Escott Zeolite Mine

Rehabilitation Management Plan

Zeolite Australia Pty Ltd

234 Escott Road, Werris Creek NSW 2341

Prepared by:

SLR Consulting Australia

10 Kings Road, New Lambton NSW 2305,
Australia

SLR Project No.: 630.30206.00000

18 August 2023

Revision: 03

Revision Record

Revision	Date	Prepared By	Checked By	Authorised By
630.30206-Zeolite RMP_V3	18 August 2023	Sam McDonald	Stephen Shoesmith	Stephen Shoesmith
630.30206-Zeolite RMP_V2	13 March 2023	Sam McDonald	Stephen Shoesmith	Stephen Shoesmith
630.30206-Zeolite RMP_V1	19 August 2022	Joel Cook	Reine Byrne	Stephen Shoesmith

Basis of Report

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

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

Summary Table

Summary Table	
Name of Mine	Escott Zeolite Mine
Rehabilitation Management Plan Commencement Date	July 2022
Mining Authorisations (Lease / Licence No.)	ML1356
Name of Authorisation holder(s)	Zeolite Australia Pty Ltd
Name of Mine Operator (if different)	Zeolite Australia Pty Ltd
Date	August 2023
Version	3

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Acronyms and Abbreviations

AL	Assessment Lease
AMD	Acid Mine Drainage
ANC	Acid Neutralising Capacity
bcm	Bank Cubic Metre
DPIE-RR	Department of Panning, Industry and Environment – Resources Regulator
DA	Development Application
EMP	Environment Management Plan
EPA	Environment Protection Authority
EPL	Environment Protection Licence
LEP	Local Environmental Plan
LGA	Local Government Area
MOP	Mining Operation Plan
NAF	Non-Acid Forming
NAG	Net Acid Generation
NAPP	Net Acid Production Potential
PAF	Potentially Acid Forming
PAH	Polycyclic aromatic hydrocarbons
PIRMP	Pollution Incident Response Management Plan
POEO Act	*Protection of the Environment Operations Act 1997*
PPM	Parts per Million
REA	Rejects Emplacement Area
RMP	Rehabilitation Management Plan
RQAP	Rehabilitation Quality Assurance Process
RR	Resources Regulator
SEE	Statement of Environmental Effects
SSD	State Significant Development
SSI	State Significant Infrastructure
TARP	Trigger Action Response Plan
TEC	Threatened Ecological Communities
TSF	Tailings Storage Facility
WCC	Werris Creek Coal
WCCM	Werris Creek Coal Mine

1.0 Introduction to Mining Project

Escott Zeolite Mine (Zeolite) is an open cut zeolite mine and processing plant owned and operated by Zeolite Australia Pty Limited (ZAPL). Zeolite comprises Mining Lease (ML) 1356, approximately 1.5km South of Werris Creek and 11km North-Northwest of Quirindi in the Northwest slopes and plains region of New South Wales, within an area defined as Gunnedah Coalfield (**Figure 1**).

This Rehabilitation Management Plan (RMP, the Plan) has been prepared in accordance with the Mining Exploration and Geoscience – Resources Regulator's (RR) *Form and Way: Rehabilitation Management Plan for Large Mines* (Resource Regulator, 2021) and associated guidelines (refer **Section 1.3**). The Plan has also been prepared to satisfy the relevant conditions of Mining Lease ML 1356.

This RMP has been prepared by SLR Consulting Australia Pty Limited (SLR) in conjunction with Zeolite.

1.1 History of Operations

1.1.1 Historic Consent

Zeolite was granted development consent by the former Quirindi Shire Council (now Liverpool Plains Shire Council) in 1988 with the authorization of Development Application (DA) 27/88 for a proposed mineral extraction. This followed with DA 27/88 and 29/93 in 1989 and 1994 which approved the development for a zeolite mine and processing plant on site.

In 1992 Zeolite were granted Private Mining Agreement 25, authorizing the resource activity of open cut mining zeolite for the title owner within a 2-hectare boundary. This later transitioned into a 10-year Mining Lease (ML) in 1994, ML 1356 which encompasses an area of 96.6 hectares (ha). In 2004, this ML was renewed for a further 21-year term, adding the ML 1356 Conditions. The *Environment Operations Act* was implemented in 1997. This required Zeolite to acquire an Environmental Protections Licence (EPL) to cover their consents and set out conditions relating to pollution prevention and monitoring. They were granted EPL 6378 in 1999 which allowed for the mining of between 0-30,000 Tonnes of zeolite material annually.

Since the commencement of exploration activities in 1988, subsequent small scale mining campaigns have produced between 2,000 and 6,000 tonnes of zeolite a year. Since 2018, production was increase to up to 15,000 tonnes (T) of zeolite per annum, due to increasing demands.

1.1.2 Current Consent

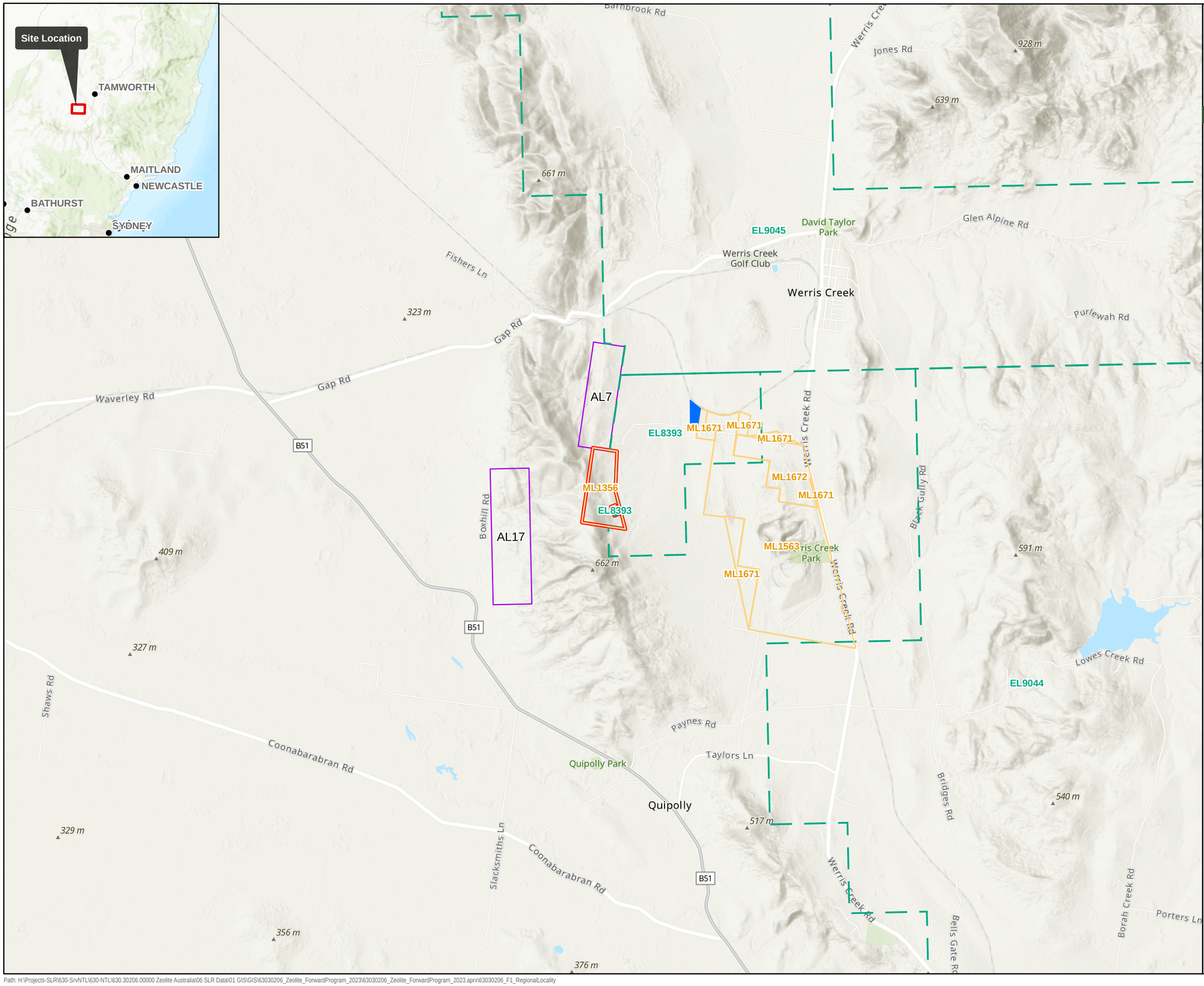
Zeolite currently operates under the conditions and commitments of ML 1356 and EPL 6378. Under this authorisations and licence, Zeolite is authorized to produce up to 30,000 T of Zeolite annually. All authorisations and consents are listed in **Section 1.2**.

