793 km^2 of marginal habitat suitable for foraging and dispersal. However, as discussed, the Proposed Action Area is on the ecotone of the habitats that provide good quality breeding habitat (mallee associations on sand dunes), and those that are not optimal for breeding (open woodlands and tall shrub). To the northeast of the Proposed Action Area there is extensive areas of mallee covered sand dunes with more extensive deep litter rafts that would provide greater quality breeding habitat. Hence the clearing of the habitat within the Proposed Action Area is likely to cause movement of any individuals using this area into the surrounding higher quality habitat. Due to the low density and transient nature of this species, this movement is unlikely to cause disturbance to the population in the surrounding area. Hence the size of the local population in the region will not be impacted by the medium-term loss of habitat. Potential indirect impacts include the possibility of vehicle strike during clearing, construction and operational phases of the Proposed Action. Due to the low numbers of Malleefowl expected to be transiently within the Proposed Action Area, and the shy nature of this species, it is considered unlikely that they will encounter vehicles on the access roads, however mitigation measures such as speed limits and fauna sighting registers will be implemented (refer to Section 8.8.1.2). Care will be taken to ensure that Malleefowl are not impacted during clearing activities, including a pre-clearance survey and presence of a spotter-catcher during clearing (refer to Section 8.8.1.1.2).
Reduce the area of occupancy of an important population?	**No.** The AOO for Malleefowl within a 40 km buffer of the Proposed Action Area is approximately 4,800 ha (ALA, 2022). This entire area is outside of the Proposed Action Area therefore the clearing of this habitat would not reduce the AOO of the local population. There are signs of Malleefowl that have been recorded within the Proposed Action Area (tracks and one inactive mound) that are not considered within the AOO assessment as they are not direct records for the species. If these were used as data points for the calculation, then there would be a small temporary decrease in the AOO due to clearing. As no population of Malleefowl is considered more important than any other, and as any reduction in habitat would be medium term, this is not considered a significant impact.
Fragment an existing important population into two or more populations	**No.** There is confirmed presence of Malleefowl to the north-east of the Proposed Action within the mallee dominated sand dunes. However, the Proposed Action Area is located on the edge of this habitat type and partially within the adjacent habitat of Nullarbor plains habitat. The distribution of records in Figure 8-9 (ALA occurrence records), shows that there are no records of this species within the Nullarbor habitat type. Hence any disturbance as a result of the Proposed Action would occur on the edge of the population extent and hence will not fragment a population.
Adversely affect habitat critical to the survival of a species	**No.** Whilst habitat critical to the survival of the species is not formally defined for Malleefowl, in the context of the Proposed Action it is reasonable to conclude given the higher quality of the habitat to the northeast of the Proposed Action Area which includes more extensive deep leaf litter critical for breeding, that would be the critical habitat, rather than the more marginal habitat within the footprint itself. The loss of habitat for the local population would not be permanent as the rehabilitation will aim to recreate the mallee dominated vegetation that they require for breeding. The species is known to prefer mature mallee that has not been impacted (e.g., by fire) for at least 30 years as breeding habitat due to the availability of leaf litter and shrub density. The medium-term loss of suboptimal habitat for the species will not affect the survival of the species as the species is likely to temporarily re-locate to the optimal habitat to the northeast until the revegetation is suitably mature.

Significant impact criteria for a Vulnerable species	Assessment of impact to Malleefowl
Disrupt the breeding cycle of an important population	**No.** As discussed above, the optimal breeding habitat for this species is located to the northeast in the mallee dominated sand dunes which have the extensive deep leaf litter rafts that are required for breeding. The breeding habitat within the Proposed Action Area is likely suboptimal in the north and unsuitable in the south. Movement of Malleefowl during the breeding season is likely to be restricted to within 1 km of the nest chamber (Stenhouse & Moseley, 2018), hence the Proposed Action is unlikely to impact on the individuals using the habitat to the northeast of the area of disturbance. Whilst some tracks have been found within the Project Area, it is unlikely that these are important dispersal corridors as they lead to the unsuitable plains areas. The birds are more likely to disperse to the northeast to more suitable habitat.
Modify, destroy, remove or isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline.	**No.** There will be a medium-term reduction in the availability of the suboptimal habitat available within the Proposed Action Area. Rehabilitation will progressively reinstate the same mallee dominated habitats as those that currently occur on the land so there will be no long-term permanent loss, modification or isolation of habitat. However, it is known that Malleefowl preferentially use habitat that has not been impacted for 30 or more years and hence there may be a time lag between the revegetation of the land and use by the species. Multiple surveys within the Project Area have shown that the Proposed Action Area is suboptimal habitat for Malleefowl and is likely to be used transiently by a small number of individuals. The medium-term loss of 1,684 ha of potential habitat across both the Proposed Action and adjacent J-A mine is unlikely to affect breeding, as 1,505,874 ha of potentially suitable habitat is available adjacent to the Project Area. As Malleefowl are known to use a wide variety of food resources that are transient, widespread and patchily distributed, the cumulative loss of 0.10% of suboptimal habitat will not cause a decline in the species.
Result in an invasive species that are harmful to a vulnerable species becoming established?	**No.** Invasive species are known to be a key threat to Malleefowl. Species such as foxes and to a lesser extent feral cats predate on the species, whilst introduced herbivores such as feral goats and rabbits compete for food resources. Foxes, feral cats and rabbits are all established and have been recorded within the Proposed Action Area. The Proposed Action is unlikely to increase the abundance of these species and may decrease their numbers due to the mitigation measures implemented. Whilst increased light may increase predation, the mitigation measures discussed in Section 8.8.1.3 will ensure that the impacts of lighting are minimised. A weed control program will be undertaken to ensure that there is no increase in the type or abundance of weed species within the Proposed Action Area. Particular attention will be paid to the control of Buffel grass which is a potential threat to Malleefowl habitat.
Introduce disease that may cause the species to decline	**No.** There is no information on disease in Malleefowl populations (DCCEEW, 2019).
Interfere substantially with the recovery of the species	**No.** The Malleefowl Recovery Plan objectives are to reduce habitat loss, reduce grazing pressures, reduce fire threat, reduce predation, reduce isolation and fragmentation and reduce mortality on roads. All of these factors have been considered within this table and has been concluded that they will not have a significant impact on this species. There has been considerable research and monitoring of Malleefowl populations which has shown that the rate of decline in numbers has decreased, but overall numbers continue to fall (DCCEEW, 2019). The temporary loss of a small area of suboptimal habitat (0.10%) will not interfere substantially with the recovery of the species.

8.5.1.7 Summary

In summary the population of Malleefowl within the Proposed Action Area has been shown to be small and transient and is unlikely to represent an 'important population'. Habitat more suitable for the species occurs to the northeast of the disturbance area which is more likely to be 'critical habitat' than that found within the Conceptual Footprint.

The direct impact will be the medium-term loss of up to 2,115 ha (0.10% of available habitat within Yellabinna Regional Reserve) of suboptimal habitat within the Proposed Action Area on the southwestern edge of the species known range in the South Australia. This loss of suboptimal habitat will not cause fragmentation of a population, nor decrease the AOO or EOO for the species. It will not significantly affect the breeding cycle of the species as the Proposed Action Area is not ideal breeding habitat, and dispersal is likely to be to the northeast rather than to the south the Proposed Action Area towards the Nullarbor Plains.

Indirect impacts such as increase in invasive and pest species, and the impact of increased light and noise will be mitigated by the measures in Section 8.8.1.3. The residual impact of these indirect factors is unlikely to be significant.

In conclusion, the Proposed Action is **unlikely to have a significant residual impact on Malleefowl**.

8.5.2 Sandhill Dunnart

8.5.2.1 Ecology

Sandhill Dunnart is a nocturnal insectivorous marsupial that occurs in predominantly arid and semi-arid regions of Australia. They are opportunistic feeders eating prey types in similar proportions to their availability (Churchill, 2001).

The climate of the distributional range of the Sandhill Dunnart is characterized by high diurnal variations and high seasonal variations. The presence of large spinifex hummocks is an important habitat feature as they provide a moderated microclimate suitable for the species nest sites (Churchill, 2001). Sandhill Dunnarts commonly nest within hummocks or in burrows dug beneath hummocks although they have also been recorded using hollow logs and *Notomys mitchelli* (Mitchell's hopping-mouse) burrows (DEW, 2019).

Sandhill Dunnarts have an average home range size of 7.8 ha (rage of 1.8 ha to 19.0 ha) (Churchill, 2001). The home ranges of males overlap those of other males and females; however females have exclusive home ranges (DEW, 2019). Density of Sandhill Dunnarts is likely to be dependent on habitat availability, habitat quality, predation and food resources (Gaikhorst & Lambert 2014). In general individuals may move 200-300 m within a foraging period but have ability to traverse long distances in short periods of time if necessary. Their high mobility appears to be necessary in a system with spatially and temporally variable food resources (McLean 2015).

8.5.2.2 Distribution

Sandhill Dunnart is known to occur in three core populations (near Queen Victoria Spring Nature Reserve in the south-western corner of the Great Victoria Desert, Western Australia; Yellabinna Regional Reserve in the south-eastern Great Victoria Desert, South Australia; and Eyre Peninsula, South Australia).

Surveys conducted in the Yellabinna Regional Reserve between 2008 and 2012 indicate the species is generally restricted to the northwest portion of the Reserve (Woinarski & Burbidge, 2016), which is northeast of the Project Area.

The location of the Proposed Action in relation to Sandhill Dunnart records is shown in Figure 8-7. There are 517 records from South Australia, with 249 of these recorded since 2010 (ALA, 2022).

Sandhill Dunnarts are known to prefer areas where fire most recently burned between 20-40 years ago, as this allows the spinifex grass (*Triodia*) to gain suitable density, height and depth and to provide the Dunnarts refuge from introduced and native predators (Landscape SA, 2022). The *Triodia* coverage required is thought to be between 10-70% (DCCEEW, 2019). In Yellabinna Regional Reserve, monitoring between 2008 and 2012 demonstrated a tenuous relationship between spinifex height (but not cover, size or continuity) in an area of dunes where capture rates are seemingly higher than elsewhere. However, spinifex height has been comparable at other locations where capture rates are lower and in areas where no Sandhill Dunnarts were found in surveys. Ongoing research is being undertaken to define this species exact habitat requirements.

8.5.2.3 Occurrence within the Project Area

There are no records of Sandhill Dunnart recorded within the Proposed Action Area despite targeted surveys for this species consisting of 1,666 trap nights. The species was recorded within the larger Project Area in 2014 and is known to occur in Yellabinna Regional Reserve in low densities where the density of *Triodia* is greater than within the Proposed Action Area. The density of *Triodia* within the Proposed Action Area was recorded as sparse. Whilst the exact requirements for optimal species habitat has not yet been confirmed, the presence of relatively dense and continuous *Triodia* is known to be necessary for both breeding and foraging. Hence the habitat within the Proposed Action Area is suboptimal.

There is one record from south of the Proposed Action Area. This record was of a single male Sandhill Dunnart and was recorded in habitat that is unsuitable for the species. This record is anomalous and should be disregarded (B. Backhouse, pers comms, 16 January 2023). Hence this outlier has been excluded from the calculations of EOO and AOO shown below.

With this exclusion, the AOO for one record is shown to intersect with the Proposed Action Area marginally, however the EOO does not intersect the Proposed Action Area (refer to Figure 8-9).Figure 8-11 shows that for the Yellabinna Sandhill Dunnart population, the AOO based on all records is 11,200 ha (refer to Figure 8-11), whilst the EOO is calculated as 294,500 ha (ALA, 2022).

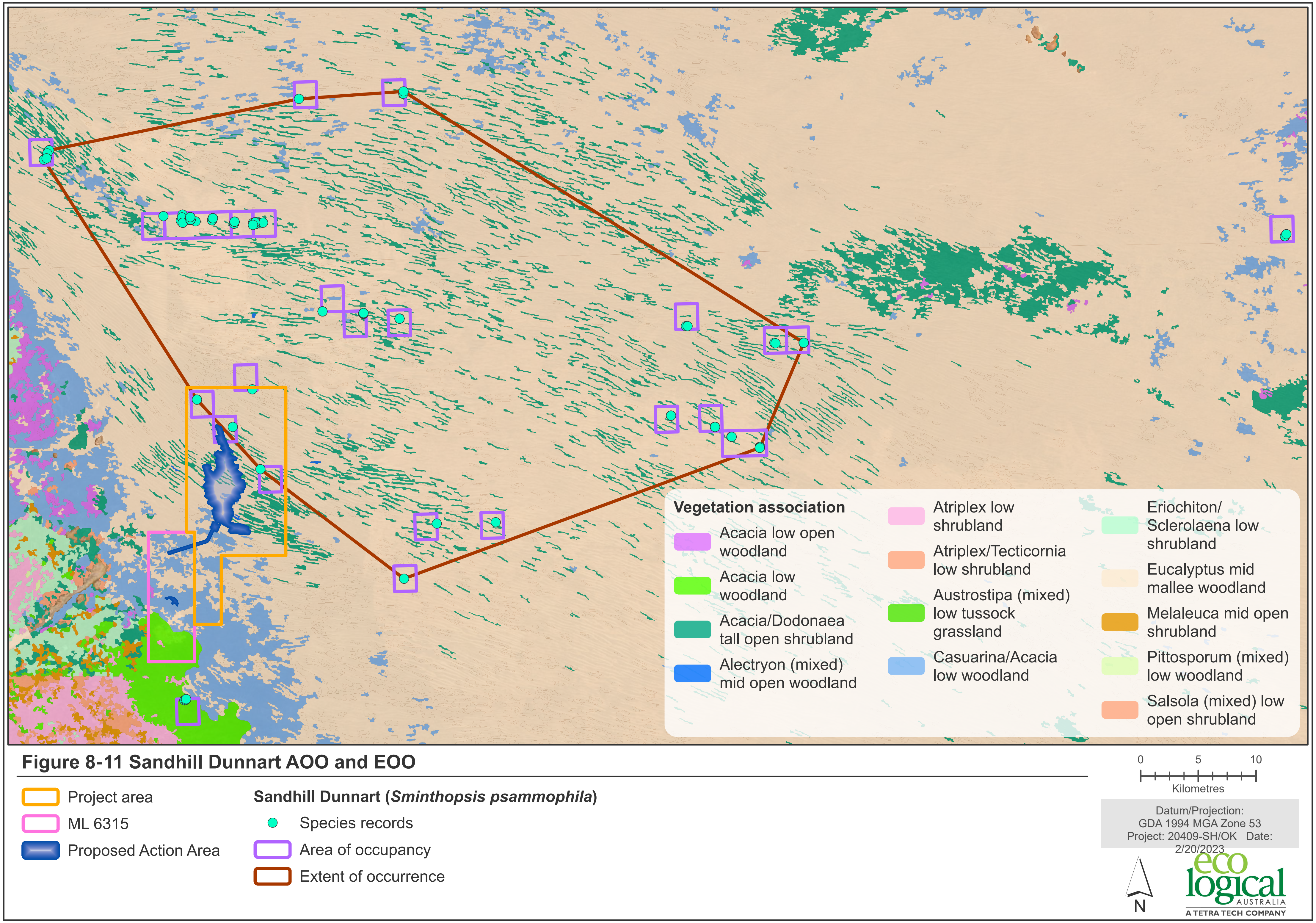


Figure 8-11 Sandhill Dunnart AOO and EOO

8.5.2.4 Key Threats

The key threats to the Sandhill Dunnart are identified in the Conservation Advice for the species (DoE, 2015) and consist of:

- **Predation by feral cats and red foxes:** Feral cats and foxes are known predators of some *Sminthopsis* species in arid Australia but the extent of their impact on Sandhill Dunnart is unknown (DEW 2019a). Whilst is likely to have had a severe impact on the species over its entire range (Woinarski et al, 2014), current core populations of Sandhill Dunnarts are surviving in the presence of both cats and foxes (McLean, 2015). Furthermore, in a study of feral cats in the northern Australian savanna, McGregor et. al. (2015) found the hunting success of the cats (n = 13) was only 17% in habitats with dense grass or complex rocks, compared to 70% in open areas (n = 101). This suggests that dense and complex microhabitats are likely to decrease cat predation rates.
- **Inappropriate fire regimes:** Change in fire patterns is considered a major threat to Sandhill Dunnart (Woinarski et al, 2014). However, there is no evidence that fire regimes have changed in recent history in the eastern Great Victorian Desert (GVD) (Yellabinna Regional Reserve) (Armstrong 2015; Morelli 1992), nor is there evidence that prescribed burns would alter subsequent fire frequency or extent (Armstrong 2015; Price et al. 2015). Fire is therefore not considered a direct threat to Sandhill Dunnarts in this region (DEW, 2019). This threat will not be considered further.
- **Habitat loss and fragmentation:** The impact of habitat loss for agriculture and the associated habitat fragmentation has had a severe impact on the Sandhill Dunnart population on the Eyre Peninsula (Aitkin, 1971). However there has been such clearing in the GVD where the impact of habitat loss and fragmentation is likely to be much less. Fragmentation of habitat, where it occurs, increases the vulnerability of the species to being made locally extinct by stochastic events such as drought and large wildfires (DCCEEW, 2019)
- **Introduced herbivores:** Introduced herbivores (cattle, goats, sheep, rabbits and camels) may have impacted on the survival of Sandhill Dunnarts indirectly in a variety of ways, including:

  - altering the structure of spinifex hummocks
  - changing the fire regime by removing biomass
  - reducing floristic diversity of habitats over time
  - causing soil compaction and disturbance
  - encouraging the spread of introduced predators such as foxes and cats into areas that usually have only very low densities.

  It is likely that this is not a significant threat to Sandhill Dunnart within the Yellabinna Regional Reserve as the southern GVD is not suitable for high densities of introduced stock due to lack of water resources and the low nutritional value of spinifex (DCCEEW, 2019)

- **Invasion by *Cenchrus ciliaris* (Buffel grass):** Buffel grass is considered a major threat to Sandhill Dunnarts due to the way that its dominance across landscapes leads to changes in the intensity and frequency of fires, resulting in the loss of nesting spinifex hummocks and potential changes to food availability (Sandhill Dunnart Workshop 2014).

8.5.2.5 Targeted mitigation

Mitigation of impacts to Sandhill Dunnart consist of:

- pre-clearance surveys to ensure no direct impact on individuals during vegetation clearing (refer to Section8.4.3.2.1)
- monitoring and control of predator populations within the Project Area including fox and wild cat (refer to Section 8.4.3.2.4)
- monitoring and control of feral herbivore populations within the Project Area including rabbits and feral camels (refer to Section 8.4.3.2.4.3)
- monitoring and control of weed species with particular focus on Buffel grass (refer to Section 8.4.3.2.3)
- measures to ensure that the risk of fire is not increased as a result of the Proposed Action (refer to Section 8.4.3.8)
- education and awareness raising with staff (refer to Section 8.4.3.2.1)
- maintaining site speed limits and a register of fauna sightings/ interaction to identify any road crossing hotspots (refer to Section 8.4.3.2.1)
- fauna friendly lighting planning, design and usage (refer to Section 8.4.3.5)
- revegetation targeted towards habitat suitable for the species (refer to Section8.4.3.4.1).

8.5.2.6 Assessment and significance of residual impacts

For species listed as endangered under the EPBC Act, there is no requirement to determine whether a population is an 'important population', although it should be noted that the Draft Sandhill Dunnart Recovery Plan (DEW, 2019) for the species notes that the population in Yellabinna Regional Reserve is an important population. For impact assessment of endangered species the impacts are assessed on 'a population'. A population is defined under the EPBC Act as an occurrence of the species in a particular area.

Table 8-11 shows a significant residual impact assessment for Sandhill Dunnart using the guidance within the EPBC Significant Impact Guidelines for assessing potential impacts on MNES.

Table 8-11 Sandhill Dunnart significant residual impact assessment

Significant impact criteria for an Endangered species	Assessment of impact to Sandhill Dunnart
Lead to a long-term decrease in the size of a population of a species?	**No.** Several targeted surveys have failed to record Sandhill Dunnarts within the Proposed Action Area. Although the species is known to be trap-shy, they were caught outside of the Proposed Action Area during the 2014 survey (four individuals). There was one old burrow that may have been that of Sandhill Dunnart (unconfirmed) recorded within a *Triodia* clump on the northern edge of the Project Action Area in 2021. Surveys for Sandhill Dunnart completed within the adjacent Yellabinna Regional Reserve indicate that they are likely to be restricted to the northwest portion which is northeast of the Project Area in areas of relatively dense and continuous *Triodia* cover. Research has shown that recreation of *Triodia* vegetation is complex, with low germination rates and complex requirements for germination. There has been no large-scale success in recreating this habitat type, and whilst Iluka will commit to investigating all available options, the risk of failure to recreate this vegetation type is high. Hence using the precautionary principle, revegetation cannot be assumed to reduce the impact of the Proposed Action on Sandhill Dunnart. Should revegetation be unsuccessful, the clearing of the vegetation within the Proposed Action Area may cause the permanent loss of 1,179 ha of potentially suitable habitat, and 928 ha of marginal habitat for Sandhill Dunnart. However, as discussed, the Conceptual Footprint is on the ecotone of the habitats that provide good quality breeding habitat (mallee associations over spinifex on a sandy substrate), and those that are not optimal for breeding (open woodlands and tall shrub lacking spinifex understory). To the northeast of the Proposed Action Area there are extensive areas of sand dunes with spinifex cover that would provide greater quality breeding habitat and are known to support Sandhill Dunnart due to surveys completed within the Reserve. Hence the clearing of the habitat within the Proposed Action Area is likely to cause movement of any individuals using this area into the surrounding higher quality habitat. Due to the low density and transient nature of this species, this movement is unlikely to cause disturbance to the population in the surrounding area. Hence the size of the population in the region will not be significantly impacted by the loss of habitat. Potential indirect impacts include the possibility of vehicle strike during clearing, construction and operational phases of the Proposed Action. Due to the low numbers of Sandhill Dunnart expected to be transiently within the Proposed Action Area, and the shy nature of this species, it is considered unlikely that they will encounter vehicles on the access roads, however mitigation measures such as speed limits and fauna sighting registers will be implemented (refer to Section 8.8.1.2.1). Care will be taken to ensure that Sandhill Dunnart are not impacted during clearing activities, including a pre-clearance inspection, staged vegetation clearing and presence of a spotter-catcher during clearing (refer to Section 8.8.1.1.2).
Reduce the area of occupancy of a species?	**No.** The closest record for the Sandhill Dunnart is from 2014 located approximately 2 km to the northeast of the Proposed Action Area. Whilst it is acknowledged that Sandhill Dunnarts can move up to 2 km in two hours if required, their known foraging range is only 200-300 m. The species has more often been recorded in the habitat to the northeast of the Project Area within Yellabinna Regional Reserve and the Proposed Action Area is more likely to be suboptimal foraging habitat due to the sparsity of *Triodia* coverage. The loss of 1,979 ha of suboptimal foraging habitat that is well connected to better quality habitat is unlikely to permanently reduce the AOO of the species.
Fragment an existing population into two or more populations	**No** The population of Sandhill Dunnart is located primarily to the northeast of the Proposed Action Area within Yellabinna Regional Reserve where there are more records of the species. The Proposed Action Area is a discrete area and as such will not fragment habitat in the same way that linear infrastructure would. Sandhill Dunnart are highly mobile and can circumnavigate the Proposed Action Area if required.