Following on from the identification of additional markets for the zeolite product, Zeolite have applied for a new DA for the expansion of the current mining operations into the adjoining Assessment Lease 7 (AL7) located to the north of ML 1356. To accommodate the expansion, Zeolite Australia are planning to add modifications and/or an expansion of their existing processing facility located off Escott Road, east of the mining operations.

ZEOLITE MINE REHABILITATION MANAGEMENT PLAN

REGIONAL LOCALITY

FIGURE 1



LEGEND

- Project Approval Boundary
- Zeolite Processing Plant
- Assessment Lease
- Exploration Licence
- Mining Lease

Data sources:
Basemap: Esri, HERE, Garmin, Foursquare, METI/NASA, USGS, Esri, Geoscience Australia, NASA, NGA, USGS, Esri, HERE, Garmin, FAO, NOAA, USGS, Esri, USGS
Project Approval Boundary and mining boundaries: © State Government of NSW and Department of Regional New South Wales 2019

0 1 2 km

Coordinate System:	GDA2020 MGA Zone 56
Scale:	1:70,000 at A4
Project Number:	630.30206
Date Drawn:	17-Aug-2023
Drawn by:	JH

SLR

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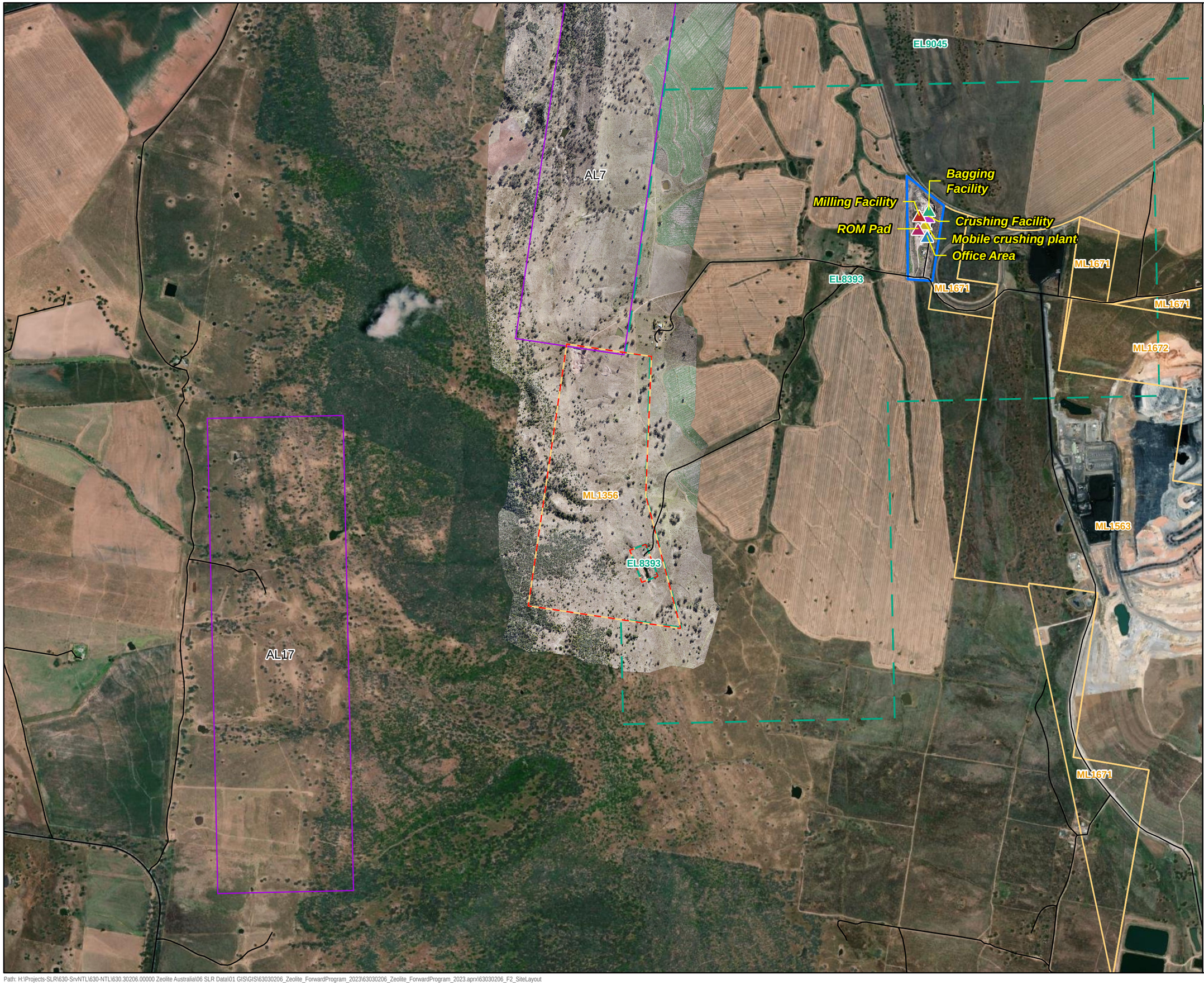
ZEOLITE MINE REHABILITATION MANAGEMENT PLAN

SITE LAYOUT

FIGURE 2



LEGEND

- Project Approval Boundary
- Zeolite Processing Plant
- Assessment Lease
- Exploration Licence
- Mining Lease
- Roads
- Bagging Facility
- Crushing Facility
- Milling Facility
- Mobile crushing plant
- Office Area
- ROM Pad

Data sources:
NSW SS
Basemap: Maxar
Project Approval Boundary and mining boundaries: © State Government of NSW and Department of Regional New South Wales 2019
High resolution imagery: Processing Plant - Wildsky Drone Survey (2022)
Zeolite Mine - Stewart Surveys (2023)

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0 250 500 m

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Scale:	1:20,000 at A4
Project Number:	630.30206
Date Drawn:	17-Aug-2023
Drawn by:	JH

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1.2 Current Development Consents, Leases and Licences

1.2.1 Development Consents

Table 1 presents the development consent held by Zeolite.

Table 1: Development Consents

Project Approvals/Development Consents				
Consent	**Issuing/Responsible Authority**	**Date of last renewal**	**Expiry**	**Comments**
Development Application (DA 27/88)	Liverpool Plains Shire Council (Formerly Quirindi Shire Council)	16/02/1989	NA	Proposed Zeolite mine within portions 163, 215 and part 235 Parish of Grenfell. (MLA 212 now ML 1356)
Development Application (DA 29/93)	Liverpool Plains Shire Council (formerly Quirindi Council)	23/05/1994	NA	Zeolite processing plant, portion 139, Parish of Grenfell. (Now Lot 34 in DP856002).

1.2.2 EPBC Approval

The Commonwealth Environment Protection and Biodiversity Conservation Act 1999 (EPBC Act) requires consideration of the potential for a "significant impact" to be imposed by an activity on a 'matter of national environmental significance' (MNES). If such an impact is likely to be imposed, the activity must be referred to the Commonwealth for determination as to whether it constitutes a "controlled action".

The Zeolite operation do not constitute a controlled action under the EPBC Act, and therefore no approval from the Australian Government Minister for the Environment is required.

1.2.3 Authorisations

Zeolite currently holds Mining Lease (ML) 1356. This authorisation is outlined in Table 1 2.