Significant impact criteria for an Endangered species	Assessment of impact to Sandhill Dunnart
Adversely affect habitat critical to the survival of a species	**No.** Due to the availability of better-quality habitat to the northeast of the Project Area within Yellabinna Regional Reserve, it is unlikely that the habitat within the Proposed Action Area is critical to the survival of the species due to the sparsity of *Triodia* coverage. 2,108 ha of potential habitat may be impacted by the Proposed Action, including 1,179 ha of good quality habitat and 928 ha of marginal habitat. This habitat occurs as patches between and on top of dunes, interspersed with habitat that is not considered suitable for the species. The loss of this habitat which represents 0.12% of that available in the surrounding area, is unlikely to adversely impact the species.
Disrupt the breeding cycle of a population	**No.** Despite targeted surveys since 2014, there is no evidence that Sandhill Dunnart is breeding within the Proposed Action Area with only one old disused burrow (unconfirmed as being that of Sandhill Dunnart) recorded on the north-eastern boundary of the Proposed Action Area.
Modify, destroy, remove or isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline.	**No.** Ground-truthed vegetation mapping indicates potentially suitable *Triodia* habitat for Sandhill Dunnart is located throughout much of the Project Area where the dunal areas persist, grading to unsuitable in the southwestern areas where the dunal areas grade to the plains. However, the density of *Triodia* is sparse and does not constitute the dense and continuous *Triodia* coverage required by the species. Habitat that is potentially suitable for the species occurs as discontinuous patches both between and on the top of dune crests, interspersed with non-sandy habitat types that are unsuitable for the species. When considered in the context of the 1,534,082ha of suitable habitat within the surrounding Yellabinna Regional Reserve, the temporary short-midterm loss of 2,108 ha of suboptimal habitat (0.12%) is unlikely to cause a decline in Sandhill Dunnart.
Result in an invasive species that are harmful to an endangered species becoming established?	**No.** A weed control program will be undertaken to ensure that there is no increase in the type or abundance of weed species within the Proposed Action Area. Particular attention will be paid to the control of Buffel grass which is a known threat to Sandhill Dunnart habitat. Invasive species are known to be a key threat to Sandhill Dunnart. Species such as foxes and to a lesser extent feral cats predate on the species. Foxes, feral cats, camels and rabbits are all established and have been recorded within the Proposed Action Area. The Proposed Action is unlikely to increase the abundance of these species and may decrease their numbers due to the mitigation measures implemented. Whilst increased light may increase predation, the mitigation measures discussed in Section 8.8.1.3 will ensure that the impacts of lighting are minimised.
Introduce disease that may cause the species to decline	**No.** Feral cats are known to be established within the Proposed Action Area and hence although toxoplasmosis and sarcoptic mange have the potential to impact Sandhill Dunnart, the Proposed Action is unlikely to introduce disease that is not already present within the Proposed Action Area.
Interfere substantially with the recovery of the species	**No.** There is a recovery plan in place for the Sandhill Dunnart and few of the recovery actions in that plan are relevant to the Project. The approved conservation advice for the species lists conservation and management actions, none of which are contradictory with the Project. The loss of habitat associated with the Project is small relative to what is available in the region and no individuals of the species have been recorded near the Proposed Action Area. Therefore, the Project is not considered likely to interfere substantially with the recovery of the species.

8.5.2.7 Summary

In summary there is no evidence that a stable or established population of Sandhill Dunnart is present within the Proposed Action Area despite significant survey effort (1,666 trap nights). Habitat more suitable for the species occurs to the northeast of the Proposed Action Area which is more likely to be 'critical habitat' than that found within the Proposed Action Area. The habitat within the Proposed Action Area is suboptimal for Sandhill Dunnart as it lacks the continuous dense *Triodia* coverage likely to be required by the species.

The direct impact will be the temporary loss of 2,108 ha (0.12% of available regional habitat) of suboptimal habitat on the edge of the species known range in the Yellabinna Regional Reserve area (when discounting the anomalous record south of the Project Area). This loss of suboptimal habitat will not cause fragmentation of a population due to the mobile nature of the species and their capacity to travel significant distance when required. It will not significantly affect the breeding cycle of the species as the Proposed Action Area is not ideal breeding habitat, and dispersal is likely to be to the northeast rather than to the south the Conceptual Footprint towards the Nullarbor Plains.

The additional clearing of 128 ha of marginal habitat within J-A as a result of the Atacama Project will not be material as it is not suitable habitat for Sandhill Dunnart and the areas are unlikely to be used by the species as they are adjacent to active mining operations.

Indirect impacts such as increase in invasive and pest species, and the impact of increased light and noise will be mitigated by the measures in Section 8.8.1.3. The residual impact of these indirect factors is unlikely to be significant.

In conclusion, the Proposed Action is **unlikely to have a significant residual impact on Sandhill Dunnart**.

8.5.3 Ooldea Guinea-flower

8.5.3.1 Ecology

Ooldea Guinea-flower is a small wiry glabrous shrub growing up to 50 cm high.

The surveys completed for the Proposed Action note a general association with deep sand dunes (10-15 m in height with occasional 20 m peaks), co-association with *Eucalyptus capitanea* (Desert ridge-fruited mallee) and *Leptospermum coriaceum* (Green tea-tree), and co-location with fire scars (ALA, 2021).

8.5.3.2 Distribution

In depth research has not been completed to explain the distribution of this species across the disjunct South Australian populations, where it is known to exist (e.g., north of the Ooldea Railway Siding, east around Lake Everard) or in relation to landform or other habitat features or fire events (DEWHA, 2008).

The distribution of the species in relation to the Project Area is shown in Figure 8-8. There are 286 records of Ooldea Guinea-flower within South Australia with 253 of these records since 2010 (ALA, 2022).

8.5.3.3 Occurrence within the Project Area

Despite extensive survey effort including transect surveys on 4 km of potential habitat, and ramble surveys over 94 km of dune habitat, Ooldea Guinea-flower has not been recorded within the Project Area. In 2014 a total of 283 individual plants were recorded in five separate patches with the closest record located approximately 1.5 km from the Project Area (refer to Figure 8-12).

Ooldea Guinea-flower was recorded outside of the Project Area on tall dune crests dominated by tall shrubland of *Hakea francisiana* (Bottle-brush Hakea) and *Grevillea stenobotrya* (Sandhill Spider-flower) with emergent *Callitris verrucosa* (Mallee Cypress-pine) over *Bossiaea walkeri* (Cactus Pea), T*hryptomene elliottii, +/- Leptospermum coriaceum* (Green Tea-tree), *Triodia basedowii* (Lobed Spinifex) and *Triodia lanata* (ELA 2021).

It is noted that the habitat in the north of the Project Area is more suitable for this species as it contains the deep dunes that appear to be key habitat features. These dune crests have some suitable habitat including the occurrence of *Leptospermum coriaceum* (Green tea-tree), however the co-associated *Eucalyptus capitanea* (Desert ridge-fruited mallee) is absent, as is the presence of fire scars that may be required for germination. The habitat to the south of the Project Area is suboptimal for this species as it lacks the presence of suitable dune crest habitat as has often been replaced by the interdune habitat that has covered the dune crests.

Figure 8-12 shows that the AOO for the Yellabinna Ooldea Guinea-flower population, which is calculated as 6,000 ha, whilst the EOO is calculated as 64,400 ha. Neither the AOO nor the EOO are shown to intersect the Proposed Action Area, or the Project Area.

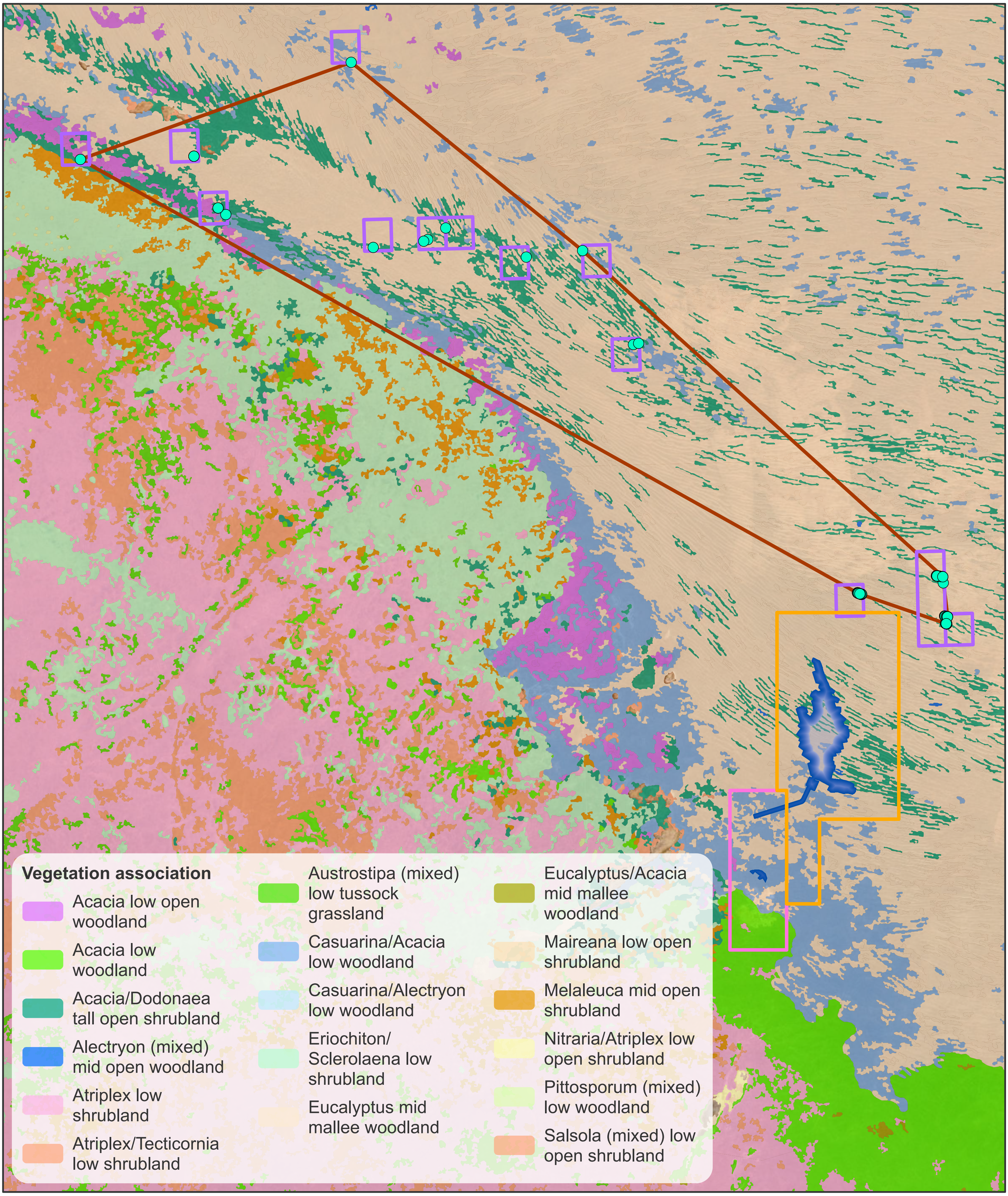
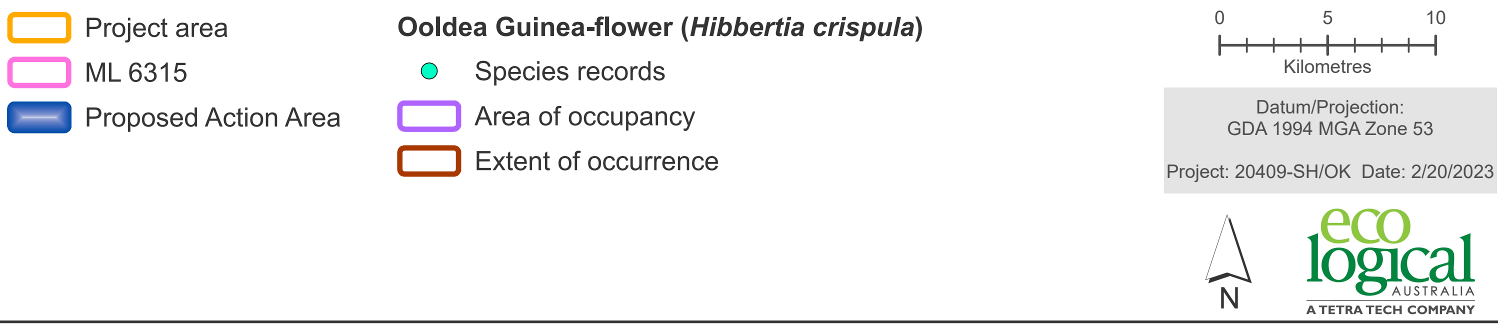


Figure 8-12 Ooldea Guinea-flower AOO and EOO



8.5.3.4 Key Threats

The key threats to Ooldea Guinea-flower are:

- competition with exotic weeds (including Buffel grass),
- grazing by feral animals such as rabbits and camels
- fragmentation of habitat.

The impacts of these threats are poorly known and there is currently no management plan for the species (DEWHA, 2008).

8.5.3.5 Targeted Mitigation

Mitigation of impacts to Ooldea Guinea-flower include:

- pre-clearance surveys to ensure no direct impact on individuals during vegetation clearing (refer to Section 8.4.3.1.2)
- monitoring and control of feral herbivore populations within the Project Area including rabbits and camels (refer to Section 8.4.3.2.4)
- measures to ensure that the risk of fire is not increased as a result of the Proposed Action (refer to Section 8.4.3.8)
- weed control program to ensure that there is no increase in the number of species, abundance or distribution of weed species (refer to Section 8.4.3.2.3). Particular effort will be undertaken to ensure that there is no increase in abundance or spread of Buffel grass as this is a known competitor to Ooldea Guinea-flower.
- education and awareness raising with staff (refer to Section 8.4.3.2.1).

8.5.3.6 Assessment and significance of residual impacts

Definition of 'important population' and 'critical habitat'

The Guidelines (DoE, 2013) state that for a Vulnerable listed species, an important population is: "*a population that is necessary for a species' long-term survival and recovery. This may include populations…. That are key source populations for breeding or dispersal, and/ or populations that are necessary for maintaining genetic diversity and/ or populations that are near the limit of the species range*." As the population of Ooldea Guinea-flower found to the north of the Project Area is one of only three distinct populations in Australia, it would be considered an 'important population'. It should be noted that this population is outside of the Project Area (and therefore outside of the Proposed Action Area) and that no individuals of Ooldea Guinea-flower have been recorded within the Project Area despite repeated targeted survey.

Habitat critical to the survival of a species or 'critical habitat' refers to areas that are necessary:

- for the long-term maintenance of the species or ecological community (including the maintenance of species essential to the survival of the species, such as pollinators)
- to maintain genetic diversity and long-term evolutionary development, or

- for the reintroduction of populations or recovery of the species.

The Proposed Action Area would not be defined as critical habitat for Ooldea Guinea-flower as it does not have any key features that are not found to a greater extent outside of the Project Area. The species appears to require steep and deep sand dunes and co-associations with *Eucalyptus capitanea* and *Leptospermum coriaceum*. Whilst the north of the Project Area has some suitable habitat including the occurrence of *Leptospermum coriaceum* on deep dune crests, the co-associated *Eucalyptus capitanea* is absent, as is the presence of fire scars that may be required for germination. The habitat to the south of the Project Area is suboptimal for this species as it lacks the presence of suitable dune crest habitat as this has often been smothered by the interdune habitat that has covered the dune crests.

Table 8-12 shows a significant residual impact assessment for Ooldea Guinea-flower using the guidance within the EPBC Significant Impact Guidelines for assessing potential impacts on MNES.

Table 8-12 Ooldea Guinea-flower significant residual impact assessment

Significant impact criteria for a Vulnerable species	Assessment of impact to Ooldea Guinea-flower
Lead to a long-term decrease in the size of an important population of a species?	**No.** There is no population of this species within the Project Area. Pre-clearance surveys will ensure that no previously unrecorded individuals of this species are directly impacted during vegetation clearance. The nearest patch of Ooldea Guinea-flower is approximately 1.5 km from the edge of the Project Area, and 5.5km from the edge of the Proposed Action Area which includes a 50m buffer. No indirect impacts such as light or dust are expected to reach this location. Control of feral animal species will be undertaken to ensure that there is no increase in grazing pressure as a result of the Proposed Action.
Reduce the area of occupancy of an important population?	**No.** The AOO of the population is located outside of the Proposed Action Area will not be impacted by the Proposed Action.
Fragment an existing important population into two or more populations	**No.** There are two sub-populations to the northeast of the Project Area. The Proposed Action will not impact on, nor fragment these two populations.
Adversely affect habitat critical to the survival of a species	**No.** The area of disturbance within the Proposed Action Area is not considered to be habitat critical to the survival of the species as it does not currently contain Ooldea Guinea-flower and does not contain all the habitat elements to support the species. Land to the northeast of the Project Area would be considered critical to the survival of the species and whilst this will not be directly impacted, indirect impacts on this habitat have been considered. The mitigation measures discussed in Section 8.8.1.2.3 including weed control (with a focus on Buffel grass) will ensure that there are no adverse impacts on this critical habitat.
Disrupt the breeding cycle of an important population	**No.** The nearest population is outside of the Project Area and the Proposed Action will not disrupt the breeding cycle of that population.
Modify, destroy, remove or isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline.	**No.** The Proposed Action will result in the loss of a maximum of 797 ha of potentially suitable (but suboptimal) habitat for Ooldea Guinea-flower. This represents approximately 0.12% of the suitable habitat within the region. The loss of such a small proportion of suitable habitat will not cause the species to decline.
Result in an invasive species that are harmful to a vulnerable species becoming established?	**No.** A weed control program will be undertaken to ensure that there is no increase in the type or abundance of weed species within the Project Area. Particular attention will be paid to the control of Buffel grass which is a known competitor to Ooldea Guinea-flower.
Introduce disease that may cause the species to decline	**No.** There are no known diseases that affect the species.
Interfere substantially with the recovery of the species	**No.** There is no current management plan or recovery plan for the species.

8.5.3.7 *Summary*

Ooldea Guinea-flower has not been recorded within the Proposed Action Area or Project Area, despite significant survey effort and the plant being a conspicuous shrub, even when not flowering or fruiting.

The habitat within the north of Project Area is suboptimal for Ooldea Guinea-flower as it lacks the combination of deep and steep dunes with *Eucalyptus capitanea* and *Leptospermum coriaceum* and the presence of fire scars that appear to be a factor for germination. The habitat in the south of the Proposed Action Area is unsuitable habitat as the topography graduates to rolling plains that are unsuitable for Ooldea Guinea-flower.

The clearing of 128 ha within J-A as a result of the Atacama Project will not be material as it is not suitable habitat for Ooldea Guinea-flower as it contains none of the co-associations required by the species.

The closest record is approximately 1.5 km to the north of the Project Area. Key threatening processes as a result of the Proposed Action would be introduction and spread of Buffel grass, as well as increases in pest herbivore density such as rabbits. Mitigation will be targeted at the monitoring and control of these species. There is confidence in the success of these mitigation measures as there has been no significant increase in pest and weed species at the adjacent J-A site over the past 10 years of monitoring, with the exception of a very small outbreak of Buffel Grass which was recognized during routine monitoring and is currently being treated with the expectation of eradication from the ML.

In conclusion, the Proposed Action is **unlikely to have a significant residual impact on Ooldea Guinea-flower**.

8.6 Offsets

As the above assessment has demonstrated that there are no significant residual impacts on MNES expected as a result of the Proposed Action, there is no requirement for provision of an offset under the EPBC Act.

8.7 Environmental record of the person proposing to take the action

There are no proceedings under Commonwealth, State of Territory law for the protection of the environment or the conservation and sustainable use of natural resources against Iluka.

Iluka has been operating in South Australia since 2009 and has extensive mineral sands mining experience demonstrated through operations in Western Australia, Victoria, New South Wales, Sierra Leone and the United States for over 60 years.

Iluka have been commended for the way they operate in South Australia at the nearby J-A Operation and have received numerous South Australian Premier’s Awards including:

- 2014 for Environmental Excellence.
- 2017 for Social Inclusion.
- 2018 for Excellence in Innovation: Environmental Management.

- 2018 for Diversity in Action awarded jointly to both Iluka and the FWCAC.

Iluka have also been commended for rehabilitation works in WA; most recently by award of the Golder Gecko Award for innovation in native vegetation rehabilitation by the development of the Flora Restorer.

The key components of Iluka's environmental management approach that are applicable to the Proposed Action include:

- A Health, Safety, Environment and Community Management System (HSECMS) which manages potential environmental impacts throughout all phases of operations.
- Management and monitoring requirements will be implemented, including measurement criteria; response actions; monitoring and auditing procedures; and reporting and review commitments.

A copy of Iluka's environmental policy as well as their environmental management framework is detailed in Section 10.

Iluka have been undertaking significant environmental monitoring and rehabilitation works at the J-A site (adjacent to the Project Area) for over ten years. Additionally, Iluka has continued to support environmental research and community programs in the local community and at post graduate tertiary level. The annual monitoring and reporting shows that no impacts to native flora and fauna have been identified due to mining operations and weed and pest species diversity and abundance are addressed through a site management program. Progressive rehabilitation is occurring across the site and topsoil stockpiling and seed collection are undertaken for future rehabilitation.

8.8 Ecologically sustainable development

Section 3A of the EPBC Act defines the principles of ecologically sustainable development (ESD). Table 8-13 outlines how each of the five principles have been applied to the Proposed Action.

Table 8-13 Ecologically Sustainable Development.

Principle	Consideration of principle in proposed action
'Integration Principle' Decision-making processes should effectively integrate both long-term and short-term economic, social and equitable considerations	A holistic decision-making process has been established for the Proposed Action with the aim to provide an integrated and transparent approach. Iluka has invited comment from a range of stakeholders and has considered and responded to these considerations. There has been evaluation of the socio-economic, cultural and ecological features of the environment that may be affected by the Proposed Action and there is demonstration that any impact and risks will be acceptable.

Principle	Consideration of principle in proposed action
'Precautionary Principle' If there are threats of serious or irreversible environmental damage, lack of full scientific certainty should not be used as a reason for postponing measures to prevent environmental degradation	The Precautionary Principle has been referred to several times throughout this impact assessment document. Significant effort has been used to identify risk associated with the Proposed Action. A wide range of field studies have been completed by Iluka over the past ten years and the results of these studies have been combined with extensive desk-top research. Information gathered during these studies was used to inform the Proposed Action and has reduced the uncertainty surrounding the prediction of impacts for assessment. Iluka have ensured that the design of the Proposed Action is such that where possible it avoids serious or irreversible impacts to the environment. Impacts have been identified and described under each key environmental factor. Avoidance, minimization and mitigation measures have been proposed to ensure that any impacts resulting from the Proposed Action are environmentally acceptable.
'Intergenerational Principle' That the present generation should ensure that the health, diversity and productivity of the environment is maintained or enhanced for the benefit of future generations	Iluka have committed to a range of mitigation measures to ensure that the environmental impacts and risk resulting from the Proposed Action are managed to an acceptable level. The resulting mitigation measures including extensive land rehabilitation and associated revegetation research and as such the Proposed Action will not forego the health, diversity and productivity of the environment for future generations.
'Biodiversity Principle' The conservation of biological diversity and ecological integrity should be a fundamental consideration in decision-making	Iluka made the fundamental decision to design the Proposed Action to use facilities at the adjacent J-A site to reduce the area of impact and hence conserve biological diversity and ecological integrity within the Proposed Action area.
'Valuation Principle' Improved valuation, pricing and incentive mechanisms should be promoted	Iluka accepts that the cost of the Proposed Action must include environmental impact mitigation, management, maintenance and closure and rehabilitation activities.

8.9 Information sources

The following (Table 8-14) outlines the information sources relevant to the EPBC Act assessment within this MLP.

Table 8-14 Information resources and their reliability

Report name (source of information)	How recent is the information	How the reliability of the information was tested	What uncertainties (if any) are in the information
Humphries, S.E., Groves, R.H. and Mitchell, D.S. (1991). Plant invasions of Australian ecosystems: a status review and management directions	1991	Peer reviewed report in scientific journal. High reliability	Low uncertainty
Copley, P.B. and Kemper, C.M. (eds.). (1992). A Biological Survey of the Yellabinna Dunefield	1987	Peer reviewed report in scientific journal. High reliability	Low uncertainty
Morelli J. (1992). Fire Management in the Great Victoria Desert	1992	National Government Report. High reliability	Low uncertainty
Humphries, S.E., Groves, R.H. and Mitchell, D.S. (1993). Plant Invasions: homogenizing Australian ecosystems	1993	CSIRO Report. High reliability	Low uncertainty
Harlen, R., and D. Priddel. (1996). Potential food resources available to mMalleefowl Leipoa ocellata in marginal mallee lands during drought.	1996	Peer reviewed document in scientific journal. High reliability	Low uncertainty
Adair, R.J. and Groves, R.H. (1998). Impact of Environmental Weeds on Biodiversity: a Review and Development of a Methodology	1998	CSIRO report. High reliability	Low uncertainty
Owens, H. (2000). Guidelines for Vertebrate Surveys in South Australia	2000	State Government (SA) Report. High reliability	Low uncertainty
Churchill, S. (2001). Survey and ecological study of the Sandhill Dunnart, Sminthopsis psammophila at Eyre Peninsula and the Great Victoria Desert	2001	State Government Report (SA). High reliability	Low uncertainty
Lawson, B.E., Bryant, M.J. and Franks, A.J. (2004). Assessing the potential distribution of Buffel grass (Cenchrus ciliaris L) in Australia using a climate-soil model	2004	Peer reviewed document in scientific journal. High reliability	Low uncertainty
Benshemesh, J. (2005). Marsupial Mole Survey of the Yellabinna and Yumbarra Conservation Reserves, Lower Great Victoria Desert	2005	State Government (NT) Report. High reliability	Low uncertainty

Report name (source of information)	How recent is the information	How the reliability of the information was tested	What uncertainties (if any) are in the information
Clarke, R. 2005. Ecological requirements of birds specialising in mallee habitats: modelling the habitat suitability for threatened mallee birds	2005	Peer reviewed document in scientific journal. High reliability	Low uncertainty
Clarke, P.J., Latz, P.K. and Albrecht, D.E. (2005). Long-term changes in semi-arid vegetation: Invasion of an exotic perennial grass has larger effects than rainfall variability	2005	Peer reviewed document in scientific journal. High reliability	Low uncertainty
SKM (2006). Fauna Survey 2005: Part I – Mineral Deposit Area, Yellabinna Regional Reserve	2005	Site specific study completed by qualified and experienced scientists following government methodology and guidelines. High reliability	Low uncertainty
Badman F J (2006a). Eucla Basin Baseline Vegetation Survey Jacinth & Ambrosia Deposits, Infrastructure Corridor, Fowlers Bay	2006	Site specific study completed by qualified and experienced scientists following government methodology and guidelines. High reliability	Low uncertainty
Badman F J (2006b). Eucla Basin Baseline Vegetation Survey Jacinth & Ambrosia Deposits	2006	Site specific study completed by qualified and experienced scientists following government methodology and guidelines. High reliability	Low uncertainty
Badman F J (2007). Jacinth-Ambrosia Project: A Vegetation Survey of the Jacinth – Ambrosia Wellfield and Pipeline Corridor	2007	Site specific study completed by qualified and experienced scientists following government methodology and guidelines. High reliability	Low uncertainty
Benshemesh, J. (2007). National Recovery Plan for Malleefowl	2007	State Government (SA) Report. High reliability	Low uncertainty
DEWHA (2008a) Approved conservation advice for Ooldea Guinea-flower	2008	National Government Report. High reliability	Low uncertainty
DEWHA (2008b). Threat abatement plan for predation by the European red fox	2008	National Government Report. High reliability	Low uncertainty

Report name (source of information)	How recent is the information	How the reliability of the information was tested	What uncertainties (if any) are in the information
DEWHA (2008c). Threat abatement plan for competition and land degradation by unmanaged goats	2008	National Government Report. High reliability	Low uncertainty
EBS Ecology 2008a Vegetation Mapping and Data Recording for JA	2008	Site specific study completed by qualified and experienced scientists following government methodology and guidelines. High reliability	Low uncertainty
EBS Ecology 2008b JA Fauna Monitoring- Outline of Proposed Plan	2008	Site specific study completed by qualified and experienced scientists following government methodology and guidelines. High reliability	Low uncertainty
EBS Ecology 2009a JA Fauna Monitoring	2008	Site specific study completed by qualified and experienced scientists following government methodology and guidelines. High reliability	Low uncertainty
EBS Ecology 2009b JA Fauna Monitoring	2009	Site specific study completed by qualified and experienced scientists following government methodology and guidelines. High reliability	Low uncertainty
EBS Ecology 2009c Sandhill Dunnart Survey	2009	Site specific study completed by qualified and experienced scientists following government methodology and guidelines. High reliability	Low uncertainty
Paltridge, R., Latz, P., Pickburn, A. and Eldridge, S. (2009). Management Plan for Rare and Threatened Flora in the Anangu Pitjantjatjara Yankunytjatjara Lands of South Australia	2009	Peer reviewed document in scientific journal. High reliability	Low uncertainty
DEWHA. Survey guidelines for Australia's threatened birds - Guidelines for detecting birds listed as threatened under the Environment Protection and Biodiversity Conservation Act 1999.	2010	National Government Report. High reliability	Low uncertainty

Report name (source of information)	How recent is the information	How the reliability of the information was tested	What uncertainties (if any) are in the information
EBS Ecology 2010a Predator Activity Monitoring	2009	Site specific study completed by qualified and experienced scientists following government methodology and guidelines. High reliability	Low uncertainty
EBS Ecology 2010b J-A Fauna Monitoring	2010	Site specific study completed by qualified and experienced scientists following government methodology and guidelines. High reliability	Low uncertainty
EBS Ecology 2010c J-A Vegetation Monitoring	2010	Site specific study completed by qualified and experienced scientists following government methodology and guidelines. High reliability	Low uncertainty
EBS Ecology 2010e JA Fauna Monitoring	2010	Site specific study completed by qualified and experienced scientists following government methodology and guidelines. High reliability	Low uncertainty
EBS Ecology 2011 J-A Vegetation Monitoring	2011	Site specific study completed by qualified and experienced scientists following government methodology and guidelines. High reliability	Low uncertainty
DSEWPaC (2011) Survey guidelines for Australia's threatened mammals	2011	National Government Report. High reliability	Low uncertainty
Parsons, B.C., Gosper, C.R. (2011). Contemporary fire regimes in a fragmented and unfragmented landscape: implications for vegetation structure and persistence of the fire sensitive Malleefowl	2011	CIRSO report. High reliability	Low uncertainty
Parsons, B.C., Gosper, C.R. (2011). Contemporary fire regimes in a fragmented and unfragmented landscape: implications for vegetation structure and persistence of the fire sensitive Malleefowl. International Journal of Wildland Fire 20: pp. 184-194	2011	Peer reviewed report in scientific journal. High reliability	Low uncertainty

Report name (source of information)	How recent is the information	How the reliability of the information was tested	What uncertainties (if any) are in the information
EBS Ecology 2012a J-A Vegetation Monitoring	2012	Site specific study completed by qualified and experienced scientists following government methodology and guidelines. High reliability	Low uncertainty
EBS Ecology 2012b JA Fauna Monitoring	2011	Site specific study completed by qualified and experienced scientists following government methodology and guidelines. High reliability	Low uncertainty
Marshall, V., Lewis, M. and Ostendorf B (2012). Buffel grass (Cenchrus ciliaris) as an invader and threat to biodiversity in arid environments: A review. Journal of Arid Environments	2012	Peer reviewed report in scientific journal. High reliability	Low uncertainty
Walsh, J. C., K. A. Wilson, J. Benshemesh, and H. P. Possingham. (2012). Unexpected outcomes of invasive predator control: the importance of evaluating conservation management actions	2012	Peer reviewed report in scientific journal. High reliability	Low uncertainty
Cooke, BD, Chudleigh, P, Simpson, S & Saunders, G (2013), The Economic Benefits of the Biological Control of Rabbits in Australia, 1950–2011	2013	Peer reviewed report in scientific journal. High reliability	Low uncertainty
EBS Ecology 2013a Baseline	2013	Site specific study completed by qualified and experienced scientists following government methodology and guidelines. High reliability	Low uncertainty
EBS Ecology 2013b Sonoran Pest Plant Survey	2013	Site specific study completed by qualified and experienced scientists following government methodology and guidelines. High reliability	Low uncertainty
EBS Ecology 2014a J-A Vegetation Monitoring	2014	Site specific study completed by qualified and experienced scientists following government methodology and guidelines. High reliability	Low uncertainty

Report name (source of information)	How recent is the information	How the reliability of the information was tested	What uncertainties (if any) are in the information
EBS Ecology 2014b JA Fauna Monitoring	2013	Site specific study completed by qualified and experienced scientists following government methodology and guidelines. High reliability	Low uncertainty
Gaikhorst, G. and Lambert, C. (2014). Sandhill Dunnart – a species review and where this elusive little beast lives in Western Australia. Goldfields Environmental Management Group Workshop proceedings	2014	Peer reviewed article in scientific journal. High reliability	Low uncertainty
Woinarski JCZ, Burbidge AA and Harrison PL (2014). The Action Plan for Australian Mammals 2012	2014	Peer reviewed document in scientific journal. High reliability	Low uncertainty
Armstrong, G. (2015) Alinytjara Wilurara NRM Fire Management Strategy Review	2015	Peer reviewed document in scientific journal. High reliability	Low uncertainty
Commonwealth of Australia (2015). Threat abatement plan for predation by feral cats	2015	National Government Report. High reliability	Low uncertainty
DOE (2015). Conservation Advice Sminthopsis psammophila sandhill Dunnart	2015	National Government Report. High reliability	Low uncertainty
EBS Ecology 2015 a Baseline	2014	Site specific study completed by qualified and experienced scientists following government methodology and guidelines. High reliability	Low uncertainty
EBS Ecology 2015 b J-A Fauna Monitoring	2014	Site specific study completed by qualified and experienced scientists following government methodology and guidelines. High reliability	Low uncertainty
EBS Ecology 2015 c JA Vegetation Monitoring Observations	2014	Site specific study completed by qualified and experienced scientists following government methodology and guidelines. High reliability	Low uncertainty

Report name (source of information)	How recent is the information	How the reliability of the information was tested	What uncertainties (if any) are in the information
McGregor, H., Legge, S., Jones, M.E. and Johnson, C.N. (2015). Feral cats are better killers in open habitats, revealed by animal-borne video	2015	Peer reviewed document in scientific journal. High reliability	Low uncertainty
McLean, A. (2015). Conservation biology of an endangered semi-arid marsupial, the Sandhill Dunnart	2015	PhD University study completed by a qualified scientist following government methodology and guidelines. High reliability	Low uncertainty
Price, O.F., Penman, T.D., Bradstock, R.A., Boer, M.M. and Clark, H. (2015). Biogeographical variation in the potential effectiveness of prescribed fire in south-eastern Australia	2015	Peer reviewed article in scientific journal. High reliability	Low uncertainty
DEE (2016). Threat abatement plan for competition and land degradation by rabbits	2016	National Government Report. High reliability	Low uncertainty
DWP (2016) Survey and monitoring guidelines for the Sandhill Dunnart	2016	National Government Report. High reliability	Low uncertainty
Woinarski, J. & Burbidge, A.A. (2016). Sminthopsis psammophila	2016	Woinarski, J. & Burbidge, A.A. (2016). Sminthopsis psammophila	Low uncertainty
EBS Ecology 2018 JA Fauna Monitoring	2017	Site specific study completed by qualified and experienced scientists following government methodology and guidelines. High reliability	Low uncertainty
DEW (2019). Draft National Recovery Plan for the Sandhill Dunnart	2019	National Government Report. High reliability	Low uncertainty
DCCEEW (2019) Threatened Species Strategy Year 3 Scorecard – Malleefowl	2019	National Government Report. High reliability	Low uncertainty
EBS Ecology 2019a Baseline	2019	Site specific study completed by qualified and experienced scientists following government methodology and guidelines. High reliability	Low uncertainty

Report name (source of information)	How recent is the information	How the reliability of the information was tested	What uncertainties (if any) are in the information
EBS Ecology 2019b Atacama Project EPBC	2019	Site specific study completed by qualified and experienced scientists following government methodology and guidelines. High reliability	Low uncertainty
EBS Ecology 2019c Malleefowl	2019	Site specific study completed by qualified and experienced scientists following government methodology and guidelines. High reliability	Low uncertainty
National Malleefowl Recovery Team (2019). National Malleefowl Monitoring Manual	2019	National Government Manual. High reliability	Low uncertainty
Leseberg, N.P. and Murphy, S.A. (2019) Automated acoustic surveys for Night Parrot in the eastern Eucla Basin	2019	Peer reviewed document in scientific journal. High reliability	Low uncertainty
DCCEEW (2020). National Light Pollution Guidelines for Wildlife including Marine Turtles, Seabirds and Migratory Shorebirds	2020	National Government Guidelines. High reliability	Low uncertainty
Eco Logical Australia (2020). Iluka Atacama Rehabilitation Viability Study – Vegetation	2020	Site specific study completed by qualified and experienced scientists following government methodology and guidelines. High reliability	Low uncertainty
ELA 2022 Threatened Species Assessment	2021	Site specific study completed by qualified and experienced scientists following government methodology and guidelines. High reliability	Low uncertainty
Matters of National Environmental Significance Assessment for the Atacama Project (ELA/ Tetra Tech Coffey, 2022)	2022	Site specific study completed by qualified and experienced scientists following government methodology and guidelines. High reliability	Low uncertainty

Report name (source of information)	How recent is the information	How the reliability of the information was tested	What uncertainties (if any) are in the information
DCCEEW – National Environmental Science Program Threatened Species Research Hub (2019) Threatened Species Strategy Year 3 Scorecard – Malleefowl. Australian Government, Canberra.	2019	National Government Report. High reliability	Low uncertainty

8.10 Conclusion

Significant flora and fauna surveys have been completed in the Project Area since 2014. These surveys have been completed by experienced and qualified scientists and to the relevant Guidelines. Even so, there are no records of any of the three MNES species of concern occurring within the Proposed Action Area. Signs of these species within the Proposed Action Area are limited to an old disused burrow that may belong to Sandhill Dunnart (unconfirmed), and an old disused Malleefowl mound (that is not confirmed to have been used for successful breeding), both of which were recorded on the north-eastern boundary of the Proposed Action Area, and a Malleefowl track found in the southern corner of the Project Area. These records suggest at best a low density and transient population of Malleefowl and Sandhill Dunnart within the Proposed Action Area, with no conclusive evidence of breeding habitat.

Tracks, old disused Malleefowl mounds and an old disused (unconfirmed) Sandhill Dunnart burrow within the Proposed Action Area suggest that, at most, the habitat in the north of the Project Area may be used by a small and transient population of Malleefowl and Sandhill Dunnart. The southern extent of the Proposed Action Area and the vegetation within ML 6315are unlikely to be suitable habitat for Malleefowl, Sandhill Dunnart, nor Ooldea Guinea-flower as all three require the extensive sand dunes and associated complex mallee over *Triodia*. This habitat becomes less dominant as the sand dunes in the north moderate to rolling plains in the south of the Proposed Action Area and the vegetation transitions to that of the Nullarbor Plains.

There is extensive higher-quality habitat available for all three species in areas to the north and east and directly connected to the Project Area in the sand dunes of the Yellabinna Regional Reserve. This optimal habitat for the three target species constitutes between 0.10 and 0.12% of the same habitat within YRR. Hence the medium-term loss of up to 2,185 ha of less optimal habitat within the Proposed Action Area is unlikely to cause a significant impact on these species.

Using the Precautionary Principle, avoidance and extensive mitigation measures will be utilised to mitigate the key threats to these species in the unlikely event that they are present within the Proposed Action Area at the time that the Proposed Action is undertaken, and to prevent indirect impacts occurring within the high quality of habitat of the neighbouring Yellabinna Regional Reserve.

The key avoidance measure is the co-location of the Proposed Action adjacent to the existing J-A site. This enables disturbance and vegetation clearing to be significantly reduced by utilising the processing and tailings facilities that already exist at J-A so that only 128 ha of additional clearing is required. Hence reducing the direct impacts on any MNES within the habitat more suited to the MNES species towards the north of the Proposed Action Area.

An extensive suite of mitigation measures will also be implemented to ensure that there are no significant indirect impacts on populations of MNES beyond the Proposed Action Area. These include weed management (including focus on Buffel grass), pest species management and light impact management. There is a high degree of certainty that these management programs can suitably reduce any indirect impacts to an insignificant level due to their success in the Iluka owned neighbouring J-A site.

Considering the lack of records of the three target species within the Proposed Action Area, the avoidance and mitigation measures instigated and the history of success within the J-A site, there is a high level of confidence that there will not be any significant residual impacts on MNES as a result of the Proposed Action.

9 DESCRIPTION OF CONTRIBUTIONS TO THE ECONOMY

As required under regulation 30(1)(g) of the *Mining Regulations 2020*, this Section outlines the contributions of the Atacama Project to the economy.

As mentioned earlier in this document Iluka has operated the J-A mine, adjacent to the Atacama Project, since 2009. Throughout this time Iluka has gained an understanding of the needs of the local communities, and the region more broadly. Iluka has formed relationships with the various stakeholder groups and organisations located in the Far West Coast region, and further mining operations at Atacama will allow Iluka to continue these relationships and provide further social, economic and environmental benefits. In a report, conducted by Acil Allen Consulting in May 2020, an assessment of the economic contribution of the J-A mine to the Australian economy as of 2018 was undertaken. The proximity of the Atacama orebody to the existing mining infrastructure and the proposed used of the processing operations at J-A allows this report to be used as a proxy to understand the predicted economic benefits of the Atacama Project.

9.1 Direct contributions

Iluka, through the current J-A operation, plays an important role in the South Australian economy as well as the regional economy in which it operates. Iluka is committed to ensuring maximum economic benefits are returned to the region through J-A and the Atacama Project (once approved) via:

- Indirect employment (goods and services)
- direct employment (wages)
- financial support for local community organisations
- State and Federal taxes and royalties.

Each of these direct contributions to the economy are discussed further below.

9.1.1 Goods and services

In 2018, Iluka spent just over $105.5 million on goods and services to be able to operate J-A as well as undertaken exploration related activities in South Australia (Table 9-1). Of this, $105.5 million was spent on goods and services provided by Australian businesses (i.e., 100%), $85.9 million was spent on South Australian businesses, $2.4 million was spent on businesses located in the Far West Coast region and $2.3 million on businesses in the Eyre Peninsula region. This is displayed graphically in Figure 9-1.

Table 9-1 J-A and exploration spending (2018) (source Acil Allen Consulting (2020))

	Goods and services ($ million)	Wages ($ million)	Community investments ($ million)	Total ($ million)
J-A	105.3	10.5	0.1	**115.9**
Exploration (SA)	0.2	0.4	0.0	**0.6**
Total	**105.5**	**10.9**	**0.1**	**116.5**

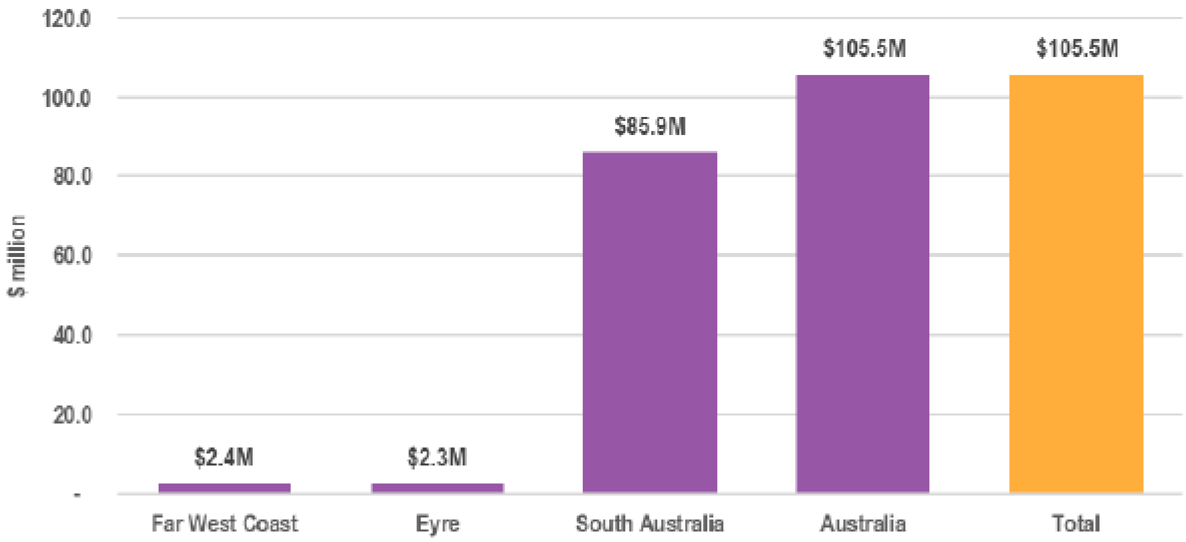


Figure 9-1 J-A and exploration (SA) spending on goods and services (2018) (source Acil Allen Consulting (2020))

It can be reasonably expected that Iluka will continue to spend similar amounts of money on goods and services in South Australia and Australia more broadly as a result of the Atacama Project which will extend the LOM with the Eucla basin by approximately four years.

9.1.2 Wages

In 2018 Iluka spent approximately $10.9 million on wages for its direct employees and fixed term contractors as a result of the J-A operations and exploration related activities in South Australia (Table 9-1). It is approximated that $8.2 million of the wages were spent on employees and/ or fixed term contractors living in South Australia including $2.9 million people living in the Far West Coast region and $0.3 million on people living in the Eyre Peninsula region. This is displayed graphically in Figure 9-2.

The number of jobs at that will be created for the Project will increase (see Section 9.3 for details on FTE numbers) by approximately 33% and therefore it is reasonable to expect that wages will be approximately 33% more than displayed in Figure 9-2. This will continue over the LOM for the Atacama Project.

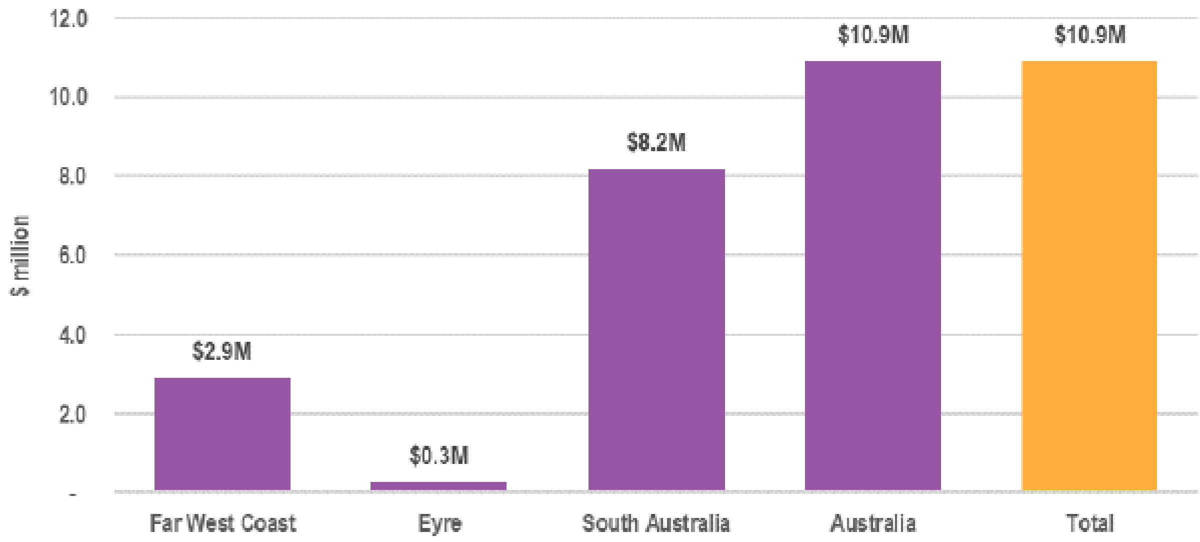


Figure 9-2 -A and exploration (SA) wages (2018) (source Acil Allen Consulting (2020))

9.1.3 Community investment

Iluka provides sponsorship to local communities and organisations, services, activities and businesses in the Far West Coast region. In 2018, this investment totalled $97,304 (Acil Allen Consulting, 2020). It is anticipated that the Atacama Project would lead to a continued and additional financial contribution to community investment over the four further years LOM the Atacama Project adds within the Eucla basin. Existing community benefit programs funded by Iluka include:

- Iluka social investment program
- Iluka small grants program.