Table 2: Authorisations

Mining/Exploration Authorisations				
Tenements (issue date)	**Issuing / Responsible Authority**	**Date of last renewal**	**Expiry**	**Comments**
Mining Lease No 1356 (1992)	DPE	02/08/2004	01/08/2025	Mining Lease Conditions 2004. First renewal of initial 10-year term 1994 to 2004 (former PMA 25)
Assessment Lease No 7 (1992)	DPE	05/03/2018	28/11/2022	Renewed
Assessment Lease No 17 (1992)	DPE	12/05/2009	12/05/2020	Renewal sought
Exploration License No 7901 (1992)	DPE	14/02/2012	14/02/2020	3 units. Renewed for 3 years.
Exploration Licence No 8393 (1992)	DPE	28/01/2021	06/10/2023	Granted

1.2.4 Licences

A summary of all licences held by Zeolite for the mining operations are included in **Table 3.**

Table 3: Licences

Approval	Issuing/Responsible Authority	Date of last renewal	Expiry	Comments
Environment Protection Licence No. 6378 (1999)	Environment Protection Authority	12-03-2021	12-03-2026	Mining for minerals (0-30,000 tonnes obtained)

1.3 Applicable Guidelines

In addition to the regulatory requirements identified above, this Plan has been prepared with consideration for the following guidelines, standards, and policies:

- *Form and way: Rehabilitation Management Plan (large mines)*
- *Form and way: Rehabilitation objectives, rehabilitation completion criteria and final landform and rehabilitation plan for large mines*
- *Guideline: Rehabilitation risk assessment*
- *Guideline: Rehabilitation objectives and rehabilitation completion criteria*
- *Planning for Integrated Mine Closure Toolkit (ICMM, 2008)*
- *Mining Amendment (Standard Condition of Mining Leases – Rehabilitation) Regulation 2021*
- *Strategic Framework for Mine Closure (ANZMEC 2000)*
- *Leading Practice Sustainable Development Program for the Mining Industry – Mine Closure and Completion, Mine Rehabilitation (Commonwealth Department of Industry, Tourism and Resources)*
- Best Practice Environmental Management in the Mining Industry Series
- Enduring Value (Mineral Council of Australia 2015), and
- *State Environmental Planning Policy (Mining, Petroleum Production and Extractive Industries) 2007 (Mining SEPP).*

1.4 Land Ownership and Land Use

1.4.1 Land Ownership

ML 1356 occupies an area of 96.96 ha (excluding the 2 ha of former PMA 25) and is located within parts of freehold land described as Lots 215, 235 and 163 in DP 751017 as indicated in **Figure 1** and **Figure 2.** After review of reserves of Zeolite, it is the intention of Zeolite that ML 1356 will be renewed for a further term under the *Mining Act 1992* (“Mining Act”).

This land is owned by Werris Creek Coal Pty Limited and is in the Parish of Grenfell, County of Buckland in the Liverpool Plains Shire Council, local government area. Access to ML 1356 is via Escott Road, sections of Crown Road then by mutual agreement with the landowner across Lots 163 and 215 in DP 751017.

Two Assessment Leases, AL 7 covering an area of 129 ha immediately north and adjoining ML 1356 and AL 17 covering an area of 2.2 km2 separate and to the west are also held by ZAPL. In addition, and encompassing the above authorities, Exploration Licence EL 7901 (Act 1992) covering 3 units was granted 14 February 2012, renewed for a 3-year period with expiry 14 February 2020. Refer to **Figure 3.**

1.4.2 Historic Land Use

Land use in the surrounding area is smaller scale mixed farming, however, this trends to larger more intensive agriculture further west on the Liverpool Plains. To the south of the Mine, between Taylors Lane and Paynes Road, several landholders are dependent on irrigation to sustain relatively high intensity lucerne cropping with cattle grazing. Land in the Zeolite specific area was cultivated land, sloping land with scattered tree coverage, and was used for grazing.

Other notable current or previous land uses within or immediately surrounding the Mine are as follows:

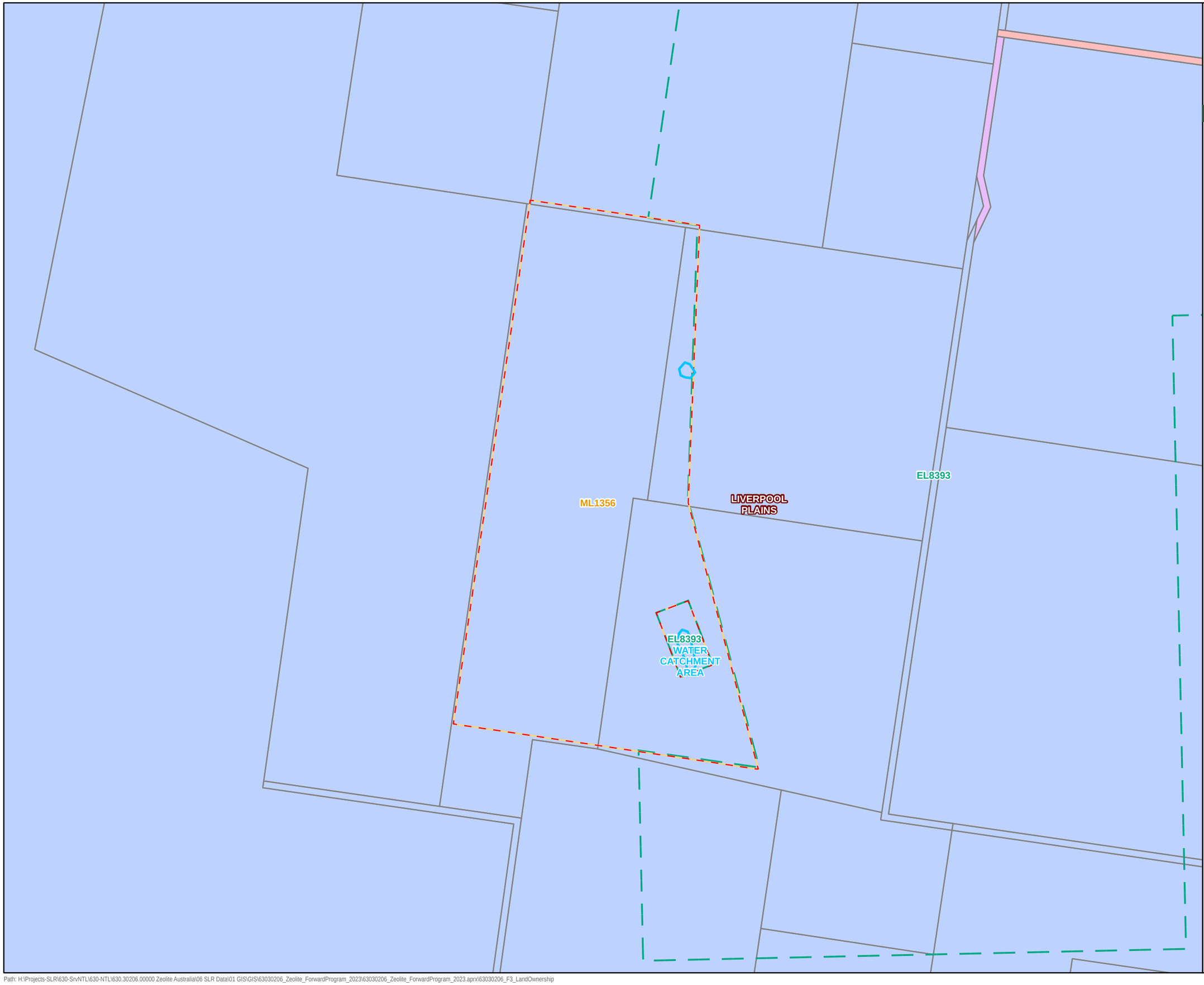
- Former gravel extraction quarries of Liverpool Plains Shire and Tamworth Regional Council which have been incorporated into the open cut of the Mine,
- A large open cut coal mine owned, run and serviced by Werris Creek Coal Pty Limited,
- The former Werris Creek Colliery, remnants of which have been identified on the “Preston Park” property, and
- A biodiversity offset area on lands of the Mine and surrounding properties.

In the sites early history, it had evidence of European disturbance by grazing and clearing, but no evidence pre-European disturbance.