Some of the largest investments distributed by Iluka to external community organisations between 2018 and 2020 have included (WSP, 2023):

- Ceduna Council for the provision of a swimming enclosure off Ceduna Jetty in 2018
- Yadu Health as part of the Covid connections partnership in Ceduna in 2020
- Schoolplus Project with Ceduna Area School in 2018
- University of Adelaide STEM Outreach Program
- reoccurring NAIDOC and Oysterfest celebrations.

9.1.4 Taxation and royalties

The production of mineral sands for J-A incurs royalties payable to the South Australian Government for LOM. Iluka also pays payroll taxation and other taxation payments. These royalties/ taxation payments will also be incurred for the Atacama Project.

In 2018, J-A operations and exploration related activities resulted in a total payment of $19.5 million (inclusive of $18.3 million in royalty payments, $0.5 million of payroll taxation and $0.6 million in other taxation payments).

A preliminary assessment by Iluka has modelled the LOM State Government royalties for the Atacama Project calculated to be $64 million (assuming total cash flow based on 2022 Australian dollar value), or $78 million (assuming a 2.5% per annum inflation rate over the LOM). That these two calculations are preliminary and will change as, and if, the Atacama mine plan progresses.

9.2 Economic impact to Gross Product

Iluka, through the J-A operation and other exploration related activities in South Australia, contributes money via the purchase of goods and services, payment of wages, community investment and taxation/ royalties, resulting in an impact to the economy. The contribution to the value added in an economy is known as the contribution to Gross Product (Acil Allen Consulting, 2020). Gross Product can be assessed regionally (Gross Regional Product) at a State level (Gross State Product) or nationally (Gross Domestic Product).

The assessment by Acil Allen Consulting (2020) found that in 2018 Iluka contributed $298.1 million to Gross State Product in South Australia and a total of $342.2 million to Gross Domestic Product (GDP) for Australia. As outlined in Figure 9-3, this was predominately through operating expenditure (OPEX). This contribution includes $12.0 million to the value of the economy of the Far West Coast region and $2.1 million to the Eyre Peninsula region. Acil Allen Consulting (2020) notes that this contribution in the Far West Coast is significant as the region has a small population and its economy is limited to agricultural, fishing and government services industries.

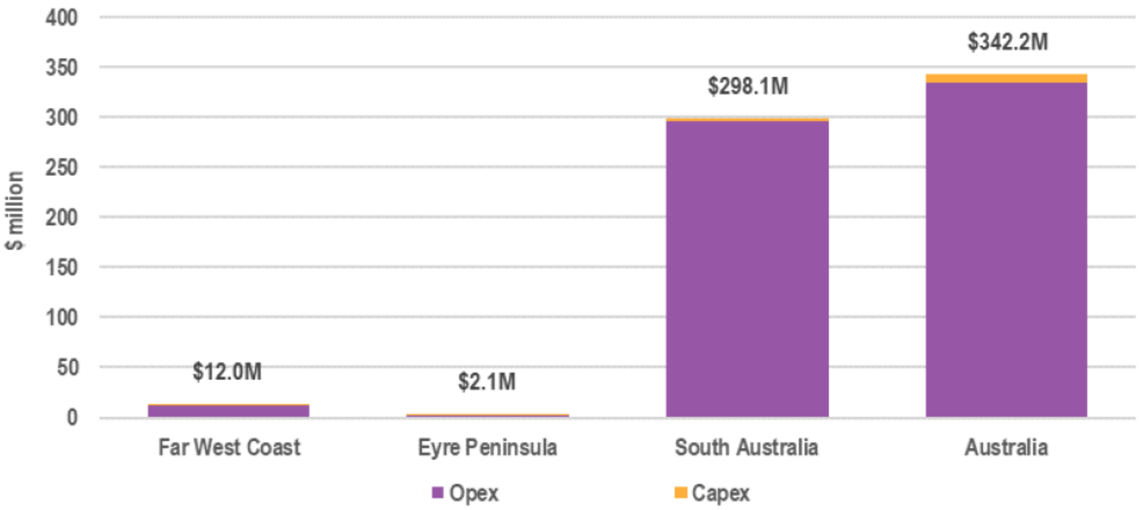


Figure 9-3 Contribution to gross product: J-A operations, 2018 ($ million) (Source Acil Allen (2020))

It is anticipated this economic impact to Gross Product would continue for the further four years of operation that the Atacama Project provides within the Eucla basin.

9.3 Job creation

In 2018, Iluka directly employed 67 people, 19 of which lived in the local area (Table 9-2). Additionally, Iluka employed 223 contractors, 26 of which lived in the local area (Table 9-2). In this context local area is defined by WSP as including the Ceduna Local Government Area (LGA) which encompasses the town of Ceduna and surrounding localities including Thevenard, Smokey Bay, Denial Bay and Koonibba as well as key townships and communities outside of the Ceduna LGA including Yalata, Penong, Maralinga (Oak Valley) and Scotdesco.

Table 9-2 Direct J-A workforce over time (source WSP (2023))

Year	Iluka		Major contractors		Total J-A workforce		
	Total	Local area	Total	Local area	Total	Local area	Local area (%)
2011	65	33	66	33	131	66	50
2012	69	29	154	36	223	65	29
2013	70	36	93	36	163	72	44
2014	68	29	155	19	223	48	22
2015	76	31	165	20*	231	51	22
2016	77	26	35	5*	112	31	28
2017	45	15	187	23*	232	38	16
2018	67	19	223	26	290	45	15
2019	99	26	235	21	334	47	14

Job creation is measured in FTE and is derived from the direct employment by Iluka at the J-A mine and the indirect jobs created from the spending by Iluka on goods, services, community investments, wages, and taxation to operate the mine which then creates employment in other industries (WSP, 2023).

It is estimated that the direct and indirect employment and expenditure by Iluka supports approximately 49 FTE jobs in the Far West Coast region, and 12 FTE in the Eyre Peninsula region as a result of J-A operations. Of these, 23 FTE of the 49 FTE jobs are in the Far West Coast region and 10 FTE of the 12 FTE jobs from Eyre Peninsula region are indirect, meaning that this proportion of employment occurs in ancillary industries and businesses located in the region (Acil Allen Consulting, 2020). Indirect and induced employment refers to indirect flow on economic benefits to local businesses and industries, that may result in additional employment.

Table 9-3 Total J-A employment impact (source WSP (2023))

Aspect	Far West Coast	Eyre Peninsula	South Australia (total)	Australia (total)
Indirect and induced	23	10	604	816
Direct (Iluka FTE Employees)	26	2	76	89
Total job creation (FTE)	**49**	**12**	**680**	**905**

The Atacama Project will increase the number of FTEs in South Australia including the Far West Coast. The Project will require a construction workforce of approximately a further 50-90 employees for a 12-month period, followed by approximately a further 300-350 FTE operational employees (Iluka and contractor) for six further years.

10 OPERATOR CAPABILITY

This chapter provides confidence to DEM in Iluka's capability to operate the Atacama Project in a manner that is safe and manages the risks and impacts of the Project.

10.1 Environmental management system

As currently occurs at the existing J-A mine site, the approach to environmental management for the Atacama Project is underpinned by Iluka's Health, Safety, Environment and Community Management System (HSECMS). The HSECMS governs the management of potential environmental impacts throughout all phases of operations – from exploration through to mine closure. The system consists of policies, standards, procedures, guidelines and plans. Routine audits are conducted to measure the company's compliance and effectiveness in managing sustainability performance, and to drive continual improvement in the area.

The system is hierarchical, where documents and systems meet and support the requirements of higher levels, demonstrated in Figure 10-1.

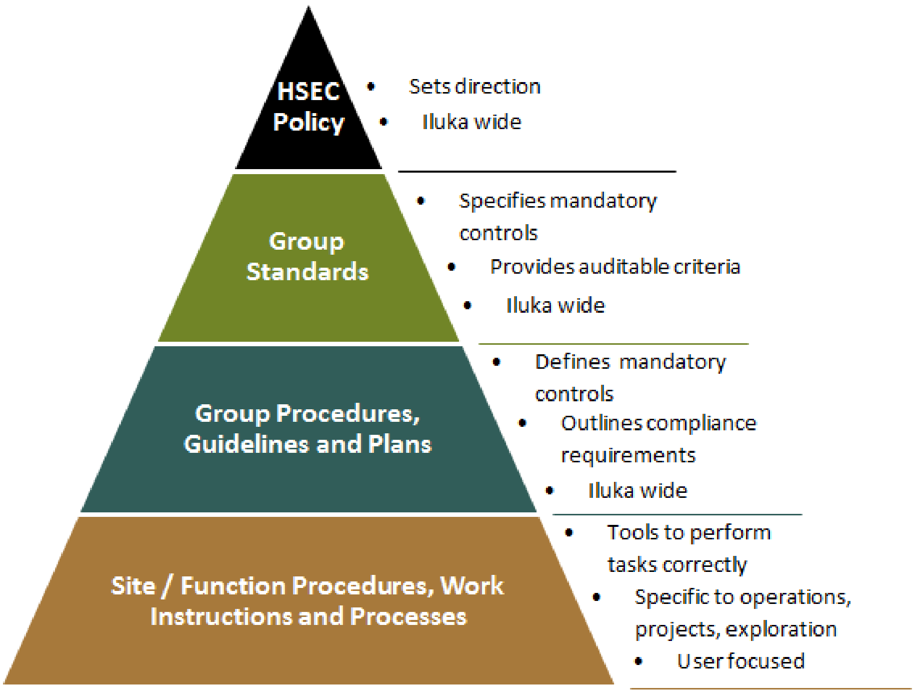


Figure 10-1 Management System documentation hierarchy

Within the HSEC policy, compliance with legislative requirements is recognised as the minimum standard to achieve. This is demonstrated in Iluka's HSEC policy a copy of which is found in Figure 10-2.

Health, Safety, Environment & Community Policy

Within Iluka we believe that maintaining high levels of performance and pursuing leading practice in the areas of health, safety, environment and community reflects our values of acting with Integrity, demonstrating Respect, and taking Accountability.

We will:

- protect the health and safety of our people by identifying and taking appropriate action to mitigate workplace fatalities, injuries and illnesses;
- assess and manage the people, environment and community risks associated with our activities;
- engage early, inclusively and meaningfully, and incorporate stakeholder views into our decision-making processes;
- seek to make a positive difference to the social and economic development of the areas in which we operate;
- acknowledge and respect the histories, cultures, customs and values of indigenous people and communities where we operate;
- develop effective and timely plans for the cessation of operations, rehabilitation and relinquishment of mined areas;
- use resources efficiently, in particular energy, water and land;
- maintain a product stewardship approach towards the use of our products;
- comply with all legislative requirements, which we recognise as the minimum standard;
- set clear, achievable and measurable performance targets;
- seek to continuously improve performance;
- maintain a HSEC management system covering all areas of the business; and
- provide appropriate HSEC training to our people.

Tom O'Leary
Managing Director

June 2020

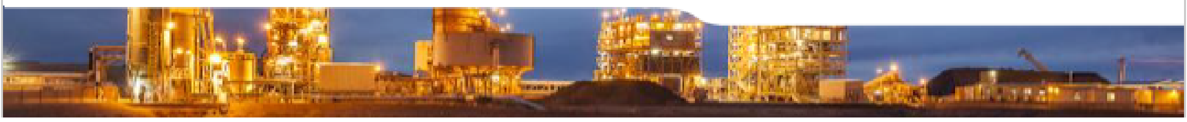


Figure 10-2 Health, Safety, Environment and Community policy

The HSEC standards (see Figure 10-3) contained within the system specify uniform mandatory performance requirements which govern decisions and behaviour in support of the HSEC policy. They provide a basis for verifying compliance through audits and assessments.

EHS STANDARDS

Standard 1	Risk & Hazard Management
Standard 2	Stakeholder Relations
Standard 3	Training & Awareness
Standard 4	Contractor Management
Standard 5	Design, Construction & Operations
Standard 6	Process Safety
Standard 7	Environmental Management
Standard 8	Rehabilitation & Closure
Standard 9	Carbon & Energy
Standard 10	Radiation Management
Standard 11	Workplace Health & Hygiene
Standard 12	Incident Reporting & Investigation
Standard 13	Emergency & Crisis Preparedness
Standard 14	Audit & Assurance

Figure 10-3 Iluka HSEC standards

The individual environmental requirements of each site are considered and site-specific management plans, procedures and work instructions are developed. Environmental plans will be developed for the Atacama Project, this will likely be done through updating of the plans associated with the J-A mine site as part of the PEPR process. Once completed all management plans will capture all PEPR outcomes and measurement criteria and assign controls, monitoring, measurement and reporting responsibilities.

All on-site contractors at Atacama will be required to maintain an effective HSEC management system and demonstrate they can meet Iluka's HSEC requirements. This is assessed at both pre-qualification stage and ongoing validation and management provided through documented inspections and audits.

10.2 Resources

The HSECMS contains the commitment for adequate resources to be allocated commensurate with the requirements of the management system and legislative requirements.

Accountability of adherence to the Iluka HSECMS, inclusive of legislative compliance, is resourced through:

Directors:

- endorse the HSEC policy
- endorse the annual sustainability strategy

- seek assurance that there is effective compliance with the HSEC policy and Group standards
- ultimately accountable for sustainability performance at Iluka
- regularly review sustainability performance, risks and strategic issues.

Managing Director:

- approves the HSEC policy and reviews every three years with the Executive Team
- establishes sustainability performance targets and ensure that they are disseminated and cascaded through the company
- ensures all levels of management meet the requirements of the HSECMS.

General Manager People & Sustainability:

- develops and recommends the sustainability strategy for consideration by the Executive
- maintains adequate levels of sustainability expertise within the company
- incorporates sustainability threats, opportunities and risks into the annual planning process
- implements systems to enable effective recognition of positive team and individual performance
- incorporates sustainability leadership into training programs for management and supervisory employees and contractors
- establishes and maintains a training management system, which supports sustainability requirements
- maintains the HSECMS.

Manager Environment, Manager Communities & Indigenous Affairs, Group Health & Safety Manager:

- identifies sustainability threats, opportunities and risks
- develops the annual sustainability strategy
- maintains the HSECMS
- audits the implementation of the management system, legislative and obligation compliance
- provides guidance on the development of targets and performance indicators
- develop and implement programs to promote HSEC awareness
- maintains the HSEC pages on Iluka
- provides management with support and advice on meeting objectives and targets
- ensures that external Sustainability reporting accurately reflects performance
- conducts Group level analysis and trending on sustainability related data
- custodian of Group Sustainability data systems.

Manager Procurement:

- integrates and maintains sustainability evaluation in the supply contracts system
- supports processes for HSEC pre-qualification and on-going validation of vendor performance within the procure-to-pay systems and process.

Chief Financial Officer:

- supports sustainability aspects in external reporting
- engages sustainability team members when dealing with relevant shareholder concerns and information dissemination
- approves reports to regulators, statutory authorities, general public and other interested parties where relevant.

Executive:

- communicate and apply the Iluka HSEC policy
- implement the requirements of the HSECMS within their areas of responsibility
- encourage recognition of positive team and individual performance
- report to the Executive on sustainability performance for their areas
- allocate adequate resources commensurate with the requirements of the management system, legislative requirements and other obligations
- act upon audit findings
- maintain associations with relevant industry bodies and government agencies.

Operations and Functional Managers:

- develop business plans that align with wider sustainability objectives and targets
- promote a culture of accountability and risk awareness, ensuring corrective and preventive actions are completed
- promote active participation in HSEC matters in general
- provide effective resources to implement the management system within the operation/ function
- ensure overall compliance to the HSECMS within the operation/ function
- consistently apply counselling and disciplinary procedures related to HSEC aspects/ non-conformances
- conducts site or functional level analysis and trending on sustainability related data.

Managers, Coordinators, Supervisors:

- develop and reinforce positive behaviours and communication accountabilities among employees, contractors and visitors
- encourage employee involvement in HSEC processes
- counsel employees and contractors about poor performance
- ensure HSEC requirements are embedded in process maps and procedures
- manage HSEC issues associated with their operation or function.

Advisors, Specialists, Principals and Managers in HSEC related disciplines:

- promote leading practice and coordinate continuous improvement activities
- provide specialist advice and guidance on sustainability aspects, issues, improvements and performance

- analyse and trend data for their operation or site and implement programs to address problem areas
- support the Operations or Function Manager in implementing the HSECMS
- develop and implement management plans and/or approaches that address specific operational and project risks.

Employees and Contractors:

- understand the Iluka HSEC policy and supporting standards
- accept accountability to ensure personal safety and the health and safety of others, and protect the environment
- identify, assess and control risks prior to undertaking any activity
- actively challenge or refuse to work in unsafe conditions or where unacceptable impact to the environment or community may occur
- intervene to prevent incidents
- actively participate in HSEC meetings, initiatives, risk assessments and monitoring programs
- report all incidents and near hits immediately to a supervisor
- correct or isolate hazardous situations in the workplace
- understand and follow the local emergency procedures
- comply with and suggest improvements to site documentation, processes and procedures.

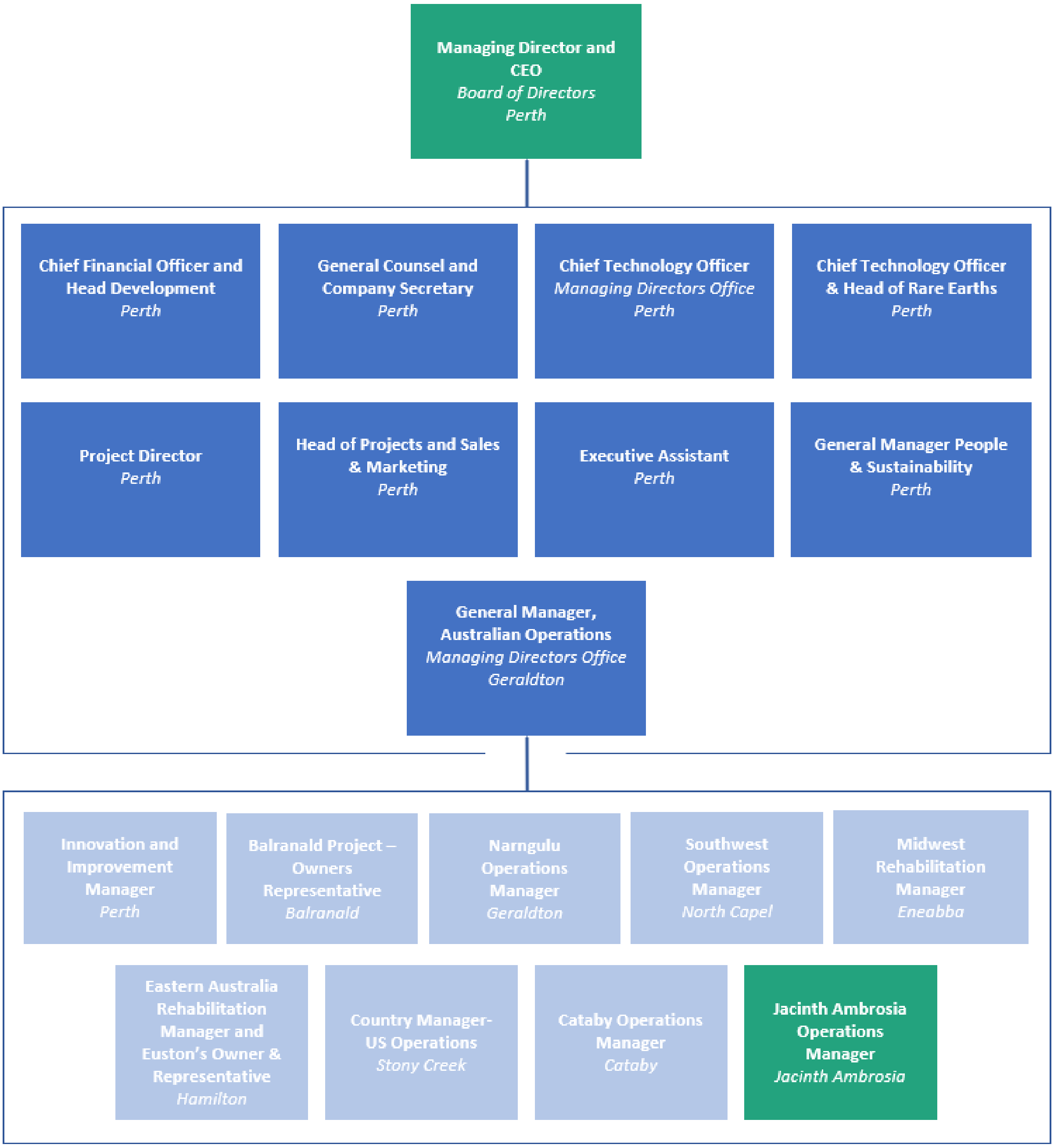


Figure 10-4 Iluka corporate organisational structure

10.3 Communication

The Atacama Operations Manager (this will be the same person as the J-A Operations Manager) is responsible for ensuring the mine site environmental aspects and impacts, and policies and procedures to manage those impacts, are communicated to all employees, contractors and visitors. Communication is achieved by various methods including daily pre-start meetings, inductions, toolbox meetings, training sessions, e-mails, reports, newsletters and notice boards.

External stakeholder communication is managed as per Section 5.

10.3.1 Site induction

All employees, contractors and visitors to J-A and Atacama will be required to undergo a comprehensive induction to ensure they have appropriate knowledge of:

- legislative obligations of both the individual and the company
- key environmental issues associated with the mine operations
- overview of Iluka HSECMS
- site specific environmental management policies and procedures
- responsibilities to minimise the environmental impacts associated with operational activities
- hazard and incident reporting and management
- legislative obligations of both the individual and the company
- emergency services and procedures.

10.3.2 Training

Additional to general inductions, ongoing training will be provided to reinforce management of environmental impacts and maintaining compliance with legislation. This will comprise both toolbox meetings and specific workshops including:

- notification of any changes to policies and procedures
- environmental incident awareness (identification, response and reporting)
- key risk awareness e.g., dust, groundwater, flora and fauna, rehabilitation and other
- vehicle hygiene management
- emergency response training.

10.3.3 HSEC committee

As currently occurs for J-A there will continue to be a HSEC committee which will consist of elected representatives from across the site and will include contractors as well as employees. The committee aims to:

- facilitate the consultation, cooperation and awareness of all employees on HSEC issues
- assist with the efficient flow of information and communications through all levels of the workplace
- conduct reviews of standards, procedures and other initiatives pertaining to HSEC on site and recommend actions

- conduct and assist with inspections and audits and recommend actions
- recommend site HSEC training needs
- review any changes or intended changes to the site that may impact on the safety and health of employees.

10.4 Risk management system

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
- communicated to the appropriate levels.

The risk management process, adopted from ISO31000, is shown in Figure 10-5.

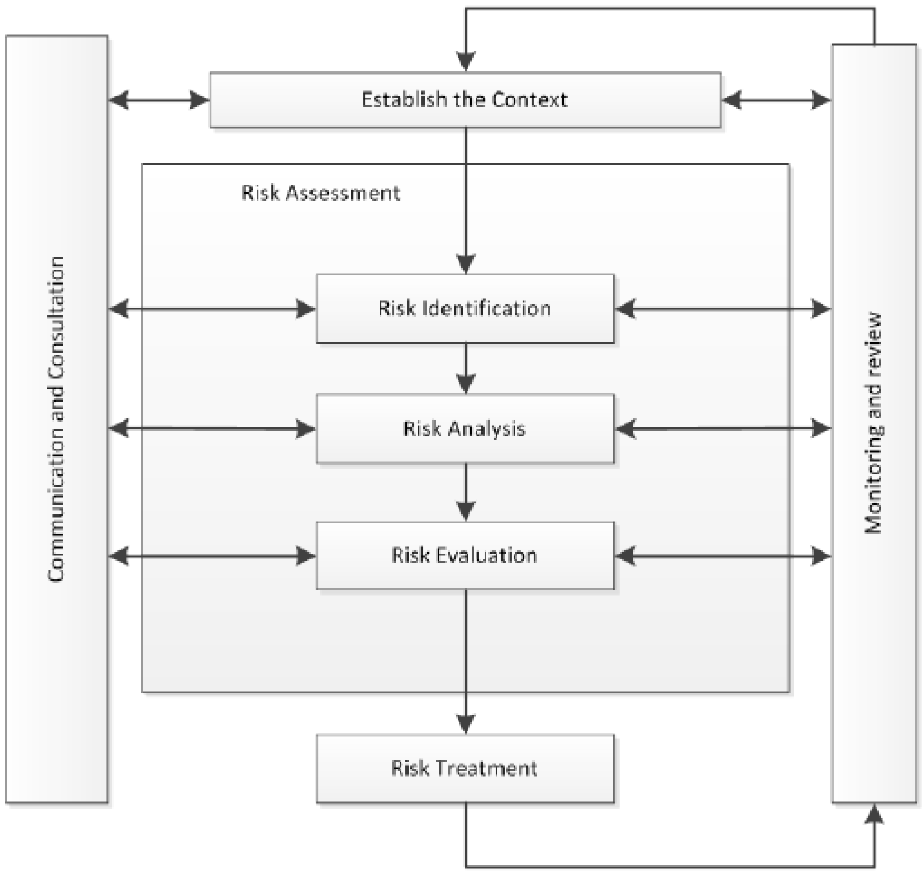


Figure 10-5 Iluka risk management process

As currently occurs for the J-A mine site an environmental risk register will be maintained for site and will be updated annually as a minimum or when there is a change in activity.

10.5 Emergency response plan

The J-A *Eucla Basin Emergency Response Plan* has been prepared to assist personnel to prepare for and manage an incident within the Eucla Basin and this will be updated to include the Atacama Project. It defines site incident response plans for all situations identified in the emergency preparedness risk assessment.

The emergency and crisis management flowchart is provided in Figure 10-6.

The plan is designed to:

- define roles, responsibilities, and actions of personnel in the event of an incident
- clearly specify incident response plans for all situations identified in the risk assessment
- provide a method of controlling and minimising injury to persons, damage to property, prevent and mitigate environmental impacts in the event of a site related emergency and or disaster
- ensure the safety of all personnel during an incident or emergency
- ensure incident response equipment and personnel are maintained in a state of readiness at all times
- define a process for the continued review and update of incident response plans
- support recovery post incident, returning the site to normal operations
- Ensure that personnel are aware of their responsibilities in the event of an incident.

Currently at J-A an emergency response team (ERT) is on duty for all shifts, with routine training provided. This will continue to occur with the approval of the Atacama Project.

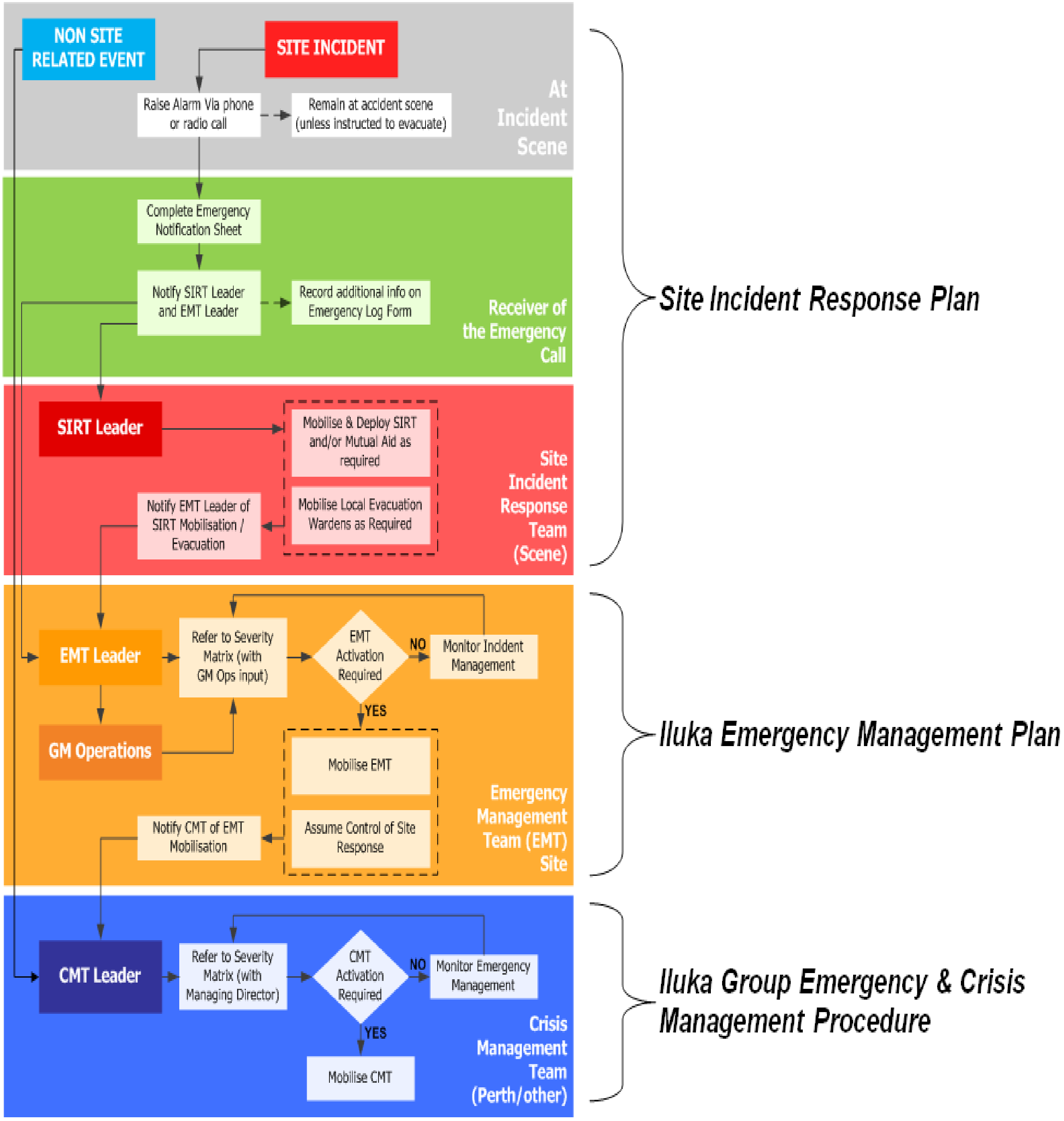


Figure 10-6 Emergency crisis management process

10.5.1 Previous experience of the Operator

Iluka has been operating in South Australia at the nearby J-A mine site since 2009. The company (and its predecessors) also have extensive mineral sands mining experience demonstrated over 60 years through operations in Western Australia, Victoria, New South Wales, Sierra Leone, Sri Lanka and the United States.

Iluka has been commended for the way it operates in South Australia with numerous awards received at the South Australian Premier's Awards including:

- 2014 award for Environmental Excellence for 'Pro-Activity Beyond Compliance initiative at J-A"
- 2017 for Social Inclusion.
- 2018 award for Excellence in Innovation: Environmental Management for '*Jacinth-Ambrosia Mine rehabilitation research programs to achieve restoration success*'.
- 2018 award for Diversity in Action '*Partnerships with the Far West Coast and Iluka*' was awarded jointly to both Iluka and the FWCAC.

11 REFERENCES

Adair, R.J. and Groves, R.H. (1998). *Impact of Environmental Weeds on Biodiversity: a Review and Development of a Methodology*. Environment Australia, Canberra.

Alluvium (2014). *Atacama Development Project: Atacama Surface Water Study*. Report by Alluvium Consulting Australia for Iluka Resources Limited. Kent Town, South Australia.

Armstrong, G. (2015) *Alinytjara Wilurara NRM Fire Management Strategy Review*. Unpublished internal report. Department of Environment, Water, and Natural Resources, South Australia.

ARPANSA (2014). Fact sheet '*Understanding radiation health risks*'.

Australian Bureau of Statistics (ABS) (2018). Ceduna.

Badman F J (2006a). *Eucla Basin Baseline Vegetation Survey Jacinth & Ambrosia Deposits, Infrastructure Corridor, Fowlers Bay*. Report prepared for Iluka resources by Badman Environmental, South Australia.

Badman F J (2007). *Jacinth-Ambrosia Project: A Vegetation Survey of the Jacinth – Ambrosia Wellfield and Pipeline Corridor*. Report prepared for Iluka resources.

Benshemesh, J. (2005). *Marsupial Mole Survey of the Yellabinna and Yumbarra Conservation Reserves, Lower Great Victoria Desert, SA*. Department for Environment and Heritage, Adelaide.

Benshemesh, J. (2007). *National Recovery Plan for Malleefowl*. Department for Environment and Heritage, South Australia.

Bureau of Meteorology (BOM) (1990). *Köppen Classification System.* Australian Government. Assessed online 8 October 2019 at www.bom.gov.au/iwk/climate_zones/map_1.shtml

Bureau of Meteorology (BOM) (2022a). *Climate statistics for Australian locations (Maralinga)*. Accessed online 31 May 2022 at http://www.bom.gov.au/climate/averages/tables/cw_018114.shtml

Bureau of Meteorology (BOM) (2022b). *Climate statistics for Australian locations (Tarcoola)*. Accessed online 31 May 2022 at http://www.bom.gov.au/climate/averages/tables/cw_016098.shtml

CDM Smith (2022a). *Baseline Soils Assessment, Atacama Project*. A report prepared for Iluka Resources Limited.

CDM Smith (2022b). *Sediment sampling and analysis for Atacama Development Project*. A report prepared for Iluka Resources Limited.

Churchill, S. (2001). *Survey and ecological study of the Sandhill Dunnart, Sminthopsis psammophila at Eyre Peninsula and the Great Victoria Desert*. Department for Environment and Heritage, Adelaide.

Cincunegui, Guadalupe (Managing Director Independent Heritage Consultants). Email to: Jasmine Richards (MLP Project Manager). 2023

Clarke, P.J., Latz, P.K. and Albrecht, D.E. (2005). *Long-term changes in semi-arid vegetation: Invasion of an exotic perennial grass has larger effects than rainfall variability*. Journal of Vegetation Science.16, 237-248.

Clarke, R. H. (2005). *Ecological requirements of birds specialising in mallee habitats: modelling the habitat suitability for threatened mallee birds*. Department of Zoology, La Trobe University.

Commonwealth of Australia (2015). *Threat abatement plan for predation by feral cats.* Canberra.

Cooke, BD, Chudleigh, P, Simpson, S & Saunders, G (2013). *The Economic Benefits of the Biological Control of Rabbits in Australia, 1950–2011.* Australian Economic History Review 53, 91-107

Copley, P.B. and Kemper, C.M. (eds.). (1992). *A Biological Survey of the Yellabinna Dunefield, South Australia in October 1987*. South Australian National Parks and Wildlife Service, and South Australian Museum, Adelaide.

Corbett, L. K. (1995). The Dingo in Australia and Asia. J B Books ISBN 978-1-876622-30-5

DCCEEW – National Environmental Science Program Threatened Species Research Hub (2019). *Threatened Species Strategy Year 3 Scorecard – Malleefowl*. Australian Government, Canberra.

DCCEEW (2010). *National Feral Camel Action Plan*.

DCCEEW (2022). *Quarterly Update of Australia's National Greenhouse Gas Inventory*: June 2022, Australian Government Department of Climate Change, Energy, the Environment and Water

Department for Energy and Mining (DEM) (2020). *Preparation of a mining application for metallic and industrial minerals, Minerals Regulatory Guidelines MG2a, Minerals Resource Division*. December 2020. Department of State Development, South Australia, Australia.

Department for Energy and Mining (DEM) (2022). *SARIG map*. Viewed 31 May 2022. Available from https://map.sarig.sa.gov.au/

Department for Energy and Mining (DEM) (2022b). *Onshore licensing*. Viewed 13 December 2022. Available from https://www.energymining.sa.gov.au/industry/energy-resources/licensing-and-land-access/onshore-licensing

Department for Energy and Mining (DEM) (2022c). *Conservation areas*. Viewed 13 December 2022. Available from https://www.energymining.sa.gov.au/industry/minerals-and-mining/communities-and-land-access/mineral-exploration-and-land-access/conservation-land

Department for Environment and water (DEW) (2019). *Yellabinna and Warna Manda Parks Management plan 2019*. Viewed 14 December 2022. Available https://cdn.environment.sa.gov.au/environment/docs/yellabinna-warna-manda-parks-management-plan-2019.pdf

Department for Environment and Water (DEW) (2019a). *Draft National Recovery Plan for the Sandhill Dunnart (Sminthopsis psammophila)*. Department for Environment and Water, South Australia.

Department for Environment and water (DEW) (2022). *Park management- Regional Reserves*. Viewed 23 September 2022. Available from https://www.environment.sa.gov.au/topics/park-management/regional-reserves#:~:text=Yellabinna%20Regional%20Reserve,of%20the%20Trans%2DAustralia%20Railway

Department for Environment and Water (DEW, 2023). *Climate change. South Australia's greenhouse gas emissions.* Date accessed 18 January 2023: https://www.environment.sa.gov.au/topics/climate-change/south-australias-greenhouse-gas-emissions.

Department for Environmental and Water (DEW) (2019b). *Park fire restrictions.* Updated 17 October 2019. Government of South Australia.

Department for Environment and Water (DEW, 2023). National Parks and Wildlife Service South Australia. *Yellabinna Regional Reserve*. Date accessed 11 January 2023: Yellabinna… - National Parks and Wildlife Service South Australia

Department for Manufacturing, Innovation, Trade, Resources and Energy (DMITRE, 2013). *Field Guide for Landscape Function Analysis for environmental monitoring and assessment.*

Department of Climate Change, Energy, the Environment and Water (DCCEEW) (2020). *National Light Pollution Guidelines for Wildlife including Marine Turtles, Seabirds and Migratory Shorebirds.*

Department of Environment, Water and Natural Resources (DEWNR) (2013). *Yellabinna Reserves Supplementary Document to the Yellabinna Reserves Management Plan 2013*.

Department of Environment, Water and Natural Resources (DEWNR, 2017). *Significant Environmental Benefit (SEB) Reforms*. Department of Environment Water and Natural Resources.

Department of Parks and Wildlife (DWP) (2016). *Survey and monitoring guidelines for the Sandhill Dunnart (Sminthopsis psammophila) in Western Australia.* DPW, Perth.

Department of Sustainability, Environment, Water, Population and Communities (DSEWPaC) (2011). *Survey guidelines for Australia's threatened mammals; guidelines for detecting mammals listed as threatened under the Environment Protection and Biodiversity Conservation Act 1999*, Commonwealth of Australia, Canberra.

Department of the Environment (DoE) (2013). *Matters of National Environmental Significance Significant impact guidelines 1.1, Environment Protection and Biodiversity Conservation Act 1999.* Commonwealth of Australia.

Department of the Environment (DOE) (2015). *Conservation Advice Sminthopsis psammophila Sandhill Dunnart.*

Department of the Environment and Energy (DEE) (2016). *Threat abatement plan for competition and land degradation by rabbits*. Commonwealth of Australia, Canberra.

Department of the Environment and Energy (DotEE) (2018). *NVIS (Version 5.1)*. Commonwealth of Australia.

Department of the Environment, Water Heritage and the Arts (DEWHA) (2008a). *Approved conservation advice for Hibbertia crispula (Ooldea guinea-flower)*. DEWHA, Canberra.

Department of the Environment, Water Heritage and the Arts (DEWHA) (2008b). *Threat abatement plan for predation by the European red fox*. DEWHA, Canberra.

Department of the Environment, Water, Heritage and the Arts (DEWHA) (2008c). *Threat abatement plan for competition and land degradation by unmanaged goats,* DEWHA, Canberra.

Department of the Environment, Water Heritage and the Arts (DEWHA) (2010). S*urvey guidelines for Australia's threatened birds - Guidelines for detecting birds listed as threatened under the Environment Protection and Biodiversity Conservation Act 1999.* Report prepared for the Commonwealth by Michael Magrath, Michael Weston, Penny Olsen and Mark Antos, and updated in 2008 by Ashley Herrod.

EBS (2008a). *Vegetation Mapping and Data Recording for the Jacinth-Ambrosia Mine*. Report prepared for Iluka resources. Environmental and Biodiversity Services. Adelaide.

EBS (2008b). *JA Fauna Monitoring – Outline of Proposed Plan*. Environmental and Biodiversity Services. Adelaide.

EBS (2009a). *Jacinth-Ambrosia Fauna Monitoring: December 2008*. Report to Iluka. EBS Ecology, Adelaide.

EBS (2009b). *Jacinth-Ambrosia Fauna Monitoring: April 2009.* Report to Iluka. EBS Ecology, Adelaide. EBS Ecology (2010a). Jacinth-Ambrosia Fauna Monitoring: October 2009. Report to Iluka. EBS Ecology, Adelaide.

EBS (2009c). *Sandhill Dunnart Survey.* Iluka Resources, Barton Regional Exploration Program, October 2009. Report to Iluka Resources Ltd.

EBS Ecology (2010a). *Predator Activity Monitoring (September 2009) – Barton Mineral Sands Drilling Program*. Report to Iluka Resources. EBS Ecology, Adelaide.

EBS Ecology (2010b). *Jacinth-Ambrosia Fauna Monitoring: October 2009*. Report to Iluka. EBS Ecology, Adelaide.

EBS Ecology (2010c). *Jacinth-Ambrosia Vegetation Monitoring: December 2009*. Report to Iluka Resources Ltd. EBS Ecology, Adelaide.

EBS Ecology (2010e). *Jacinth-Ambrosia Fauna Monitoring: October 2010*. Report to Iluka. EBS Ecology, Adelaide.

EBS Ecology (2011). *Jacinth-Ambrosia Vegetation Monitoring: October 2010*. Report to Iluka Resources. EBS Ecology, Adelaide.

EBS Ecology (2012a). *Jacinth-Ambrosia Vegetation Monitoring: November 2011*. Report to Iluka Resources. EBS Ecology, Adelaide.

EBS Ecology (2012b). *Jacinth-Ambrosia Fauna Monitoring November/December 2011*. Report to Iluka Resources. EBS Ecology, Adelaide.

EBS Ecology (2013a). *Sonoran Baseline Flora and Fauna Assessment*. Report to Iluka Resources Limited. EBS Ecology, Adelaide.

EBS Ecology (2013b). *Sonoran Pest Plant Survey, August 2013*. Report to Iluka Resources Ltd. EBS Ecology, Adelaide.

EBS Ecology (2014a). *Jacinth-Ambrosia Mine, Vegetation Monitoring Observations, November 2013.* Report to Iluka Resources. EBS Ecology, Adelaide.

EBS Ecology (2014b). *Jacinth-Ambrosia Fauna Monitoring November 2013. Report to Iluka Resources.* EBS Ecology, Adelaide.

EBS Ecology (2015a). *Atacama Baselines Flora and Fauna Assessment – 2014.* Report to Iluka Resources Limited. EBS Ecology, Adelaide.

EBS Ecology (2015b). *Jacinth-Ambrosia Fauna Monitoring November 2014.* Report to Iluka Resources. EBS Ecology, Adelaide.

EBS Ecology (2015c). *Jacinth-Ambrosia Mine, Vegetation Monitoring Observations, November 2014.* Report to Iluka Resources. EBS Ecology, Adelaide.

EBS Ecology (2018). *Jacinth-Ambrosia Fauna Monitoring Summer 2017*. Report to Iluka. EBS Ecology, Adelaide.

EBS Ecology (2019a). *Baseline Environmental Investigations Atacama Project*. Report to Iluka Resources Limited. EBS Ecology, Adelaide.

EBS Ecology (2019b), Atacama Project EPBC assessment report, Report to Iluka Resources Limited. EBS Ecology, Adelaide.

EBS Ecology (2019c). *Targeted Malleefowl Survey Atacama*. Report to Iluka Resources Limited. EBS Ecology, Adelaide.

Eco Logical Australia (ELA) (2020). *Iluka Atacama Rehabilitation Viability Study – Vegetation.* Prepared for Iluka Resources.

Eco Logical Australia (ELA) (2022a). *Atacama Threatened Species Assessment, Spring 2021*. Prepared for Iluka Resources Limited, Adelaide, SA.

Eco Logical Australia (ELA) (2022b). *Matters of National Environmental Significance Assessment for the Atacama Project.* Prepared for Iluka Resources Limited, Adelaide, SA.

EMM (2022). *Atacama Project – Groundwater and Geochemical Baseline Report*. Report to Iluka Resources Limited. EMM Consulting Pty Ltd, Adelaide.

EMM (2022b). *Atacama Surface Water Assessment, Version 3.* Prepared for Iluka Resources Limited. November 2022 EMM Consulting Pty Ltd, Adelaide.

Farmer, A. M. (1993). The effects of dust on vegetation—a review. Environmental pollution, 79(1), 63-75.

Gaikhorst, G. and Lambert, C. (2014). *Sandhill Dunnart – a species review and where this elusive little beast lives in Western Australia*. Goldfields Environmental Management Group Workshop proceedings. Available at: http://www.gemg.org.au/biennialworkshop.html

Geological Society of Australia South Australian Division (GSA) (2018). *Geological Monuments (Geological Heritage Sites) in South Australia, Part 10*. Geological Society of Australia, South Australian Division.

Geoscience Australia (2009). *Radiometric Map of Australia provides new insights into uranium prospectively.*

Geoscience Australia (2013). *Earthquakes – Metadata*, last updated 21 May 2013, viewed on 3 August 2022, available at < https://sarigbasis.pir.sa.gov.au/WebtopEw/ws/catapp/sarig/cat/Record?w=version_highest_version_key=%271922%27>

Godske, C. L., Bergeron, T., Bjerkenes, J. & Bundgaard, R. C. (1957). *Dynamic Meteorology and Weather forecasting*. American Meteorological Society, 1957.

Golos, P.J. and Dixon, K. (2014) *Waterproofing topsoil stockpiles minimises viability decline in the soil seed bank in an arid environment*. Restoration Ecology. Vol 22 Issue 4, pp 495- 501.

Greenbase Pty Ltd. (2022) *GHG Estimates for Atacama Project*. Letter dated 15 December 2022.

Harlen, R., and D. Priddel. 1996. *Potential food resources available to malleefowl Leipoa ocellata in marginal mallee lands during drought*. Australian Journal of Ecology 21:418-428.

Hatch (2022). *Atacama Traffic Impacts Study*. Report prepared to Iluka Resources Limited.

Humphries, S.E., Groves, R.H. and Mitchell, D.S. (1991). *Plant invasions of Australian ecosystems: a status review and management directions*. CSIRO, Canberra.