ZEOLITE MINE REHABILITATION MANAGEMENT PLAN

LAND OWNERSHIP

FIGURE 3



LEGEND

- Project Approval Boundary
- Exploration Licence
- Mining Lease
- Property Boundaries
- Water Catchment Area
- Local Government Area

Land Ownership Category

- Crown
- Freehold
- Local Government Authority

Data sources:
NSW SS
Project Approval Boundary and mining boundaries: © State Government of NSW and Department of Regional New South Wales 2019

0 200 400 m

Coordinate System:	GDA2020 MGA Zone 56
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Drawn by:	JH

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ZEOLITE MINE REHABILITATION MANAGEMENT PLAN

LAND USE AND CONTOURS

FIGURE 4

LIVERPOOL PLAINS

ML1356

EL8393

EL8393

LEGEND

- Project Approval Boundary
- Exploration Licence
- Mining Lease
- Roads
- Property Boundaries
- Local Government Area
- Current Landform Contour (5m)

Land Use

- 1.3.0 Other minimal use
- 2.1.0 Grazing native vegetation
- 3.2.0 Grazing modified pastures
- 3.3.0 Cropping
- 5.4.0 Residential and farm infrastructure
- 6.2.0 Reservoir/dam

Data sources:
NSW SS
Project Approval Boundary and mining boundaries: © State Government of NSW and Department of Regional New South Wales 2019
High resolution imagery: Processing Plant - Wildsky Drone Survey (2022)
Zeolite Mine - Stewart Surveys (2023)
Landuse: © State Government of NSW and Department of Planning and Environment 2020

0 100 200 m

Coordinate System:	GDA2020 MGA Zone 56
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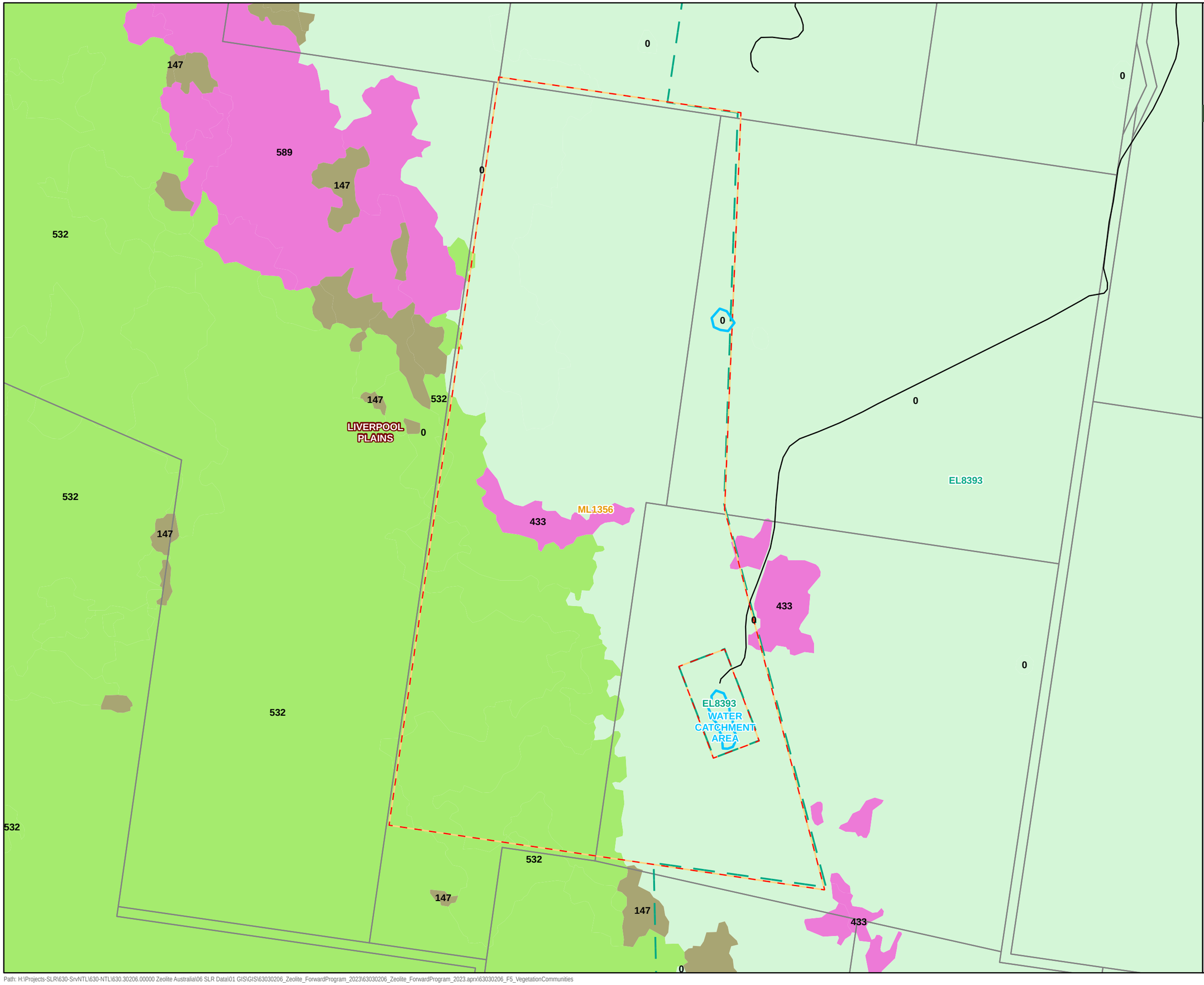
ZEOLITE MINE REHABILITATION MANAGEMENT PLAN

VEGETATION COMMUNITIES

FIGURE 5



LEGEND

- Project Approval Boundary
- Exploration Licence
- Mining Lease
- Roads
- Property Boundaries
- Local Government Area
- Water Catchment Area

Vegetation Mapping

- Dry Sclerophyll Forests (Shrubby sub-formation)
- Grassy Woodlands
- Not native vegetation
- Rainforests

Data sources:
NSW SS
Project Approval Boundary and mining boundaries: © State Government of NSW and Department of Regional New South Wales 2019
High resolution imagery: Processing Plant - Wildsky Drone Survey (2022)
Zeolite Mine - Stewart Surveys (2023)
Landuse: © State Government of NSW and Department of Planning and Environment 2020
Vegetation: NSW OEH Border Rivers Gwydir/Namoi Regional Native Vegetation V2 (2015)

0 100 200 m

Coordinate System:	GDA2020 MGA Zone 56
Scale:	1:7,000 at A4
Project Number:	630.30206
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Drawn by:	JH

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1.4.3 Current Land Use

The current land use for the site is a zeolite mineral mine and processing plant. Zeolite will continue to develop the northern block of ML1356. Areas within ML1356 not disturbed by mining will remain as native pasture species with scattered trees that fits the description of Box-Gum Woodland.

1.4.4 Future Land Use

The future land use nominated for Zeolite consists of a safe, stable, non-polluting and sustainable landform.

It is anticipated that areas disturbed by mining will be revegetated to predominately native vegetation. Revegetation will include woodland vegetation communities, generally consistent with the pre-mining landscape to facilitate a range of post mining land uses which may include grazing, woodland vegetation, habitat features for fauna and flora corridors.

Drainage structures will re-establish water flows within and around rehabilitated landforms. Backfilling of mining areas will be undertaken to form depressions within the landform, with mine voids to remain as functional water storages. Water stored within void areas could be used for stock watering, bushfire response or ecosystem features.

2.0 Final Land Use

2.1 Regulatory Requirements for Rehabilitation

The regulatory requirements specific to post mining land use, rehabilitation, and closure at Zeolite are summarised in Table 2 1.