Humphries, S.E., Groves, R.H. and Mitchell, D.S. (1993). *Plant Invasions: homogenizing Australian ecosystems.* Conservation Biology in Australia and Oceania. Surrey Beatty and Sons, Chipping Norton. 149-170.

IHC Independent Heritage Consultants (2020). *Atacama Project – Baseline Desktop Assessment*. Report Prepared for Iluka Resources Ltd.

Iluka Resources Pty Ltd (2008). *Haul Road Upgrade Development Application*. 5 March 2008.

Iluka (2022). *Jacinth Ambrosia Environment Procedure*. Fire Management. Date issued 15 March 2022.

Iluka (2017). *Updated Mineral Resource and Ore Reserve Statement.* ASX release date 20 February 2017 [https://www.asx.com.au/asxpdf/20170220/pdf/43g4fffv5vb43z.pdf] accessed 16 January 2020.

Jacobs (2021). *Jacinth-Ambrosia Fauna Monitoring: October 2020*. Report to Iluka. Jacobs Group (Australia) Pty Limited.

Jacobs (2022a). *Jacinth-Ambrosia Fauna Monitoring: Spring 2021*. Report to Iluka. Jacobs Group (Australia) Pty Limited.

Jacobs (2022b). *Iluka Atacama Air Quality Baseline Review – Atacama Air Quality Baseline Assessment.* Report to Iluka Resources Limited. Jacobs Group (Australia) Pty Limited.

Jacobs (2022c). *Atacama Project - Air Quality Impact Assessment*. Revision O. Report to Iluka Resources.

KE (2008). *Katestone Environmental, Air quality assessment of a proposed mineral sands mine and electricity generators* – Jacinth Ambrosia Project, Iluka Resources Limited, February 2008.

Lancaster, N (2011). *Desert dune processes and dynamics. In Arid Zone Geomorphology: Process, form and change in drylands*. Wet Sussex, Wiley-Blackwell pp 487-515.

Lawson, B.E., Bryant, M.J. and Franks, A.J. (2004). *Assessing the potential distribution of buffel grass (Cenchrus ciliaris L) in Australia using a climate-soil model*. Plant Protection Quarterly. 19: 155-163.

Lee, Joanne (Superintendent J-A). Email to: Jasmine Richards (MLP Project Manager). 2022.

Leseberg, N.P. and Murphy, S.A. (2019). *Automated acoustic surveys for Night Parrot (Pezoporus occidentalis) in the eastern Eucla Basin, South Australia*. Report to EBS Ecology. Adaptive NRM, Malanda.

Lohman, (1972). *Definitions of selected ground-water terms, revisions and conceptual refinements*. Water Supply Paper 1988. United States Geological Survey.

Marshall, V., Lewis, M. and Ostendorf B (2012). *Buffel grass (Cenchrus ciliaris) as an invader and threat to biodiversity in arid environments: A review.* Journal of Arid Environments. 78: 1-12

McGregor, H., Legge, S., Jones, M.E. and Johnson, C.N. (2015). *Feral cats are better killers in open habitats, revealed by animal-borne video*. PLoS One 10(8): 12pp.

McLean, A. (2015). *Conservation biology of an endangered semi-arid marsupial, the Sandhill Dunnart (Sminthopsis psammophila)*. Ph.D. thesis, School of Biological Sciences, The University of Adelaide.

Morelli J. (1992). *Fire Management in the Great Victoria Desert.* SA National Parks and Wildlife Service.

National Environment Protection (Assessment of Site Contamination) Measure 1999 (April 2013), NEPC 2013, Canberra.

National Malleefowl Recovery Team (2019). *National Malleefowl Monitoring Manual:* Edition 2019_1.

Owens, H. (2000). *Guidelines for Vertebrate Surveys in South Australia using the Biological Survey of South Australia*. National Parks and Wildlife SA, Government of South Australia.

Paltridge, R., Latz, P., Pickburn, A. and Eldridge, S. (2009). *Management Plan for Rare and Threatened Flora in the Anangu Pitjantjatjara Yankunytjatjara Lands of South Australi*a. Department for Environment and Heritage, South Australia.

Parsons Brinckerhoff (2014). *Iluka Resources Atacama/Sonoran Typhoon Development Project, Social Impact Assessment.* Document No. 14—210-0202185729A. 18 December 2014.

Parsons, B.C., Gosper, C.R. (2011). *Contemporary fire regimes in a fragmented and unfragmented landscape: implications for vegetation structure and persistence of the fire sensitive malleefowl*. International Journal of Wildland Fire 20: pp. 184-194.

Pieri, C., Dumanski, J., Hamblin, A. S., & Young, A. (1995). *Land quality indicators*. World Bank Discussion Paper 315. Washington, DC: World Bank.

Price, O.F., Penman, T.D., Bradstock, R.A., Boer, M.M. and Clark, H. (2015). *Biogeographical variation in the potential effectiveness of prescribed fire in south-eastern Australia*. Journal of Biogeography. 1-12.

Radiation Consulting Australia (2022). *Iluka Atacama Project Environmental Radiation Impact Assessment.* June 2022.

SA Radiation (2015). *Typhoon & Sonoran Baseline Radiation Survey.*

SA Radiation (2016). *Atacama Baseline Radiation Survey Report.* Report prepared for Iluka Resources Ltd. 3 May 2016.

SKM (2006). *Fauna Survey 2005: Part I – Mineral Deposit Area, Yellabinna Regional Reserve, South Australia*. Report to Iluka Resources Ltd. Sinclair Knight Mertz.

SKM (2014). *Sonoran Development Project: Baseline Soil Survey*. Report prepared for Iluka Resources Ltd.

Solomon, S. B., Peggie, J. R., Wise, K. N., & Paix, D. (1988). *Radon levels in Australian homes. In Radiation protection practice.*

The South Australian Division of the Geological Society of Australia. 2002. *Geological Monuments in South Australia, Parts 1-9*. The South Australian Division of the Geological Society of Australia. https://www.gsa.org.au/Public/Divisions/South_Australia/SA-Geological-Heritage/Public/Divisions/SA_Subpages/South_Australian_Geological_Heritage.aspx?hkey=77241bcf-672f-4dbc-8701-378c07acfbd8.

The South Australian Division of the Geological Society of Australia (2018). *Geological Monuments in South Australia, Part 10*. The South Australian Division of the Geological Society of Australia. https://www.gsa.org.au/Public/Divisions/South_Australia/SA-Geological-Heritage/Public/Divisions/SA_Subpages/South_Australian_Geological_Heritage.aspx?hkey=77241bcf-672f-4dbc-8701-378c07acfbd8.

Truescape (2022). Iluka Atacama - Filled Voids Visual Simulations.

UNSCEAR (2000). *Report to the General Assembly, with scientific annexes*.

Walsh, J. C., K. A. Wilson, J. Benshemesh, and H. P. Possingham (2012). *Unexpected outcomes of invasive predator control: the importance of evaluating conservation management actions.* Animal Conservation 15:319-328.

Woinarski JCZ, Burbidge AA and Harrison PL (2014). *The Action Plan for Australian Mammals 2012.* CSIRO Publishing. Collingwood, Vic.

Woinarski, J. & Burbidge, A.A. (2016). *Sminthopsis psammophila*. The IUCN Red List of Threatened Species 2016.

WSP. Design for a better future/ *Iluka Resource Ltd Atacama Project Social Impact Assessment*. January 2023.

12 DEFINITIONS AND ABBREVIATIONS

Acronym	Description
BSC	Biological Soil Crust
DAWE	Department of Agriculture, Water and the Environment
DEM	Department for Energy and Mining
DEW	Department for Environment and Water
DCCEEW	Department of Climate Change, Energy, the Environment and Water
EML	Extractive Mineral Lease
EPA	Environment Protection Authority
EP Act	*Environment Protection Act 1993*
EPBC Act	*Environment Protection and Biodiversity Conservation Act 1999*
FWCAC	Far West Coast Aboriginal Corporation
J-A	Jacinth Ambrosia
Landscape SA Act	*Landscape South Australia Act 2019*
MAP	Mean Annual Precipitation
MG	Ministerial Guidelines
Mining Act	*Mining Act 1971*
ML	Mining Lease
MLP	Mining Lease Proposal
MNES	Matters of National Environmental Significance
NPW Act	*National Parks and Wildlife Act 1972*
NV Act	*Native Vegetation Act 1991*
NVF	Native Vegetation Foundation
PEPR	Program for Environment Protection and Rehabilitation
RMP	Radiation Management Plan
RPC Act	*Radiation Protection and Control Act 2021*
RWMP	Radioactive Waste Management Plan
SARIG	South Australian Resources Information Gateway
SEB	Significant Environmental Benefit
TOR	Terms of Reference

13 TOR ATACAMA CHECKLIST

The contents of this MLP have been developed to meet the requirements of TOR Atacama – *Terms of Reference for the Atacama Mineral Sands Project Mining Lease Application in accordance with EPBC Act Accredited Assessment under the Mining Act 1971 (Notice under Section 36 of the Mining Act 1971).* Please use this checklist to find source information within the MLP.

Framework	Requirement	Section included
TOR ATACAMA	***Form of Application***	
	Applicant name(s) (company and/or individual and/or related body corporate) and each applicant's percentage share in the application Name of project Mineral type Mineral(s) to be authorised Primary mineral(s) sought Other mineral(s) sought Details of the tenement(s) giving authority to apply for the Mining Lease Native title land Details of relevant land ownership, notices, consents and agreements Declaration of accuracy Applicant(s) details including: • Name of Company and/or Individual ABN (if applicable) • ACN (if applicable) Registered address • Applicant contact details including: - Postal Address - Email - Website - Phone number (s) • Contact Person details including: - Name - Position Title - Email - Phone number(s) - Consent to receive electronic correspondence (or otherwise) An application for an ML must in accordance with section 36(1)(a) of the Mining Act 1971 be in the following form, unless otherwise specified by the Director of Mines or an authorised officer:	Section 1.1

Framework	Requirement	Section included
	• an electronic version of the Proposal must be submitted in accordance with regulation 88 of the Mining Regulations 2020; hardcopies must be submitted upon request; the information in all must be identical; • each page, plan or other separate sheet of the Proposal must include the mineral claim, retention lease or exploration licence number(s), date of the application submission and sequential page numbering; and • the electronic version of the Proposal must be submitted in one single Acrobat PDF file or if requested by the Director of Mines or an authorised officer, Microsoft Word compatible files must be submitted.	
TOR ATACAMA – 1	***Description of the Existing Environment***	
	In setting out an assessment of the environmental impacts of the proposed authorised operations in accordance with section 36(1)(c)(ii)(A) of the *Mining Act 1971* and regulation 46(2) of the *Mining Regulations 2020*, the Minister determines in accordance with regulation 46(7)(e) of the *Mining Regulations 2020* that a proposal must include a description and assessment of the environment as set out in this Terms of Reference. Each of the elements of the existing environment (as defined in section 6(4) of the *Mining Act 1971*) listed in clauses 1.1-1.20 must be described only to the extent that they may need to be considered in assessing the potential impacts of the proposed mine operations. If the element is not likely to be impacted by the operation, a statement to that effect must be included. For Matters of National Environmental Significance (MNES) provide information as per section 1.22.	Section 3
TOR ATACAMA – 1.1	***Topography and landscape***	
	Provide a description and map (as per 5.1.1.1) of the topography and landscape, detailing the: • application area; and • general surroundings	Section 3.1
TOR ATACAMA – 1.2	***Climate***	
	Provide: • a summary of rainfall and temperature patterns, evaporation rates, and wind directions and speed (including maximum wind gusts); and • details of the maximum average recurrence interval or annual exceedance probability rainfall event used for the operational and closure design of the project, and the justification for the value(s) selected.	Section 3.2
TOR ATACAMA – 1.3	***Topsoil and subsoil***	

Framework	Requirement	Section included
	Provide: • a description of the soil profile (type and depth), and the characteristics and/or productivity of all soils on the application area (show this information on a map as per 5.1.1.2 if there is a variation in soils over the application area); and • identify any soil characteristics, including (but not limited to) erodibility, acid sulfate, sodic or non-wettable soils, that may require control measures to reduce environmental impacts during operations or rehabilitation.	Section 3.3
TOR ATACAMA – 1.4	***Geology***	

	Provide a description of the following, as a minimum:
	• regional geology;
	• local geology within the application area and geological map(s) (as per 5.1.1.2), including but not limited to;
	  ○ location, dimensions and orientation (dip and strike), and extent of the mineral resource and ore reserve;
	  ○ location and composition of all rock types and rock units that are proposed to be disturbed;
	  ○ interpretation of the stratigraphy of the rocks hosting the deposit as well as any overlying and adjacent rock units;
	  ○ and an indication of the potential for extension to the orebody;
	• representative cross-sections and long section (as per 5.2.1.1) of the geology of the application area; and
	• the exploration data on which the geological interpretation was based on
		Section 3.4

TOR ATACAMA – 1.5	***Geochemistry and Geohazards***	
	Provide: • a geochemical assessment of all rock types that are proposed to be disturbed, based on representative sampling and analysis that includes the identification and quantification of, but not limited to, sulfide minerals that have the potential to generate acid or mobilise metals into the environment; and • a mineralogical assessment of all the rock types that are proposed to be disturbed, based on representative sampling and analysis for the presence and quantification of (but not limited to) radioactive minerals, asbestiform minerals or minerals that have the potential to produce respirable silica.	Section 3.4
	Describe the potential for any of the following natural geohazards to be present in the application area and show on a map: • structural instability, including slips, faults, karst features or geological discontinuities; and • major seismic events (based on historical data).	Section 3.4

Framework	Requirement	Section included
TOR ATACAMA–1.6	***Groundwater***	
	If all proposed operations are to occur at least 3 m above the seasonally high water table, provide: • a statement that all proposed operations are to occur at least 3 m above the seasonally high water table; • a statement that the proposed operations will not /are unlikely to increase the seasonally high water table to within 3 m of the mining operations anywhere within the lease application area; • an assessment of the position of the seasonally high water table beneath the entire lease application area; and • the drillhole, borehole and hydrogeological data and information the assessment is based on.	Section 3.5
	If any part of the proposed operations is likely to occur within 3 m of the seasonally high water table, or the proposed operations will/are likely to increase the seasonally high water table to within 3 m of the operations, or the proposed operations are likely to intersect aquifer unit(s), provide: • a statement describing if the application area is within an area where the water resources are prescribed under the *Landscape South Australia Act 2019* and details on the current availability of groundwater resources within the prescribed area; • a description of the local and regional hydrogeology, detailing both the stratigraphy and hydrostratigraphy; • a detailed baseline description of the groundwater characteristics and flow dynamics for aquifers within the application area which includes: ○ static water levels and groundwater heads/groundwater elevations, including seasonal fluctuations for each aquifer; ○ baseline groundwater hydrochemistry and mineralogy, including any seasonal fluctuations and spatial variability for each aquifer; ○ aquifer properties including hydraulic conductivity, transmissivity, specific yield, storage coefficient, total porosity, effective porosity and aquifer thickness; ○ recharge and discharge mechanisms, ○ hydrogeological characteristics of confining strata, including hydraulic conductivity and thickness; ○ connectivity between the proposed mining aquifer and lateral, overlying or underlying aquifers and surface water; ○ conceptualisation of the hydrogeology inclusive of conceptual diagram: a summary of all above and a description of the hydrogeological setting considered important for impact assessment; and	Section 3.5

Framework	Requirement	Section included
	○ a preliminary impact assessment/numerical model of groundwater flow (and contaminant transport model, if applicable), based on the conceptual hydrogeology. • local and regional potentiometric surface/groundwater elevation map(s) (as per 5.1.1.3) for each aquifer within the application area; • cross-section(s) (as per 5.2.1.2) of the hydrostratigraphy; • the environmental value of each aquifer determined according to the Environment Protection (Water Quality) Policy 2015, or any subsequent updates; • a description of the existence, location, condition and value of all aquatic, terrestrial and subterranean Groundwater Dependent Ecosystems (GDEs) within the application area and within and immediately surrounding the extent of predicted hydrogeological impact of the proposed mine operations; and • an assessment of any current or historical use of local groundwater by the landowner(s) and other users which includes a baseline survey of bores, including depth to groundwater, groundwater quality, bore construction details, status and purpose and collar/ground elevations.	
TOR ATACAMA – 1.7	***Surface water***	
	Provide a topographic map (as per 5.1.1.1) and description of the current drainage patterns for the application area and water catchment including: • location of watercourses, drains, dams and wetlands; • surface water catchment boundaries; • direction of drainage and discharge from the application area; • a statement describing if the application area is within an area where the water resources are prescribed under the *Landscapes South Australia Act 2019*, and provide details on the current availability of water resources within the prescribed area; • a statement if the application area is within a water protection area including areas under the *River Murray Act 2003*; • a statement as to whether the application falls within the Murray Darling Basin; and • groundwater – surface water interactions. Provide water quality data for identified watercourses, where there is potential for discharge into that watercourse from the proposed operation (whether intentional or not). Should identified watercourses be ephemeral, and it is not possible to collect water samples, provide a characterisation of sediments sampled from the watercourse bed upstream and downstream of the application area. If there is potential for changing a flow regime (including change in flow volume) or discharge into these watercourses from the proposed operations, an assessment of the use of this water by the landowner, downstream users and water dependent ecosystems must be included.	Section 3.8

Framework	Requirement	Section included
TOR ATACAMA – 1.8	***Vegetation, Weeds and Plant Pathogens***	
	Provide: • a description and map (as per 5.1.1.1) of existing flora (native and introduced) in the application area and surroundings, the State conservation status and habitat value of native vegetation present in the application area; • a description of the presence of State listed species and ecological communities; • a description of the extent the application area and adjoining land is affected or potentially affected by pathogens and declared weeds; and • if known, a description of the history of land use to identify if the existing vegetation is the result of deliberate cultivation or natural regrowth arising from previous clearance. *Note: the proponent may choose to integrate section 1.8 (Vegetation, Weeds and Plant Pathogen State matters) and section 1.22 (Commonwealth MNES)*	Section 3.9
TOR ATACAMA – 1.9	***Fauna***	
	Describe the native and feral fauna that may be present in the application area noting State conservation status of all species. *Note: the proponent may choose to integrate section 1.9 (Fauna State matters) and section 1.22 (Commonwealth MNES)*	Section 3.10
TOR ATACAMA – 1.10	***Caves***	
	If the application area is within, or near to, known caves or significant limestone formations a survey for the presence of caves must be performed. Provide a summary of the results of the survey and describe the presence of any caves in karst (limestone) areas within, or near to, the application area and show on a map (as per 5.1.1.5).	Section 3.11
TOR ATACAMA – 1.11	***Local Community***	
	Provide: • a description of the local population, the economy, services and employment; and • details of nearest town or urban areas, with a summary of the demographics of the local population	Section 3.12

Framework	Requirement	Section included
TOR ATACAMA – 1.12	***Landowners and Land Use***	
	Provide a description of: • land ownership for all titles within and adjacent to the application area; • land use (historical and current) for the application area and the surrounding areas; • the zoning as defined by the Planning and Design Code or relevant council development plans; • policies relevant to the application area, including region or council wide, zone specific and sub areas within a zone; • known plans for potential future land use changes by other parties; and • any other interests or restrictions on the application area, including: ○ public utility easements; ○ if the application is within land used for defence purposes, including (but not limited to) the Woomera Prohibited Area or the Cultana Army Training Area; ○ any overlapping or adjacent tenements under the *Mining Act 1971*, or Petroleum and *Geothermal Energy Act 2000*.	Section 3.13
TOR ATACAMA – 1.13	***Proximity to Infrastructure and Housing***	
	Provide information and a map (as per 5.1.1.4): • identifying residences within and near the application area; • identifying other human infrastructure such as (but not limited to) schools, hospitals, commercial or industrial sites, roads, sheds, bores, dams, ruins, pumps, cemeteries, scenic lookouts, roads, railway lines, fences, transmission lines, gas and water pipelines, and telephone lines (both underground and above ground); and • identifying public roads to be utilised or affected as part of proposed operations, including an estimate of the existing traffic movements	Section 3.14
TOR ATACAMA – 1.14	***Exempt Land***	
	Provide a description and map (as per 5.1.1.4) of any applicable exempt land under Section 9 of the *Mining Act 1971*.	Section 1.5
TOR ATACAMA – 1.15	***Amenity***	

Framework	Requirement	Section included
	Provide a description of scenic or aesthetic values for the application area and immediate surrounds, including features of community, tourist or visitor interest.	Section 3.15
TOR ATACAMA – 1.16	***Air Quality***	
	Provide a description of the existing levels of dust and contributors to air quality including odour (both natural and anthropogenic).	Section 3.17
TOR ATACAMA – 1.17	***Noise***	
	Provide a description and measurement data of the existing levels of noise and contributors to noise (both natural and anthropogenic).	Section 3.19
TOR ATACAMA – 1.18	***Heritage (Aboriginal, European, geological)***	
	Detail and show on a map (as per 5.1.1.1): • any registered state heritage sites in or adjacent to the application areas that are protected under legislation (in so far as may be permitted under the relevant legislation); and • include a statement concerning whether or not an Aboriginal cultural heritage survey has been conducted by the proponent and if so, the results of the survey. *Note: the proponent may choose to integrate section 1.18 (State Heritage matters) and section 1.22 (Commonwealth MNES)*	Section 3.20
TOR ATACAMA – 1.19	***Proximity to Conservation Areas***	
	Provide: • information and a map (as per 5.1.1.1) showing proximity to national parks and reserves, private conservation areas, State recognised conservation areas, heritage agreement areas and geological heritage sites; and • information on the relevant plan of management for the Yellabinna Regional Reserve; and • a statement as to whether the application area falls within the Adelaide Dolphin Sanctuary, Adelaide International Bird Sanctuary or a Marine Park. *Note: the proponent may choose to integrate section 1.19 (State matters) and section 1.22 (Commonwealth MNES)*	Section 3.21

Framework	Requirement	Section included
TOR ATACAMA – 1.20	***Pre-existing site contamination and Previous Disturbance***	
	Provide information and a map (as per 5.1.1.1) showing: • any known existing contamination of the site and of any disturbance by previous operations or other activities, including mineral exploration activities, including mineral exploration activities.	Section 3.22
TOR ATACAMA – 1.21	***Tailings generation and management***	
	If tailings generation and management is proposed, the standards set out in Minerals Policy MPOL007 must be used for baseline environmental data collection and material characterisation relating to tailings.	N/A There will be no tailings generation or management in the Atacama Project Area.
TOR ATACAMA – 1.22	***MNES***	
	Provide a description of any protected MNES that have the potential to be impacted by the proposed action. For listed threatened species and communities, provide a minimum of: • Information on the abundance, distribution, ecology and habitat preference for each listed species or community; • quantification of the extent of habitat and the number of individuals present, or historical patterns of use within the proposed project area and surrounds (including mapping identified known and/or potential habitat); • assessment of the quality and importance of known or potential habitat for the relevant listed species or community within the proposed application area and surrounds; • information detailing the locations of known populations of species, and any historical records of individuals within the proposed application area, if available. Provide information about the resources and expertise used to identify and assess environmental values on site and an assessment on the adequacy of any surveys undertaken, in particular the extent to which these surveys were appropriate to key protected matters and	Section 3.9 Section 3.10 Section 8

Framework	Requirement	Section included
	the relevant conservation advices, recovery plans, threat abatement plans and survey guidelines where applicable. (note: The relevant matters that must be carried forward into the Mining Proposal will be based on the criteria set out in the Commonwealth Significant Impact Guidelines)	
TOR ATACAMA – 2	***Description of the Proposed Operations***	
	In specifying the nature and extent of the authorised operations that are proposed in accordance with section 36(1)(c)(i) of the *Mining Act 1971*, the Minister determines in accordance with regulation 46(6)(e) of the *Mining Regulations 2020* that a proposal must include a description of the proposed operations as set out in this Terms of Reference. Each of the elements listed in clauses 2.1 2.10 must be described only to the extent that they apply to the proposed mine operation.	Section 4
TOR ATACAMA – 2.1	***General Description and Maps/Plans of Operations***	
	Provide a summary description of all elements of the proposed operation, including mining, processing and waste management (include maps/plans and cross sections as per 5.1.2 and 5.2.2).	Section 4.1
TOR ATACAMA – 2.1.1	***Options***	
	Provide a summary description of relevant options considered for mining, processing and mine waste management strategies, and provide justification for the chosen strategies, including a description of any elimination or substitution strategies that have been adopted to control a hazard in order to protect the environment. If tailings generation and management is proposed, relevant tailings options (including TSF site locations) must be analysed using an appropriate multi-criteria assessment tool. The results of the multi-criteria assessment must be provided.	Section 4.2
TOR ATACAMA – 2.2	***Reserves, Product and Market***	
TOR ATACAMA – 2.2.1	***Ore reserves or Mineral Resources (or both)***	

Framework	Requirement	Section included
	Provide: • a statement of the current Australasian Joint Ore Reserves Committee (JORC) compliant ore reserve or mineral resource estimates (or both) in the application area; and • a statement of what reserve and/or resource forms the basis for the application; or (if a JORC compliant reserve or resource (or both) has not been reported • an estimate of the resource to be mined and the basis of this estimate. Provide steps that have been taken to ensure proposed operations will not sterilize/prevent future extraction of mineral resources.	Section 4.3.1
TOR ATACAMA – 2.2.2	***Production Rate and Products***	
	Provide: • a statement of the relevant commodities that are proposed to be extracted, recovered, processed and sold, and the expected market or end use; • a statement of any other commodities present in the application area that are not proposed to be recovered for sale, and the reasons for this decision; • a quantitative estimate of production of mine gate product(s) for the life of mine, and a schedule of the annual production of mine gate product(s); and • a statement if any extractive minerals (as defined by Section 6 of the Mining Act 1971) will leave the lease	Section 4.3.2
TOR ATACAMA – 2.3	***Exploration Activities***	
	Provide information on exploration activities to be undertaken in the application area as part of the operation, including: • purpose of exploration activities • types of drilling • geophysical techniques likely to be used • earthworks required to conduct exploration activities • equipment required to conduct exploration activities; and • rehabilitation methods for exploration activities (including that not yet rehabilitated from previous tenure)	Section 4.4
TOR ATACAMA – 2.4	***Mining Activities***	

Framework	Requirement	Section included
TOR ATACAMA – 2.4.1	***Type or Types of Mining Operation to be Carried Out***	
	Provide a clear statement on the type or types of mining operation proposed to be carried out, such as: • the mining method(s) to be adopted	Section 4.5.1
TOR ATACAMA – 2.4.2	***Open Pit***	
	Describe proposed open pit workings, including (but not limited to): • Overall pit wall angles, bench height and berm width • Dimensions and depth of pit • Access ramps • Maps, plans and cross-sections of the pit (as per 5.1.2 and 5.2.2)	Section 4.5.2
TOR ATACAMA – 2.4.3	***Material Movements***	
	Provide: • expected life of mine (including scope for extension); • annual mine production rates and mine production schedule of ore and waste rock over the life of mine; and • • life of mine and annual strip ratios.	Section 4.5.4
TOR ATACAMA – 2.4.4	***Stockpiles***	
	Describe for all ore, product, subsoil and topsoil stockpiles the: • Location, size, shape and height • Method of placement • Method of stabilisation and erosion control • Water movement through stockpiles The location, maximum height and extent of stockpiles shown on map (as per 5.1.2.1)	Section 4.5.5
TOR ATACAMA – 2.4.5	***Use of Explosives***	
	If explosives are proposed to be used, describe:	Section 4.5.6

Framework	Requirement	Section included
	• type of explosives used on the site; • proposed timing and frequency of blasting; • size of blasts; and • storage of explosives (amount, type, detailed location and method of storage).	
TOR ATACAMA – 2.4.6	***Type of Mining Equipment***	
	Provide a description of the equipment (fixed and mobile) proposed to be used in the mining operation in terms of: • Type, size and capacity of machines • Approximate number of units • Noise outputs • Exhaust outputs, and • Fire ignition sources The location of fixed equipment shown on a map (as per 5.1.2.1)	Section 4.5.7
TOR ATACAMA – 2.4.7	***Mine Dewatering***	
	Provide: • estimated inflows of groundwater, stormwater and water from any other mining activities into mine workings; • details of proposed mine dewatering infrastructure, and mine water management and disposal; • contingency measures for greater than planned water inflows into mine workings; and • a mine water balance of water inflows and water outflows during operations and at completion (if not included in the water balance in clause 2.5.4).	Section 4.5.8
TOR ATACAMA – 2.4.8	***Sequence of Mining and Rehabilitation Operations***	
	Provide the following information on the sequence of operations in both text and map form (as per 5.1.2.2): • description of the sequence of mining stages; • proposed sequencing of progressive and final rehabilitation, including demonstration that progressive rehabilitation has been integrated with the mining plan;	Section 4.5.9

Framework	Requirement	Section included
	• an estimation of the quantities of sulfide minerals that have the potential to generate acid or mobilise metals, or other hazardous minerals to be mined at each mining stage; and • any mineral resource that may be sterilised from future mining by the proposed mining operations	
TOR ATACAMA – 2.4.9	***Rehabilitation Strategies and Timing***	
	Describe all activities, strategies and designs relating to mine closure for rehabilitation of open pit, stockpiles, explosives storage, mining equipment and mine dewatering infrastructure. Include timing of these activities and all opportunities for progressive rehabilitation. Include (but not limited to) the maximum area of land disturbed by proposed mining operations at any time, battering of mining faces and other earthworks, mine void backfilling, abandonment bunds, soil management, revegetation and expected water infill rates.	Section 4.5.10
TOR ATACAMA – 2.4.10	***Modes and hours of Operation***	
	State if the proposed mining operation will be worked on a continuous (24 hour, 7 days a week), regular periodical or campaign basis. If the proposed mining operation is to be worked on a regular periodical basis, specify: • proposed period(s) (daily, weekly and public holidays) to be worked; and • proposed start and finish hours the site is to be worked per period. If the operation is to be worked on a campaign basis, specify: • minimum hours the site is to be worked per year; • the minimum time of each campaign; • the maximum and minimum time between campaigns; • define the beginning and end of each campaign; • hours of mining operations during campaign; • days of mining operations during campaign; • determining factors for initiating and ceasing a campaign; • maximum and minimum tonnage of each campaign; and • maximum and minimum tonnage of production per year	Section 4.5.11
TOR ATACAMA – 2.5	***Crushing, Grinding, Processing and Product Transport***	
TOR ATACAMA – 2.5.1	***Crushing and Grinding Plant***	

Framework	Requirement	Section included
	Provide a description of the crushing/grinding plant including: • Area, size, type of construction and location of crushing/grinding plant • Throughput rate • A description of ore preparation for processing • Grind size of ore • Noise sources • Dust sources and composition • Fire ignition sources • Plans (as per 5.1.2.3)	Section 4.61
TOR ATACAMA – 2.5.2	***Processing Plant***	
	Provide a description of the processing plant including: • the methods and details of processing and value adding proposed; • number, location, area, size, type of construction (including lining and drainage systems, as appropriate) of processing plant; • any ancillary plant and infrastructure to be used for processing the minerals on site; examples of associated structures are concrete batching plants, wheel wash facilities, silos, fuel tanks, water tanks, chemical storage/use, reverse osmosis plants and bore fields; • if chemicals are to be used in the beneficiation or processing of ore, describe the nature and quantities of the chemicals to be used, their reactions with ore and their ultimate fate; • noise sources; • dust sources and composition; • fire ignition sources; • other potential air emissions (including odour) and their composition; and • plans (as per 5.1.2.3).	Section 4.6.2
TOR ATACAMA – 2.5.3	***Process Water Management***	
	Provide a water balance including: • approximate water volumes required; • a summary of the inputs and outputs (with consideration of any purge requirements); • determination of net surplus or deficit; and	Section 4.6.3

Framework	Requirement	Section included
	• process flowsheet showing all streams including stormwater management and mine dewatering where these are connected to the processing circuit.	
	Provide a description of all water ponds, including: • size, capacity, layout and location of ponds; • design and construction methods; • chemical composition of the solution to be stored in each pond; • minimum freeboard to be maintained; and • plans (as per 5.1.2.1).	Section 4.6.3
TOR ATACAMA – 2.5.4	***Type of Mobile Equipment***	
	For mobile equipment to be used in crushing/grinding, processing ore and in transporting the mine product to the point of sale, describe: • type, size and capacity of machines; • approximate number of units; • noise outputs; • exhaust outputs; and • fire ignition sources.	Section 4.6.5
TOR ATACAMA – 2.5.5	***Conveyors and Pipelines***	
	Provide a description of any conveyors or pipelines to be used for transporting material to or from the mine, processing facilities and the point of sale including: • length, size (volumes to be transported), design and type of construction and location; • the material being transported; • noise sources; • dust sources and composition; • fire ignition sources; and • plans (as per 5.1.2.1).	Section 4.6.6
TOR ATACAMA – 2.5.6	***Hours of Operation***	
	Describe the proposed hours of operation of crushing/grinding, processing and transport activities	Section 4.6.7

Framework	Requirement	Section included
TOR ATACAMA – 2.5.7	***Rehabilitation Strategies and Timing***	
	Detail all activities, strategies and designs relating to mine closure for removal, disposal and rehabilitation of processing facilities, and material transport systems, including timing of these activities.	Section 4.6.84.7.4
TOR ATACAMA – 2.6	***Wastes***	
TOR ATACAMA – 2.6.1	***Waste Rock and Tailings Storage Facilities***	
	The standards set out in Minerals Policy MPOL007 must be used for the planning, design and assessment of tailings generation and management relating to all aspects of the tailings lifecycle (i.e. construction, operation, rehabilitation, closure and governance). For waste rock and tailings storage facilities (TSF) provide: • the estimated tonnes and volumes of all waste rock and tailings to be stored; • the reserve and any resource or potential resource that the estimated tonnes and volumes of waste rock and tailings is based on; • the type, location, size, shape, height and method of construction of permanent and temporary waste storage facilities; • a geochemical and geotechnical assessment of the waste rock and tailings based on the geochemical and geotechnical properties determined from the analysis of representative sampling of all waste rock types and tailings to be disposed; • an assessment on the weathering and erosive potential of waste rock to be disposed; • conceptual specifications, drawings and plans for the design, construction, operation and completion of all facilities (as per 5.1.2.5); • the method and rate of waste rock/tailings disposal; • where relevant, a description and plan (as per 5.1.2.5) of the placement and encapsulation of waste material deemed to be hazardous, including potentially acid forming material (PAF); • the method of stabilisation and erosion control of waste storage facilities, both during operations and post completion; • surface water runoff control on disturbed and rehabilitated areas; • a geotechnical stability assessment and a factor of safety analysis; • an assessment of seepage of liquids through the waste rock and tailings storage facilities; • strategies for the containment of any seepage that has the potential to impact the environment;	Section 4.7.1

Framework	Requirement	Section included
	• an assessment of the post completion chemical and physical stability of the structure following rehabilitation, including the expected extent of erosion; • an assessment of the source, pathway and ultimate fate of any potential mobile contaminants; and • a description of the governance arrangements for the design, construction, operation and closure including when it is proposed to use third party verification. Include a water balance for the TSF (if not included in the water balance in clause 2.5.4).	
TOR ATACAMA – 2.6.2	***Other Processing Wastes***	
	Provide: • the volumes and composition of all solid and liquid wastes produced • estimated volumes of waste processing water, reverse osmosis reject water, water content of residues and method of disposal or recycling • wastewater composition • disposal and management of any hazardous material or contaminants within waste including radioactive, toxic, corrosive or flammable materials; and • the source, pathway and ultimate fate of potential mobile contaminants	Section 4.7.2
TOR ATACAMA – 2.6.3	***Industrial and Commercial Wastes***	
	List any industrial and commercial wastes generated, including, but not limited to: • putrescible waste, including sewage • oil and other hydrocarbons • tyres	Section 4.7.3
	For each waste type describe the method of disposal including: • offsite disposal • on site waste disposal (including size, location on a plan (as per 5.1.2.1 and 5.1.2.7) and construction details) • recycling (either on or offsite) • the type, area and layout of sewage systems to be installed at the site, and • describe what, if any approvals are required for the disposal of waste For each type of waste, describe any potential contaminants that may be generated from onsite storage, and the ultimate fate of those contaminants.	Section 4.7.3

Framework	Requirement	Section included
TOR ATACAMA – 2.6.4	***Rehabilitation Strategies and Timing***	
	Detail all activities, strategies and designs relating to mine closure, including timing of these activities and all opportunities for progressive rehabilitation of waste rock and tailings and any other waste to be left on site. The standards set out in Minerals Policy MPOL007 must be used for the planning, design and assessment of tailings generation and management relating to cover systems, rehabilitation, and closure	Section 4.7.4
TOR ATACAMA – 2.7	***Supporting surface infrastructure***	
TOR ATACAMA – 2.7.1	***Access and Roads***	
	Describe: • access route to the proposed operations and show on a map (as per 5.1.2.1 and 5.1.2.6); • indicate if any new roads are to be constructed, or if existing roads or intersections (public and private) are to be upgraded; • transport system(s) used to and from the proposed operations and the estimated number of vehicle movements per day; and • airport/airstrips to be constructed	Section 4.8.1
TOR ATACAMA – 2.7.2	***Accommodation and Offices***	
	Describe onsite personnel accommodation and offices, including (but not limited to): • number, area, size, type of construction and location of accommodation, office, meals or laboratory buildings, caravans or camp, and associated structures to be used on site; and • if temporary or permanent.	Section 4.8.2
TOR ATACAMA – 2.7.3	***Public and Private Services and Utilities Used by the Operation***	
	Describe: • sources of services or utilities that are, or are to be supplied to the proposed site, including but not limited to power, water, telecommunications;	Section 4.8.3

Framework	Requirement	Section included
	• if new connections to services and utilities are required, the proposed routes for connection; and • the effects to any existing services or utilities that have been or may be affected by the proposed operations	
TOR ATACAMA – 2.7.4	***Visual Screening***	
	Describe the type of screening, including existing or proposed vegetation (i.e. species and density of plantings) and show on a map (as per 5.1.2.1).	Section 4.8.4
TOR ATACAMA – 2.7.5	***Fuel and chemical storage***	
	For all fuels and chemicals proposed to be stored on site show the proposed location of storage on a map (as per 5.1.2.1) and provide detail on: • types of bulk chemicals and the volumes of each; and • proposed storage, bunding and containment for all chemical and fuel storage vessels	Section 4.8.5
TOR ATACAMA – 2.7.6	***Site security***	
	Describe and show on a map (as per 5.1.2.1) infrastructure and measures that will be adopted to prevent unauthorised access by the public, including but not limited to: • fencing; and • signage.	Section 4.8.6
TOR ATACAMA – 2.7.7	***Erosion, Sediment and Silt Control***	
	Describe and show on a plan (as per 5.1.2.1): • location and design of silt management structures; • management and disposal of silt; • strategies to control runoff on disturbed and rehabilitated areas; • storage, diversion and release of clean water (discharge water must comply with the current Environment Protection (Water Quality) Policy; and • a whole of site stormwater balance, if not included in the water balance in clause 2.5.4.	Section 4.8.7
TOR ATACAMA – 2.7.8	***Rehabilitation Strategies and Timing***	

Framework	Requirement	Section included
	Detail all activities, strategies and designs relating to mine closure for rehabilitation of supporting surface infrastructure. Provide details for timing of closure activities, including all opportunities for progressive rehabilitation	Section 4.8.8
TOR ATACAMA – 2.8	***Vegetation Clearance***	
TOR ATACAMA – 2.8.1	***Description of Vegetation Clearance***	
	If clearing of native vegetation is proposed, a map (as per 5.1.2.2) and description of the vegetation present in the application area must be provided, showing: • the extent of any proposed vegetation clearance; and • the likelihood of the presence of threatened flora. State the estimated quantum of State significant environmental benefit (SEB) to be gained in exchange for the proposed clearance and describe how the SEB will be provided. Should the applicant's assessment determine that a residual impact to MNES remains likely after the implementation of mitigation measures, provide information to demonstrate how the EPBC Act environmental offsets policy has been complied with.	Section 4.9.1
TOR ATACAMA – 2.9	***Completion***	
TOR ATACAMA – 2.9.1	***Description of Site at Completion***	
	Provide a description, plans and cross sections (as per 5.1.2.7 and 5.2.2.2) of the site as it will be at completion after all rehabilitation and closure activities have been completed, including: • potential land use options; • landforms; • proposed vegetation covers (including native vegetation that will not be disturbed due to proposed operations); • natural contours of land not to be disturbed by proposed operations; • any infrastructure that will remain on site and will become the responsibility of the landowner; • location, description and management of waste disposal areas; • location of reshaped and rehabilitated areas showing proposed surface contours and revegetation; mine voids; • location of stored and/or exposed PAF material and/or other hazardous materials;	Section 4.10

Framework	Requirement	Section included
	• expected final groundwater level and pit level water and time to reach this level, and water quality of mine voids; • location of surface water infrastructure including ponds and diversions; and representative plans and cross-sections (as per 5.1.2.7 and 5.2.2.2) that show: ○ pre-mining natural surface; ○ emplacement areas, waste disposal areas and disturbed areas; final rehabilitated surface; ○ where relevant, predicted final groundwater elevations; and interpreted geology including all rock types. Provide a description of the proposed mechanism for transferring responsibility for any potential residual liability (i.e. ongoing maintenance or monitoring) subsequent to surrender of the tenement	
TOR ATACAMA – 2.10	***Resource inputs***	
TOR ATACAMA – 2.10.1	***Workforce and local procurement***	
	For the proposed workforce (for all operations including mining, processing, waste management and supporting surface infrastructure) describe: • how operations on the site will be managed; • number and workforce breakdown by job type; • number of full-time employee positions that would be directly created by the proposal (not to include existing positions); • the proportion of the workforce that would reside in the local community and the estimated impact on local employment; • any programs to target and assist Aboriginal or local employment at the quarry; • training to be provided to employees and potential employees; • approximate timelines for creation of the positions; and • potential for local business participation, and procurement of local goods and services.	Section 4.11.1
TOR ATACAMA – 2.10.2	***Energy Sources***	
	For the proposed energy sources and usage provide: • estimates of total annual energy usage (from all sources, including personnel transport and ore transport to point of sale); • expected sources of energy;	Section 4.11.2

Framework	Requirement	Section included
	• potential for efficiency gains; • amount and percentage of zero emission energy to be utilised; • equivalent annual CO2 generated; and • any carbon offsets proposed	
TOR ATACAMA – 2.10.3	***Water Sources***	
	Provide details on the source(s) of water to be used at the mine, expected usage and any discharge, including: • expected annual water usage by source; • indicate if any water usage by source will be more than 5% of the total annual water withdrawal for that source; • percentage of water that will be recycled; and • water discharge by quality and destination	Section 4.11.3
TOR ATACAMA – 3	***Consultation***	
	In setting out the result of the consultation undertaken in connection with the proposed operations in accordance with section 36(1)(c)(iv) of the *Mining Act 1971* and regulation 47 of the *Mining Regulations 2020*, the Minister determines in accordance with regulation 46(7)(e) of the *Mining Regulations 2020* that a proposal must include: A description of: • the process undertaken for identifying stakeholders with an interest in, or stakeholders likely to be directly affected by the proposed operation; • the process undertaken for the delivery of information to, gathering of feedback from, and responding to those identified stakeholders; • if any individual or group of similar affected persons were not able to be consulted, what steps were taken to consult with them; and • the extent to which the outcomes proposed in clause 4.2.2 have been developed in consultation with the landowner and any other person who may be directly affected by the proposed mine operations. The results of the consultation undertaken with those identified stakeholders, including: • the persons consulted; • any concerns/issues raised; and • the response and steps (if any) taken or proposed to address those concerns	Section 5
TOR ATACAMA –4	***Management of Environmental Impacts***	

Framework	Requirement	Section included
TOR ATACAMA –4.1	***Assessment of Environmental Impacts***	
	In setting out an assessment of the environmental impacts of the proposed authorised operations in accordance with section 36(1)(c)(ii)(A) of the *Mining Act 1971* and regulation 46(2) of the *Mining Regulations 2020*, the Minister determines in accordance with regulation 46(7)(e) of the *Mining Regulations 2020* that a proposal must include an assessment of the environment as set out in this Terms of Reference	Section 7
TOR ATACAMA – 4.1.1	***Elements of the environment***	
	Describe the specific elements of the environment (the environment is defined in Section 6(4) of the Mining Act 1971) that may reasonably be expected to be impacted by the proposed operation during construction, operation, and indefinitely post completion. For MNES where it has been determined that there is the potential for significant impacts to those matters, address those specific MNES environmental elements in the requirements below. For each element of the environment identified: • provide a summary of any issues or considerations raised by stakeholders, and any relevant legislated or recognised standards (for MNES summarise relevant National Environmental Standards) in relation to the element of the environment; • describe all potential environmental receptors; and • undertake an impact assessment of how the element could be potentially impacted by proposed operations (during construction, operation and post completion) through the provision of the information listed in the following clause 4.1.2.	Section 7
TOR ATACAMA – 4.1.2	***Potential Impact Events***	
	Describe potential impact events associated with each phase of the proposed operations (construction, operation and post completion) and relevant to each element of the environment. For the purpose of the impact assessment, a potential impact event is the combination of a source, a pathway and an environmental receptor. The source, pathway and environmental receptor of each potential impact event must be described prior to the implementation of engineering or administrative control measures. For each potential impact event identified in clause 4.1.2, provide:	Section 7
TOR ATACAMA – 4.1.2.1	***Source***	

Framework	Requirement	Section included
	A description of the source of the potential impact event which alone or in combination has the potential to cause harm to an environmental receptor	Section 7
TOR ATACAMA – 4.1.2.2	**Pathway**	
	A description of the potential pathway, means or route (with consideration of any natural barriers) by which an identified environmental receptor can be exposed to, or may reasonably be expected to be impacted by an identified source.	Section 7
TOR ATACAMA – 4.1.2.3	***Environmental Receptor***	
	A description of the environmental receptors that may reasonably be expected to be adversely impacted by the source, taking into account the considerations for the element of the environment described under 4.1.1.	Section 7
TOR ATACAMA – 4.1.2.4	***Description of Uncertainty***	
	Describe any significant degree of uncertainty pertaining to the evaluation of sources, pathways and environmental receptors, including (but not limited to) lack of site specific information, limitations on modelling and quality of data. Describe any assumptions connected with the identified uncertainty. So far as is relevant, identify the sensitivity to change of any assumption that has been made, including whether a change in assumption may result in a new environmental impact.	Section 7
TOR ATACAMA – 4.1.2.5	***Confirmation of Impact Events***	
	For each potential impact event (including for MNES) provide: • an analysis of whether a source, pathway and receptor does exist (and if not, or if it remains uncertain, provide an explanation for the conclusion); and • a description of the likely impact from the source on the environmental receptor	Section 7
TOR ATACAMA – 4.2	***Control and Management Strategies, Uncertainty Assessment, Statement of Environmental Outcomes and Criteria***	
	For each impact event confirmed in clause 4.1.2.5, the information listed in clauses 4.2.1-4.2.4 must be provided	