Table 4: Regulatory Requirements Rehabilitation

Condition	Requirement	Domain	Timing	Section Addressed
ML 1356				
Condition 13	Rehabilitation a) Land disturbed must be rehabilitated to a stable and permanent form suitable for a subsequent land use acceptable to the Director-General and in accordance with the Mining Operations Plan so that: a. There is no adverse environmental effect outside the disturbed area and that the land is properly drained and protected from soil erosion b. the state of the land is compatible with the surrounding land and the land use requirements c. the landforms, soils, hydrology and flora require no greater maintenance that that in the surrounding land. d. In cases where revegetation is required and native vegetation has been removed or damaged, the original species must be re-established with close reference to the flora survey included in the Mining Operations Plan. If the original vegetation was not native, any re-established vegetation must be appropriate to the area and at an acceptable density. e. The land does not pose a threat to public safety. b) Any topsoil that is removed must be stored ad maintained in a manner acceptable to the Director-General.	1, 4, 5	It is noted that the RMP (this document) has superseded the MOP	Section 4.1, 4.2, 6
Condition 16	**Prevention of Soil Erosion and Pollution** Operations must be carried out in a manner that does not cause or aggravate air pollution, water pollution (including sedimentation) or soil contamination or erosion, unless otherwise authorised by a relevant approval, and in accordance with an accepted Mining Operation Plan. For the purpose of this condition, water shall be taken to include any watercourse, water body, or groundwater. The lease holder must observe and perform any instructions given by the Director- General in this regard.	1, 4, 5		Section 6.2.2
Condition 20	Access tracks must be kept to a minimum and be positioned so that they do not cause any unnecessary damage to the land. Temporary access tracks must be ripped, topsoiled and revegetated as soon as possible after they are no longer required for mining operations. The design and construction of access tracks must be in accordance with specifications fixed by the Department of Planning.	1, 4, 5		Section 6.2.2

Condition	Requirement	Domain	Timing	Section Addressed
Condition 21	a) The lease holder must not fell trees, strip bark or cut timber on the lease without the consent of the landholder who is entitled to the use of the timber, or if such a landholder refuses consent or attached unreasonable conditions to the consent, without the approval of a warden. b) The lease holder must not cut, destroy, ringbark or remove any timber or other vegetation cover on the lease area except such as directly obstructs or prevents the carrying on of operations. Any clearing not authorised under the Mining Act 1992 must comply with the provisions on the Native Vegetation Conservation Act 1997. c) The lease holder must obtain all necessary approvals or licences before using timber from any Crown land within the lease area.	1, 4, 5		Section 6
Condition 25	**Security** a) A security in the sum of $30,000.00 must be given and maintained with the Minister be the lease holder for the purpose on ensuring the fulfilment by the lease holder of obligations under this lease. If the lease holder fails to fulfil any one or more of such obligations the said sum may be applied at the discretion of the Minister towards the cost of fulfilling such obligations. For the purpose of this clause the lease holder shall be deemed to have failed to fulfil the obligations of this lease if the lease holder fails to comply with any condition or provision hereof, any provision of the Act or regulations made thereunder, or any condition or direction imposed or given pursuant to a condition or provision hereof or of any provision of the Act or regulation made thereunder. b) The lease holder must provide the security required by sub-clause (a) in one of the following forms: a. Cash b. A security certificate in a form approved by the Minister and issued by an authorised deposit-taking institution.	1, 4, 5		Section 6.2.2

2.2 Final Land Use Options Assessment

Rehabilitation will be undertaken to facilitate a range of post mining land uses which may include grazing, woodland vegetation, habitat features for fauna and flora corridors.

Detailed assessment of alternate final land use options will be undertaken as part of future mine extensions and detailed mine closure planning processes.

2.3 Final Land Use Statement

The final land use goal is to establish a safe, stable, non-polluting and sustainable landform revegetated with woodland vegetation communities generally consistent with the pre-mining landscape. Detailed assessment of alternate final land use options will be undertaken in as part of detailed mine closure planning processes and in consultation with the relevant stakeholders.

2.4 Final Land Use and Mining Domains

2.4.1 Final Land Use Domains

The final land use domains have been defined as land management units characterised by a similar post mining land use objective. Each final land use domain will require specific rehabilitation methods.

The final land use domains for this Plan are presented in **Table 5** and will be shown on the final landform plans presented in **Section 5**.

Table 5: Final Land Use Domains

Code	Final Land Use Domain	Description
A	Native Ecosystem	Areas to be rehabilitated with native grasses, shrubs and plants species reflective of the composition of Box-Gum Woodland to support the agreed final land use of native ecosystem that can facilitate a range of post mining land uses which may include grazing, woodland vegetation, habitat features for fauna and flora corridors. Includes rehabilitation to be undertaken on some existing infrastructure areas, overburden emplacement areas and open cut mining areas.
G	Water Storage	This domain includes those water storage areas that will remain in the final landform i.e. dams.
I	Infrastructure	This domain includes those items of infrastructure that will remain following mine closure for a lawful land use, namely a land use permitted without consent or following granting of development consent. In the absence of further approvals, this would indicatively include the infrastructure area of the Zeolite mine.
J	Final Void	The voids will include grassed safe slopes angling to the water filled void(s). The voids will remain as a functional water storage that could be used for a range of final land uses with a slope f 1 in 3 or less to prevent people or stock from getting trapped in the water

2.4.2 Mining Domains

Mining domains identify the footprint of areas disturbed for mining related activities. For this Plan, mining domains have been defined as the set of discrete areas that have a particular operational or functional purpose, therefore having similar geophysical and geochemical characteristics that will have similar rehabilitation requirements.

Mining domains are presented in **Table 6.**

Table 6: Mining Domains

Code	Mining Domain	Description
1	Infrastructure Area	This domain includes the Haul Road and Soil stockpiles.
3	Water Management Area	This domain includes all void, clean and dirty water dams, diversion drains and associated infrastructure.
4	Overburden Emplacement Areas	This domain will include the overburden emplacement area, both in-pit and out-of-pit components, in its entirety. This area also includes historic rehabilitation activities.
5	Active Mining Area (Open Cut Void)	This domain refers to the active area of mining beyond the toe of the in-pit component of the overburden emplacement. The size, depth and catchment of final voids will be minimised.

3.0 Rehabilitation Risk Assessment

3.1 Summary of Risk Assessments

Prior to the Rehabilitation Reforms, no previous risk assessments have been completed specifically for the rehabilitation works associated with Zeolite.

The Environmental Impact Statement prepared by R.W. Corkery & Co. Pty Limited in 1988 ("EIS"), along with the subsequent Ecological and Archaeological Due Diligence Assessments completed by RPS in 2013, provide an assessment of the risks associated with the proposed mining operations.

An inaugural risk assessment workshop was undertaken on 18 May 2022. The workshop was used to identify the key issues that presented a risk to achieving satisfactory rehabilitation at Zeolite.

The risk assessment for this RMP was performed in conjunction with ZAPL and SLR, detailing the potential rehabilitation risks for this specific site. The key outcomes from this workshop are investigated in this section.

An update to the rehabilitation risk assessment was undertaken in August 2023 as part of updates to the Forward Program and Rehabilitation Objectives.

3.2 Rehabilitation Risk Assessment

Conditions of a mining lease granted under the Mining Act 1992 require the lease holder to conduct a rehabilitation risk assessment and implement measures to eliminate, minimise or mitigate the risks in accordance with the Resources Regulator's *Guideline: Rehabilitation risk assessment.*

The risk assessment included key Zeolite and SLR personnel and was undertaken in accordance with AS/NZS ISO 31000:2018 Risk Management – Guidelines and the Risk Management Handbook for the Mining Industry (MDG1010). Zeolites' Risk Matrix was used to calculate the consequence and likelihood of an event and to evaluate the subsequent risk level (risk rank).

The risk assessment has been used to inform the preparation of this Plan. The objectives of the risk assessment were to:

- Identify the risks associated with rehabilitation and closure of Zeolite to achieve the approved post mining land uses,
- Identify knowledge gaps in Zeolites current understanding of the risks to rehabilitation,
- Identify the investigations/controls/action plans necessary to effectively mitigate risks and/or realise opportunities and to close any identified knowledge gaps,
- Inform the development of this RMP, to provide a basis to determine additional investigations and/or project works to be undertaken, and
- Provide the framework to satisfy relevant internal and government guidelines, requiring implementation of a risk-based approach to closure.

The risk workshop assessed a total of 57 key rehabilitation risks, which are summarised as:

- 15 risks were ranked as not applicable,
- 24 risks were ranked as low,
- 18 risks were ranked as moderate,

- 0 risks were ranked as significant,
- 0 risks were ranked as high, and
- 0 risks were ranked as extreme.

Rehabilitation risks, controls and proposed controls will regularly be reviewed and revised (as required)

3.2.1 Further Studies / Action Plan

The risk workshop identified that there were no key risks (high, significant, or extreme level) to the successful rehabilitation of the site when considering associated risk controls.

Due to the size and scale of this operation however, SLR and Zeolite recognised several moderate level risks that required some improvement. Improvement actions for managing rehabilitation risks are displayed in Table 3-1.

Table 7: Key Rehabilitation Risks and Identified Controls

Risk Rating	Key Risk	Key Controls	Sections Addressed
Moderate	Insufficient skills and experience of rehabilitation personnel	Experienced Zeolite personnel	6.1
		Specialist consultants engaged to develop the RMP and provided advice as required	6.1
Moderate	Lack of clearly defined responsibilities	Experienced Zeolite personnel	6.1
Moderate	Insufficient funding for or prioritisation of rehabilitation activities	Rehabilitation Cost Estimate (RCE)	6.2
Moderate	Planning does not factor in rehabilitation requirements and approval conditions	Consideration of current regulator guidelines and recommendations, including Mining Licence (ML) conditions	This Document
		Rehabilitation Management Plan	This Document
Moderate	Biological resource salvage and maintenance (e.g. subsoil, topsoil, vegetative material, seedbank, rocks, habitat resources) through clearing, salvage and handling practices	Material is collected as part of the stripping operation and stockpiled for re-use, including rock and timber identified and salvaged when required.	6.2
		Topsoil / subsoil management	6.2
		Zeolite overburden / spoil available for topsoil and subsoil supplement	6.2
Moderate	Limited pre-existing biological resources for salvage (e.g. topsoil, weeds)	Material is collected as part of the stripping operation and stockpiled for re-use, including rock and timber identified and salvaged when required	6.2
		Topsoil / subsoil management	6.2
		Zeolite overburden / spoil available for topsoil and subsoil supplement	6.2
Moderate	Clearing in adverse seasonal and weather conditions when salvaging biological resources	Operations do not take place during adverse weather conditions due to the nature of zeolite.	6.2
		Biodiversity Management Plan	6.2
		Rehabilitation Management Plan	This Document

Risk Rating	Key Risk	Key Controls	Sections Addressed
		Short term operations planning	Forward Program
Moderate	Adverse surface quality and quantity	Sediment and erosion control in place, separation of clean water and mine water catchments.	6.2
Moderate	Adverse surface quality and quantity	Sediment and erosion control in place, separation of clean water and mine water catchments.	6.2
Moderate	Uncontrolled run off from mine infrastructure, roads, waste dumps etc. can lead to sedimentation Large cleared areas/ landforms with incomplete runoff control Extreme weather events	Surface water management structures	6.2
		Hazard and incident reporting and investigation requirements	Site PIRMP
		Short term operations planning	Forward Program
Moderate	Hazards associated with retained infrastructure	Rehabilitation Management Plan	This Document
		RCE / Bond	6.2
Moderate	Generation of material and waste products from the demolition process	Waste management plan	6.2
		Waste classification and segregation	6.2
		Metal skip bins positioned in designated areas on sites	6.2
		Suitable contractor with applicable licenses engaged for demolition and disposal	6.2
		Short term operations planning	Forward Program
		Waste disposed at licenced waste facilities	6.2
Moderate	Unstable landform due to erosion and/or mass movement issues associated with inappropriate design and/or quality assurance during landform construction	Topsoil / subsoil management	6.2
		Rehabilitation management plan	This Document
Moderate	Ability to sustain safe, stable and non-polluting in pit and future	Topsoil / subsoil management	6.2
		Rehabilitation management plan	This Document
Moderate	Weed infestation	Rehabilitation Management Plan	6.2
		Rehabilitation Plan	Appendix A
Moderate	Poor machinery selection during the rehabilitation process	Rehabilitation Management Plan	This Document
		Rehabilitation Plan	Appendix A
Moderate	Long term water quality and quantity issues (e.g. acid-drainage, high salinity)	Rehabilitation Management Plan	This Document
Moderate		Short term operations planning	Forward Program

Risk Rating	Key Risk	Key Controls	Sections Addressed
	Disturbance of established rehabilitation areas	Boundary fencing to sites and rehabilitation areas	6.2
		Engagement with land/lease holder including Whitehaven	4.4

3.2.2 Action Plan

Through identifying risks that needed improvement, the risk workshop showed areas that needed further actions. These are shown in **Table 8**.

Table 8: Further Studies / Action Plan

Risk Action ID	Action	Timeframe
1_2023	Updated Rehabilitation Plan, incorporating - Quality Assurance Processes and Tools - Detailed landform and Drainage designs - Rehabilitation Planning Meetings and Processes - Rehabilitation Training - Rehabilitation Budgets - Rehabilitation Methodologies - Rehabilitation Inspections and Monitoring - GIS and Survey	2023
2_2023	Develop a Mine Closure Planning Process	2023
3_2023	Undertake and Topsoil and Resource Balance and Quality Assessment	2023
4_2023	Development of an OEMP to document non rehabilitation controls measures included within the former MOP	2023
5_2023	Development a Ground Disturbance Permit and Work Authorisation Tools	2023
6_2023	Complete the Surface water Assessment	2023/2024
7_2023	Implement recommendations from the Surface water Assessment	2024
8_2023	Undertake a Phase 1 Contamination Assessment	2024

4.0 Rehabilitation Objectives and Rehabilitation Completion Criteria

4.1 General Rehabilitation Requirements

Zeolite will:

a) Rehabilitate the site in accordance with the conditions imposed on the mining lease(s) associated with the development under the Mining Act 1992;

b) Rehabilitate the site generally in accordance with commitments and requirements of environmental Impacts Statements and Development Consents.

c) Rehabilitate the site to achieve the Rehabilitation Objectives shown in **Table 9.**

Table 9: Rehabilitation Domain Objectives

Aspect	Objective
Site	Safe, stable, non-polluting and sustainable landform Fit for the intended final land use(s) Final landform integrated with surrounding natural landforms as far as is reasonable and feasible, and minimising visual impacts when viewed from surrounding land The condition of the vegetation on the rehabilitated areas is trending towards the conditions that occur in the same vegetation type in the locality Rehabilitate all mined land to its original rough grazing land capability.
Infrastructure	All infrastructure decommissioned and removed, unless required by intended post-quarrying operations land use(s) Retained infrastructure complies with relevant standards and guidelines
Final Void	Shaped and rehabilitated with native woodland vegetation species Backfilled to support the native vegetation outcomes; Battered to a grade of 1 in 3 or less to prevent people or stock from getting trapped in the water Minimise: • The size and depth of final voids • drainage catchment of final voids; and • landform instability risk.
Revegetation	Landscaped and revegetated with native woodland vegetation species
Drainage	Hydraulically and geomorphologically stable Landscaped and revegetated using aquatic ecology and riparian vegetation consistent with surrounding watercourses
Community	Ensure public safety Minimise negative socio-economic impacts of quarry closure Opportunities to provide long term strategic benefits are pursued

4.2 Domain Rehabilitation Objectives

To achieve the broad rehabilitation objectives presented in **Section 4.0** Zeolite have developed specific domain rehabilitation objectives.

The key rehabilitation objectives for each of the domains are defined in **Table 10.**

Table 10: Rehabilitation Domain Objectives

Mining Domain (Domain Reference)	Final Land Use Domain (Domain Reference)	Rehabilitation Objective
Infrastructure Area (1)	Infrastructure (I)	• All infrastructure that is to remain as part of the final land use is safe and does not pose any hazard to the community and is approved by the Secretary for retention. • Domain safe and free from hazardous materials.
	Native Ecosystem (A)	• All surface infrastructure will be decommissioned and removed, unless approved otherwise by the Secretary • Ecosystem is established and needs no greater maintenance than those of surrounding, undisturbed land (original rough grazing land capability) • Erosion does not present a safety hazard or compromise the post mining land capability • Fauna habitat available • Growth media is appropriate to support the final land use • Runoff and/or leachate from the landlord are non-polluting • Soil fertility and soil structure is progressing towards soil parameters identified in soil of reference sites • Soils, hydrology, and woodland ecosystem with maintenance needs no greater than those of a local analogue site. • Species composition of revegetated areas is comparable with undisturbed areas or Box-Gum • Stable and permanent landform established • Vegetation consistent with the White Box-Gum Woodland • Weed control • Weeds and feral animal species do not present a risk to rehabilitation.
Water Management Area (3)	Water management (F)	• Runoff and/or leachate from the landform are non-polluting • Stable and permanent landform established • Structures require ongoing stability works no greater maintenance than those of surrounding, undisturbed land • Contain aquatic ecology and riparian vegetation consistent with surrounding watercourses
Overburden Emplacement Areas (4)	Native Ecosystem (A)	• Growth media is appropriate to support the final land use • Overburden Emplacement Areas to be shaped in accordance with the approved final landform • Ecosystem is established and needs no greater maintenance than those of surrounding, undisturbed land (original rough grazing land capability) • Existing rehabilitation will be maintained to achieve rehabilitation objectives • Erosion does not present a safety hazard or compromise the post mining land capability • Fauna habitat available • Growth media is appropriate to support the final land use • Runoff and/or leachate from the landlord are non-polluting • Soil fertility and soil structure is progressing towards soil parameters identified in soil of reference sites • Soils, hydrology, and woodland ecosystem with maintenance needs no greater than those of a local analogue site.