Framework	Requirement	Section included
TOR ATACAMA – 4.2.1	***Control and Management Strategies***	
	In setting out an outline of the measures that the applicant intends to take to manage, limit or remedy environmental impacts as confirmed in clause 4.1.2.5 in accordance with section 36(1)(c)(ii)(B) of the *Mining Act 1971* and regulation 46(3) of the *Mining Regulations 2020*, the Minister determines in accordance with regulation 46(7)(e) of the *Mining Regulations 2020* that a proposal must: • Include a description of the strategies proposed to manage, limit or remedy each impact event (for impact events relating specifically to MNES, apply the avoid, mitigate and offset hierarchy); • Demonstrate that the control and management strategies proposed are commensurate with the potential impacts, achieve compliance with other applicable statutory requirements (including National Environmental Standards for MNES) and promote progressive rehabilitation; • Include a description of any significant degree of uncertainty pertaining to the likely effectiveness of proposed control and management strategies, including (but not limited to) lack of site specific information, limitations on modelling and quality of data; • Include a description of any assumptions connected with the identified uncertainty; and • So far as is relevant, identify the sensitivity to change of any assumption that has been made and assess the likelihood of an outcome not being achieved if an assumption is later found to be incorrect	Section 7
TOR ATACAMA – 4.2.2	***Statement of Proposed Environmental Outcomes***	
	Statements of the environmental outcomes that are expected to occur are required in accordance with section 36(1)(c)(ii)(C) of the Mining Act 1971 and regulation 46(4) of the Mining Regulations 2020 and must be made for each impact event confirmed in clause 4.1.2.5. The Minister determines in accordance with regulation 46(7)(e) of the Mining Regulations 2020 that a proposal must: • Provide a statement of the proposed environmental outcome(s) (including for MNES and completion outcomes assessed on a long term basis) for each impact event confirmed in clause 4.1.2.5. • Ensure that the statement of environmental outcome(s) describe the likely consequence of the expected impact on the environment by the proposed mine operations subsequent to the implementation of the control measures described in clause 4.2.1. • Provide a statement that demonstrates the environmental outcomes would be able to be achieved taking into consideration the effectiveness of the control strategies (clause 4.2.1) and description of uncertainty (clause 4.2.2).	Section 7

Framework	Requirement	Section included
TOR ATACAMA – 4.2.3	***Draft Measurement Criteria***	
	In preparing a draft statement of the criteria to be adopted to measure each of the proposed environmental outcomes in accordance with section 36(1)(c)(iii) of the Mining Act 1971 and regulation 46(5) of the Mining Regulations 2020, the Minister determines in accordance with regulation 46(7)(e) of the Mining Regulations 2020 that the draft criteria must: • as far as practical comply with the five elements set out in regulation 46(5) of the Mining Regulations 2020; • include demonstration of the successful implementation for the State significant environmental benefit, if native vegetation is proposed to be cleared and an on-ground off-set proposed in accordance with the Native Vegetation Act; • Should the applicant's assessment determine that a residual impact to MNES remains likely after the implementation of mitigation measures, include demonstrate of how the EPBC Act environmental offsets policy has been complied with; • be developed separately for construction, operation and completion, as appropriate; and • where appropriate, recognised industry standards (including National Environmental Standards for MNES), codes of practice or legislative provisions from other Acts should be used as criteria	Section 7
TOR ATACAMA – 4.2.4	***Draft Leading Indicator Criteria***	
	Where there is a high level of reliance on control measures strategies to achieve an environmental outcome, provide a draft statement of leading indicator criteria that will be used to give an early warning that a control measure strategy may fail or be failing	Section 7
TOR ATACAMA – 5	***Maps, Plans and Cross Sections***	
	In preparing a proposal in accordance with section 36(1)(c) of the Mining Act 1971 and regulation 46 of the Mining Regulations 2020, the Minister determines in accordance with regulation 46(7)(e) of the Mining Regulations 2020 that all maps and plans must comply with the following requirements relating to the amount of detail or information to be provided: • state and show the relevant datum (Australian Height Datum (AHD) is preferred); • metric units; • title, north arrow, scale bar, text and legend; • date prepared and author; • be of appropriate resolution and scale for represented information; and • be legible in both the hardcopy and electronic versions of the submission.	All Maps, plans and cross sections

Framework	Requirement	Section included
	All cross-sections must conform to the following standards: • state and show the relevant datum (Australian Height Datum (AHD) is preferred); • metric units; • title, scale bar, text and legend; • date prepared and author; • be of appropriate resolution and scale for represented information; and • be legible in both the hardcopy and electronic versions of the submission; and • be accompanied by a map showing the orientation of the cross-sections.	All Maps, plans and cross sections
TOR ATACAMA - 5.1	***List of Maps***	
TOR ATACAMA - 5.1.1	***Maps required for Description of the Existing Environment***	
TOR ATACAMA – 5.1.1.1	***Topographic Map showing:***	
	• application area boundaries;	Figure 1-1 Appendix A
	• existing surface contours	Figure 3-17
	• existing vegetation;	Figure 3-30
	• location of watercourses, including ephemeral and permanent rivers, creeks, swamps, streams, wetlands and any man-made water management structures;	Figure 3-26
	• surface water catchment boundaries	Figure 3-26
	• direction of drainage and discharge from the application area;	Figure 3-15
	• location and extent of all previously disturbed areas associated with previous mining;	Figure 1-1
	• location and extent of any known existing contamination; and	N/A
	• location and extent of any adjacent conservation reserves, heritage sites (in so far as may be permitted by the relevant legislation) or any other significant areas.	Figure 3-34
TOR ATACAMA – 5.1.1.2	**Local Geological Map showing:**	

Framework	Requirement	Section included
	• application area boundaries; • geology within the application area, including but not limited to location, dimensions and orientation (dip and strike), and extent of the mineral resource and ore reserve; • topsoil/subsoil variation if there is a variation in soils over the application area; and • natural geohazards in the application area.	Figure 3-13
TOR ATACAMA – 5.1.1.3	**Aquifer Potentiometric Surface Map(s) showing:**	
	• application area boundaries; • potentiometric surface contours/groundwater elevation contours and the time (or time period) the contours relate to; • interpreted direction(s) of groundwater flow; and • location of representative bores (where measurements were obtained of which the contours are based on) used to establish this information.	Figure 3-26
TOR ATACAMA – 5.1.1.4	**Land Access Map showing:**	
	• application area boundaries; • cadastral information for the Tenement (including land title(s) and ownership); • any exempt land; • location of residences within and near the application area; and • human infrastructure.	Figure 1-1
TOR ATACAMA – 5.1.1.5	**Caves Map showing:**	
	• application area boundaries; and • location of the cave(s).	NA
TOOR00X - 5.1.2	***Map(s) and Plan(s) required for Description of Proposed Mine Operations***	
TOR ATACAMA – 5.1.2.1	***Site layout map showing all components of the proposed mining operation including (but not limited to):***	

Framework	Requirement	Section included
	• application area boundaries; • location of surface water and sediment management infrastructure; • location of process water dams; • location of fuel and chemical storage areas; • location of haul/access roads; • location of fixed plant; • location of mobile plant for stage 1 of mining; • location of visual screening measures; • location of fencing; • location and extent of topsoil/subsoil and product stockpiles. • location and extent of all areas proposed to be disturbed from mining including waste rock, silt/slime dams, mine infrastructure, processing plant, process water ponds, waste disposal facilities; and • location and extent of open pit(s) and/or underground workings. • location of key environmental features that are within or in close proximity to the Tenement and that are relevant to the design of the Site Layout Plan, including but not limited to housing and infrastructure, existing heritage sites, existing ephemeral and permanent rivers, watercourses, creeks or dams and/or existing native vegetation	Figure 4-1
TOR ATACAMA – 5.1.2.2	**Sequence of mining and progressive rehabilitation map showing:**	
	• application area boundaries; • staging of each progressive mining stage; • proposed native vegetation clearance; • location and applicable buffer zones for protection of native vegetation that will not be cleared; and • conceptual staging of each progressive rehabilitation stage.	Figure 4-3 Figure 4-4
TOR ATACAMA – 5.1.2.3	**Crushing, grinding and processing plant plan showing:**	
	• application area boundaries • layout of crushing, grinding and processing plant(s) and ancillary plant and infrastructure; and • if required; including lining and drainage systems.	Figure 4-6 Figure 4-7

Framework	Requirement	Section included
TOR ATACAMA – 5.1.2.4	**Tailings Storage Facility (TSF) plan showing:**	
	• application area boundaries • conceptual drawings and plans for design, construction, operation and completion of all facilities; • size, shape, height and method of construction; and • location of any waste material deemed to be hazardous including potentially acid forming material.	NA
TOR ATACAMA – 5.1.2.5	**Access route map showing:**	
	• application area boundaries • access route for heavy vehicles; • exit route for heavy vehicles; and • any road upgrades or new roads to be constructed.	Figure 4-12
TOR ATACAMA – 5.1.2.6	**Completion map showing:**	
	• application area boundaries • conceptual final landforms (including rehabilitated and non-disturbed areas); • proposed topographical contours of the entire site (including rehabilitated and non-disturbed areas); • backfilled and remaining underground workings; • location of waste disposal areas (including waste rock dumps, tailings storage facilities and PAF encapsulation); and • interpreted geology including all rock types	Figure 4-17
TOR ATACAMA – 5.2	***Summary of Cross-Sections and Long Sections***	
	Following is a summary of all cross-sections and long sections required in the proposal:	
TOR ATACAMA – 5.2.1	***Cross-sections required for description of the existing environment***	

Framework	Requirement	Section included
TOR ATACAMA – 5.2.1.1	***Long section and geological cross-section(s) showing:***	
	• a representation of the geological profile within the application area; and • depth of the resource and any overlying overburden.	Figure 3-13
TOR ATACAMA – 5.2.1.2	***Hydrogeological cross-section(s) showing:***	
	Include a series of hydrogeological cross-sections that represent the following at a regional scale and/or tenement application scale, as specified: • mineral claim boundaries; • major geological units (regional scale); • geological units showing aquifer and confining units (tenement scale); • aquifer systems (regional and tenement scale) including any palaeochannels; • interpreted hydrostratigraphy showing the known and inferred groundwater heads/groundwater elevations, interpreted groundwater flow direction, recharge and discharge mechanisms (if applicable); • location of GDEs; and other groundwater dependent receptors and users • interpreted faults (regional and tenement scale); • mineralised zone (tenement scale); • location of representative drill log sites from which geological information was obtained (regional and tenement scale); and • location of representative monitoring bores from which baseline groundwater information was obtained.	Figure 3-21 Figure 3-22 Figure 7-2
TOR ATACAMA – 5.2.2	***Cross-sections required for description of operations***	
TOR ATACAMA – 5.2.2.1	***Mining Operation cross-section(s) showing:***	
	• pre-mining natural surface; • proposed pit depth; • proposed pit dimensions (length and width); • proposed pit batters and benches; • location of underground shafts and stopes; and • stages of operation.	Figure 4-2

Framework	Requirement	Section included
TOR ATACAMA – 5.2.2.2	**Completion cross-section(s) showing:**	
	• pre mining natural surface; • proposed conceptual rehabilitated final batters and benches; • predicted final groundwater elevations; and • proposed conceptual final rehabilitated surface.	
TOR ATACAMA – 6	**Reasonable Prospect of Access to Land**	
	In preparing a statement under regulation 30(1)(e)(i) of the *Mining Regulations 2020* that demonstrates that there is a reasonable prospect that the land in respect of which an ML is sought could be effectively and efficiently mined, the Minister determines in accordance with regulation 30(2) of the *Mining Regulations 2020* that this statement must be supported by the following evidence: • A description of any waivers of exemption obtained, and/or information on the status of waivers of exemption yet to be negotiated/finalised under Section 9AA of the *Mining Act 1971*; and • A description of any native title mining agreements obtained under the *Mining Act 1971* or Aboriginal Land Use Agreements (ILUA) under the *Native Act 1993* (Cth).	Section 1.7
TOR ATACAMA – 7	**Description of contributions to the Economy**	
	For the purposes of regulation 30(1)(g) of the *Mining Regulations 2020*, the Minister determines that the following information must accompany an application for an ML: Describe: • goods and services used in the local community, state and external to state; • wages and other employee benefits; • economic benefits derived from local employment; • approximate royalty payments and other direct state government taxes; and • any other potential economic contributions proposed during the development of the mine, operation of the proposed mine and post completion.	Section 8
TOR ATACAMA – 8	**Reserves or Resources (or Both)**	
	Provide: • a JORC compliant reserve or resource estimate (or both); and	Section 4.3.1

Framework	Requirement	Section included
	• the accompanying JORC Public Report and competent person statement; or (if a JORC compliant reserve or resource (or both) has not been reported) • a detailed estimate of the resource to be mined, the basis of this estimate, and evidence that demonstrates that the resource can be economically mined at current market prices	
TOR ATACAMA	**Additional information required to address Matters of National Environmental Significance (MNES)**	
	The application for an ML must be accompanied by a proposal that complies with section 36 an of the Mining Act 1971 and regulations 46 and 47 of the Mining Regulations 2020, and must comply with the following determinations of this Terms of Reference as set out below:	
TOR ATACAMA – 9	**Background and Description of the EPBC Act Action and MNES**	
	The Proposal must include how the action relates to any other actions (of which the proponent should reasonably be aware) that have been, or are being, taken or that have been approved in the region affected by the action. The Proposal must also provide details on the current status of the action as well as the consequences of not proceeding with the action.	Section 8
TOR ATACAMA – 10	**Impacts**	
	The Proposal must provide an assessment including potential impacts (including direct, indirect, consequential and cumulative impacts) that may occur as a result of all elements and project phases of the proposed action on the protected matter. Consideration of impacts must not be confined to the immediate areas surrounding the proposed actions but must also consider the potential of the proposed action to impact on adjacent areas that are likely to contain protected matters. For each protected matter, this must include, but not be limited to an assessment of: • the direct and indirect loss and/or disturbance of habitat from the proposed action. This must include the quality of habitat and total area in hectares (and number of individuals, if available and applicable), and the area of potential habitat for the species and communities likely to be impacted; • details on whether any impacts are likely to be unknown, unpredictable or irreversible or sub-lethal (reversible over time) and what confidence is placed on the predictions or relevant impacts; • an analysis of the acceptability of the relevant impacts; • any technical data and other information used or needed to make a detailed assessment of the relevant impacts;	Section 8

Framework	Requirement	Section included
	• a local and regional scale analysis of the likely impacts. This should include a discussion of connectivity, potential cumulative impacts and information on the long term viability of the protected matter within the broader landscape region. All discussions and conclusions drawn regarding the assessment of direct or indirect impacts from the proposed action should include a full justification based on the best available information. The discussion of impacts must incorporate relevant conservation advices, recovery plans and threat abatement plants, if applicable. If these are not applicable, a brief statement to this effect must be included Note: the proponent may choose to integrate Section 10 (MNES) with Section 4 (Management of Environmental Impacts).	
TOR ATACAMA – 11	**Avoidance, Alternatives, Mitigation and Safeguards**	
	The Proposal must provide information on specific measures proposed to avoid, mitigate and manage the impacts to the relevant protected matters from the proposed action. A description of proposed avoidance, management and mitigation measures relation to MNES should be presented in the form of management plans or suitable alternatives. The discussion must incorporate conservation advices, recovery plans and threat abatement plans, where relevant. Specific measures should be presented in a detailed management plan for the protected matter likely to be impacted by the proposed action. To assist you, the Department of Climate Change, Energy, the Environment and Water's (DCCEEW) *Environmental Management Plan Guidelines* are available at www.environment.gov.au/epbc/publications/environmental-management-plan-guidelines. Documentation should clearly set out the following measures for each environmental issue and protected matter likely to be impacted by the proposed action. Measure including, but not limited to, the following items must be outlined in the documentation to: • address all project phases of the proposed action; • state the environmental and conservation objectives, performance criteria, monitoring, reporting, corrective action, responsibility and timing for each environmental issue; • describe contingencies for events, such as the identification of protected matters during pre-commencement searches (e.g. translocation management protocols); • include maps that illustrate the location of any exclusion zones or buffer zones and details on how these areas will be protected; • provide details of ongoing research and monitoring programs to support an adaptive management approach and determine the effectiveness of the proposed mitigation measures; • provide an assessment of the expected or predicted effectiveness of the avoidance and mitigation measures for each MNES protected matter. This includes the scale and intensity of impacts of the proposed action and the on-ground benefits to be gained through	Section 8

Framework	Requirement	Section included
	each of these measures. Where impact on a protected matter is avoided this should be stated. • any statutory or policy basis for the mitigation measures; • the cost of the mitigation measures; • the name of the agency responsible for endorsing or approving each mitigation measure or monitoring program; • a consolidated list of mitigation measures proposed to be undertaken to prevent, minimise, or compensate for the relevant impacts of the action, including mitigation measures proposed to be taken by State governments, local governments or the proponent	
	Should the applicant's assessment determine that a residual impact to MNES remains likely after the implementation of mitigation measures, provide information of the likely residual impacts to the protected matter after the proposed avoidance or mitigation measures are taken into account: • include reasons why avoidance or mitigation of impacts is not reasonably achieved; • identify the significant residual impacts on protected matters; and • demonstrate how the EPBC Act environmental offsets policy has been considered. The Proposal must include any feasible alternatives to the action to the extent reasonably practicable, including: • if relevant, the alternative of taking no action; • a comparative description of the impacts of each alternative on the triggered MNES protected by controlling provisions of Part 3 of the EPBC Act for the action; and • sufficient detail to make clear why any alternative is preferred to another. Short, medium and long-term advantages and disadvantages of the options must be discussed. *Note: the proponent may choose to integrate Section 11 (MNES) with Section 4 (Management of Environmental Impacts).*	Section 8
TOR ATACAMA – 12	**Offsets (if required)**	
	The Proposal must include an assessment of the likelihood of residual impacts occurring, after mitigation and management measures relating to the project have been applied. This includes direct impacts such as habitat clearing and indirect impacts such as degradation of retained habitat. If residual significant impacts to protected matters are likely, the proposal must provide: • details of an offset package (this may be in the form of an offset management plan) proposed to be implemented to compensate for any residual significant impact of the project (if relevant); • details of how the offset will compensate for the significant residual impacts upon protected matters, resulting from the action;	Section 8 A federal offset is not proposed.

Framework	Requirement	Section included
	• a description of how the offset will ensure the protection, conservation and management of protected matters for the duration of the impact; • an analysis about how the offset meets the requirements of the Department of Climate Change, Energy, the Environment and Water's (DCCEEW) Environment Protection and Biodiversity Conservation Act 1999 Offset Policy October 2012; and • The anticipated cost (financial and other) of the delivery of the offset The offset proposal should include, but not be limited to: • the location, description and suitability of the proposed offset site, including baseline conditions, environmental values and connectivity with other relevant habitat; • the extent to which the proposed offset actions correlate to, and adequately compensate for, the impacts of protected matters and habitat critical to the survival of protected matters; • a description of the conservation gain to be achieved by the offset; • information on current land tenure of any proposed offset and the method of legally securing the offset for at least the duration of the impact • measures to protect, manage and rehabilitate the ecological community and protected matter habitat at the offset site, including timing, frequency and longevity for each measure and performance criteria that must be met; • details of monitoring and reporting activities to assess the success of the offset; • an assessment of the proposed offset with clear justification for each input entered The analysis and information should be undertaken in accordance with DCCEEW's Offset Guide (offset calculator and justification of figures used in the calculation), which is available on DCCEEW's website. The information provided should specify in detail the proposed offset and fully explain how the offset will compensate for the impacts of the proposal on MNES for the full duration of the impact. Any management plan proposed to minimize the impact to the level anticipated and deliver the offset should also be provided.	
TOR ATACAMA – 13	**Social and Economic Matters**	
	The information must address the economic and social impacts (both positive and negative) of the proposed action. Consideration of economic and social matters may include: • details of any public consultation activities undertaken and the outcomes; • details of any consultation with Aboriginal stakeholders; • any monitoring programs to monitor ongoing changes to economic and social characteristics potentially affected by the proposed action; • projected economic costs and benefits of the project, including the basis for their estimation through cost/benefit analysis or similar studies; • employment opportunities expected to be generated by the project at each phase of the proposed action;	Section 5.4 Section 7.13 Section 9

Framework	Requirement	Section included
	• benefits to the local and wider community as a result of the proposed action. Economic and social impacts should be considered at the local, regional and national levels.	
TOR ATACAMA – 14	**Ecologically Sustainable Development**	
	The information must include a description of the proposed action in relation to the principles of ecologically sustainable development, as defined in the EPBC Act: • the long-term and short-term economic, environmental, social and equitable considerations; • the precautionary principle which states that a lack of full scientific certainty should not be used as a reason for postponing measures to prevent environmental degradation where there are threats of serious or irreversible environmental damage • the principles of inter-generational equity which states that the present generation should ensure that the health, diversity and productivity of the environment is maintained or enhanced for the benefit of future generations; • the conservation of biological diversity and ecological integrity should be a fundamental consideration in decision-making; • improved valuation, pricing and incentive mechanisms should be promoted	Section 8.8
TOR ATACAMA – 15	**Environmental Records of Person(s) proposing to take the Action**	
	The information provided must include details of any proceedings under a Commonwealth, State or Territory law for the protection of the environment or the conservation and sustainable use of natural resources against: • the person proposing to take the action; and • for an action for which a person has applied for a permit, the person making the application. If the person proposing to take the action is a corporation, details of the corporation's environmental policy and planning framework must also be included	Section 8.9
TOR ATACAMA – 16	**MNES Information Sources provided in the Proposal**	
	For information relating to MNES addressed in the Proposal, state: • the source of the information; • how recent the information is; • how the reliability of the information was tested; • what uncertainties (if any) are in the information; and • what guidelines, plans and/or policies were considered.	Section 8.9

Framework	Requirement	Section included
	Note: the proponent may choose to integrate Section 13 requirements with Section 4 (Management of Environmental Impacts) and/or Section 10 to align where the information sources are used.	
TOR ATACAMA – 17	**MNES Conclusion**	
	For MNES matters, provide an overall conclusion as to the environmental acceptability and sustainability of the proposal on each MNES, including: • a discussion on the consideration with the requirements of the EPBC Act, including the objects of the EPBC Act, • reasons justifying undertaking the proposal in the manner proposed, including the acceptability of the avoidance and mitigation measures; • if relevant, a discussion of residual impacts and any offsets and compensatory measures proposed or required for significant residual impacts on MNES, and the relative degree of compensation and acceptability; and • discussion of how impacts to the listed Malleefowl (*Leipoa ocellata*), Ooldea Guinea flower (*Hibbertia crispula*) and the Sandhill Dunnart (*Sminthopsis psammophila*) are acceptable, when considering all proposed avoidance, mitigation and offset measures, as consistent with the following statutory documents: o Survey guidelines for Australia's threatened birds: Guidelines for detecting birds listed as threatened under the EPBC Act (2010) – Department of the Environment, Water, Heritage and the Arts; o Survey guidelines for Australia's threatened mammals: Guidelines for detecting mammals listed as threatened under the EPBC Act (2011) – Department of Sustainability, Environment, Water, Population and Communities; o Threat abatement plan for predation by feral cats (2015) – Department of the Environment; o Threat abatement plan for competition and land degradation by rabbits (2016) – Department of the Environment and Energy; o Threat abatement plan for predation by European red fox (2008) – Department of the Environment, Water, Heritage and the Arts; o Threat abatement plan for predation, habitat degradation, competition and disease transmission by feral pigs (Sus scrofa) (2017) – Department of the Environment and Energy; o Threat abatement plan for competition and land degradation by unmanaged goats (2008) – Department of the Environment, Water, Heritage and the Arts; o National recovery plan for Malleefowl (*Leipoa ocellata*) (2007) – Department for Environment and Heritage, South Australia o Conservation Advice *Sminthopsis psammophila* sandhill Dunnart (2015) – Department of the Environment	Section 8.10

Framework	Requirement	Section included
	○ Approved Conservation Advice for *Hibbertia crispula* (Ooldea Guinea-flower) (2008) – Department the Environment, Water, Heritage and the Arts	