Mining Domain (Domain Reference)	Final Land Use Domain (Domain Reference)	Rehabilitation Objective
		• Species composition of revegetated areas is comparable with undisturbed areas or Box-Gum • Stable and permanent landform established • Vegetation consistent with the White Box-Gum Woodland • Weed control • Weeds and feral animal species do not present a risk to rehabilitation.
Active Mining Area (Open Cut Void) (5)	Native Ecosystem (A)	• The size, depth and slopes of the final void will be minimised to be accordance with the approved final landform • Battered to a grade of f 1 in 3 or less • Ecosystem is established and needs no greater maintenance than those of surrounding, undisturbed land (original rough grazing land capability) • Erosion does not present a safety hazard or compromise the post mining land capability • Fauna habitat available • Growth media is appropriate to support the final land use • Runoff and/or leachate from the landlord are non-polluting • Soil fertility and soil structure is progressing towards soil parameters identified in soil of reference sites • Soils, hydrology, and woodland ecosystem with maintenance needs no greater than those of a local analogue site. • Species composition of revegetated areas is comparable with undisturbed areas or Box-Gum • Stable and permanent landform established • Vegetation consistent with the White Box-Gum Woodland • Weed control • Weeds and feral animal species do not present a risk to rehabilitation.

4.3 Rehabilitation Completion Criteria

Completion criteria are objective target levels or values assigned to a variety of indicators (e.g., slope, species diversity, percent groundcover), which can be measured to demonstrate progress and ultimate success of rehabilitation. As such, they provide a defined end point, at which point in time rehabilitation can be deemed successful and the lease relinquishment process can proceed. The draft rehabilitation completion criteria for all areas of Zeolite are listed in Table 4 3.

These completion criteria will be utilised to demonstrate achievement of rehabilitation objectives. It is noted that the completion criteria may be subject to refinement as rehabilitation progresses, including as an outcome of ongoing consultation with the relevant stakeholders, closure studies yet to be completed, and continuous improvement processes informed by rehabilitation monitoring results. The achievement (or otherwise) of the completion criteria will be monitored and reported with Annual Rehabilitation Reports.

Closure criteria have been informed by the following information:

- Relevant conditions of ML 1356;

- The Department of Regional NSW – Mining, Exploration & Geosciences (DRNSW – MEG) rehabilitation guideline documents including:
    - *Form and way: Rehabilitation objectives, rehabilitation completion criteria and final landform and rehabilitation plan for large mines;*
    - *Guideline: Rehabilitation objectives and rehabilitation completion criteria*
- Completion criteria from the previously approved Zeolite MOP;
- Similar rehabilitation projects, and
- Specific information collected to date during detailed planning investigations.

It is noted that the rehabilitation completion criteria for Zeolite will remain in Draft until approved by the RR, following submission in August 2022. Once approved, Table 4 3 will be updated based on the approved Rehabilitation Objectives and Completion Criteria.

Table 11: Zeolite Draft Rehabilitation Completion Criteria

Final Land Use Domain	Mining Domain	Rehabilitation Objective (Describe the Desired Feature and/or Characteristics of the Final Land Use Domain)	Indicator (Specific Attribute Associated with the Objective)	Rehabilitation Completion Criteria (Benchmark for the Indicator, Based on Analogue Data where Appropriate)	Example Justification Validation Method (Evidence that the Benchmark has been Achieved)
Decommissioning					
All Mining Domains					
All final land use domains	Infrastructure Area	All surface infrastructure will be decommissioned and removed, unless approved otherwise by the Secretary	Potential hazards (e.g. electrical, mechanical) have been effectively isolated and secured.	Hazards isolated and secured.	Statement provided by suitably qualified engineer.
			Infrastructure not required for final land use removed.	Relevant infrastructure removed.	Plan showing redundant structures photos.
			Roads not required for final land use are removed.	Roads removed unless permitted for agricultural or other approved activity.	• Plan showing redundant structures. • Photos.
			Removal of all services (power, water, communications) that have been connected on the site as part of the operation.	All utility infrastructure removed.	Statement provided, utility service disconnection record / notification
			Infrastructure not required for final land use removed.	Relevant infrastructure removed.	• Plan showing redundant structures. • Photos.
		All infrastructure that is to remain as part of the final land use is safe and does not pose any hazard to the community and is approved by the Secretary for retention.	The structural integrity of the infrastructure is suitable and safe for use as part of the intended final land use.	The structural integrity of the infrastructure has been inspected by a suitably qualified engineer and determined to be suitable and safe as part of the intended final land use.	Engineering report/statement, photos, risk assessment verifying modes of failure are adequately addressed to minimise risks to public safety or the environment
		Domain safe and free from hazardous materials.	Contamination will be appropriately remediated so that appropriate guidelines for land use are met	Hazards isolated and secured.	Statement provided by suitably qualified engineer.

Final Land Use Domain	Mining Domain	Rehabilitation Objective (Describe the Desired Feature and/or Characteristics of the Final Land Use Domain)	Indicator (Specific Attribute Associated with the Objective)	Rehabilitation Completion Criteria (Benchmark for the Indicator, Based on Analogue Data where Appropriate)	Example Justification Validation Method (Evidence that the Benchmark has been Achieved)
Landform Establishment					
Domain – Rehabilitation Area – Woodland					
Final Void	Active Mining Area (Open cut void)	The size, depth and slopes of the final void will be minimised to be accordance with the approved final landform	Landforms are surveyed and demonstrated to be constructed in accordance with the final landform plan.	The western batters of the mine void(s) are benched at 12 metre intervals with 8-metre-wide berms remaining Reshaping proposed to form an overall slope angle of approximately 45 degrees	Survey verifies final landform construction in accordance with the Approved Final Landform plan
				The eastern batters cut in overburden will be mined/battered back to approximately 1:3 and grassed Formation of safe slopes down to the water filled void(s) for grazing	
				The 1:10 access ramps will remain. Drainage will be re-directed back into the mined-out voids that will retain surface water run-off Ramps being kept for easy vehicular access. Proposed drainage will prevent erosion and/or contamination because of surface water run-off.	
Growth Medium Development					
Domain – Rehabilitation Area – Woodland					
Agricultural – Grazing (Rehabilitation Area – Pasture)	All domains	Growth media is appropriate to support the final land use	Soil characteristics in the range of pre-mining soil characteristics	Application of respective amelioration actions described in Table 1 of Appendix A to achieve desired values The combination of parameters will be used to determine the progress of amelioration of soil and are key parameters associated with growth of native species and therefore are important for rehabilitation success.	• Rehabilitation records • As constructed survey

Final Land Use Domain	Mining Domain	Rehabilitation Objective (Describe the Desired Feature and/or Characteristics of the Final Land Use Domain)	Indicator (Specific Attribute Associated with the Objective)	Rehabilitation Completion Criteria (Benchmark for the Indicator, Based on Analogue Data where Appropriate)	Example Justification Validation Method (Evidence that the Benchmark has been Achieved)
Phase 5 – Ecosystem and Land Use Establishment					
All Final Land Use Domains					
All Domains	All Domains	Weeds and feral animal species do not present a risk to rehabilitation.	Weed presence	Monitoring verifies there are no significant weed infestations and weeds do not comprise a significant proportion of the species in any stratum.	Rehabilitation monitoring reports
				Records indicate that noxious weeds are controlled.	
			Feral animal density	Records indicate that feral animal pests are controlled.	
		Erosion does not present a safety hazard or compromise the post mining land capability	Erosion and Settlement Control	Visual monitoring indicates that there is no significant erosion present that constitutes a safety hazard or compromises the intended final land use.	• Water quality testing • Photographs
		Soil fertility and soil structure is comparable between rehabilitation areas and reference sites	Soil Quality	Testing verifies that soil characteristics (pH, EC and Exchangeable Sodium Percentage (ESP), nitrogen and phosphorus) are within 20% of analogue sites	Soil Sampling, testing and analyses of other contributing factors by a qualified soil scientist or agronomist
		Fauna habitat available	Presence of a range of fauna habitats	Fauna habitat is available.	Rehabilitation Records
Domain – Rehabilitation area – Woodland					
Native Ecosystem	All domains	Assisted revegetation of disturbed areas	• Species composition • Ground Cover • Surface Cover • Vegetation density	• Ground cover percentage is comparable to that of the analogue sites	• Rehabilitation monitoring records. • Photographs • Soil Sampling
		Stable and permanent landform established			

Final Land Use Domain	Mining Domain	Rehabilitation Objective (Describe the Desired Feature and/or Characteristics of the Final Land Use Domain)	Indicator (Specific Attribute Associated with the Objective)	Rehabilitation Completion Criteria (Benchmark for the Indicator, Based on Analogue Data where Appropriate)	Example Justification Validation Method (Evidence that the Benchmark has been Achieved)
		Runoff and/or leachate from the landlord are non-polluting Vegetation consistent with the Box-Gum Woodland Soils, hydrology, and woodland ecosystem with maintenance needs no greater than those of a local analogue site.	• Vegetation health • Weeds • Soils capable of supporting pasture • Area capable of retaining stock • Access made safe for public and livestock	• The diversity of species within the rehabilitated pastures is representative of the specified species mix and comparable to that of the analogue sites. • Rehabilitation monitoring verifies species diversity is characteristic of Box-Gum • Number of weeds species diversity and surface area cover ≤ analogue site • Soil test results comparable to analogue sites • No access to high walls	
Ecosystem and land use Development					
Domain – Rehabilitation area – Woodland					
Native Ecosystem	All domains	Ecosystem is established and needs no greater maintenance than those of surrounding, undisturbed land.	Ground Cover Species composition Vegetation health Weeds	• Comparison with undisturbed areas. Aim for 75% ground cover of existing grass and ground cover species recorded in Appendix A • Analogue sites provide an appropriate guide for pre-disturbance values and therefore a realistic goal for rehabilitation	Rehabilitation monitoring reports

Final Land Use Domain	Mining Domain	Rehabilitation Objective (Describe the Desired Feature and/or Characteristics of the Final Land Use Domain)	Indicator (Specific Attribute Associated with the Objective)	Rehabilitation Completion Criteria (Benchmark for the Indicator, Based on Analogue Data where Appropriate)	Example Justification Validation Method (Evidence that the Benchmark has been Achieved)
		Species composition of revegetated areas is comparable with undisturbed areas or Box-Gum	Species diversity	• Comparisons with undisturbed areas of Box-Gum Grassy Woodland • Analogue sites provide an appropriate guide for pre-disturbance values and therefore a realistic goal for rehabilitation	Rehabilitation monitoring reports
			Species Composition		
			Ecosystem growth and natural recruitment		
		Weed control	Weed presence	Number of weeds species diversity and surface area cover ≤ analogue site	Rehabilitation monitoring reports

4.4 Rehabilitation Objectives and Rehabilitation Completion Criteria – Stakeholder Consultation

4.4.1 Stakeholder Engagement

Liverpool Plains Shire Council, Whitehaven Coal and the local landholders of the land parcels adjacent to the Mine are recognised stakeholders in relation to Zeolite.

Zeolite maintains an active relationship with the Liverpool Plains Shire Council and all mining operations and rehabilitation activities are being conducted in accordance with the existing Development Consents listed in **Table 12**.

The land parcels subject to the Zeolite are owned by Werris Creek Coal Pty Ltd. Zeolite maintains a great relationship with Werris Creek and engages in regular consultation with this them to ensure all rehabilitation activities are completed in accordance with the expectations and standards required.

4.4.1.1 Relevant Statutory Authorities

Zeolite has consulted with and will continue to consult with the following regulatory bodies in relation to their operations and rehabilitation:

- Mining Exploration and Geoscience – Resources Regulator's (RR) Environment Protection Authority (EPA), and
- Liverpool Plains Shire Council (Council).

4.4.1.2 Other Key Stakeholders

Zeolite has consulted with and will continue to consult with several community groups and landholders in relation to the Zeolite operations and rehabilitation, including:

- Local community and affected landowners, and
- Werris Creek Coal Pty Ltd.

4.4.2 Proposed Future Consultation

Consultation will continue with stakeholders during the life of mine, in accordance with the SEP. **Table 12** presents a summary of the proposed future consultation activities key stakeholders.

Table 12: Summary of Proposed Future Stakeholder Engagement Activities

Stakeholder	Activities
RR	• Ongoing revisions of the RMP • Submission of the Annual Review and Annual Rehabilitation Report • Detailed Mine Closure Planning
Council	• Ongoing revisions of the RMP • Submission of the Annual Review and Annual Rehabilitation Report • Detailed Mine Closure Planning
Local community and affected landowners	• Detailed Mine Closure Planning
Werris Creek Coal Pty Ltd.	• Detailed Mine Closure Planning

5.0 Final Landform and Rehabilitation Plan

5.1 Final Landform and Rehabilitation Plan

In accordance with the requirements of the *Form and Way: Rehabilitation Management Plan for Large Mines* (RR, 2021a) *a Final Landform and Rehabilitation Plan* has been prepared to show the proposed final land use and final landform for Zeolite (refer **Figure 6** and **Figure 7).**

ZEOLITE MINE REHABILITATION MANAGEMENT PLAN

FINAL LANDFORM FEATURES

FIGURE 6

LEGEND

- Project Approval Boundary
- Road

Final Landform Feature

- Final Void

Final Landuse Domain

- Final Void
- Infrastructure
- Native Ecosystem
- Water Management Areas

Data sources:
NSW SS
Basemap: Maxar
Project Approval Boundary: © State Government of NSW and Department of Regional New South Wales 2019
High resolution imagery: Zeolite Mine - Stewart Surveys (2023)

0 100 200 m

Coordinate System:	GDA2020 MGA Zone 56
Scale:	1:7,000 at A4
Project Number:	630.30206
Date Drawn:	17-Aug-2023
Drawn by:	JH

SLR

Path: H:\Projects-SLR\630-SrvNTL\630-NTL\630.30206.00000 Zeolite Australia\06 SLR Data\01 GIS\GIS\63030206_Zeolite_ForwardProgram_2023\63030206_Zeolite_ForwardProgram_2023.aprx\63030206_F6_FinalLandformFeatures

ZEOLITE MINE REHABILITATION MANAGEMENT PLAN

FINAL LANDFORM CONTOURS

FIGURE 7

LEGEND

- Project Approval Boundary
- Road
- Contour

Data sources:
NSW SS
Basemap: Maxar
Project Approval Boundary: © State Government of NSW and Department of Regional New South Wales 2019
High resolution imagery: Zeolite Mine - Stewart Surveys (2023)

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SLR

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6.0 Rehabilitation Implementation

6.1 Life of Mine Rehabilitation Schedule

The rehabilitation schedule over the life of mine (LOM), from the commencement of the RMP until expected lease relinquishment is described in the following sections. A snapshot of mine progression is shown in **Figure 8** to **Figure 12**.

Rehabilitation planning and execution is undertaken by the experienced personnel employed by ZAPL. Where required, ZAPL engages experienced contractors and consultants to provide specialist advice.

6.1.1 Infrastructure

There are no further construction activities planned during the LOM for approved infrastructure at Zeolite. Infrastructure upgrades may be subject of future modifications during the LOM.

Key infrastructure will be decommissioned following the close of mining activities. Infrastructure that supports or facilitates the approved post mining land use may not be decommissioned. Planning for infrastructure decommissioning will be included in the detailed mine closure process.

6.1.2 Mining Activities

Mining is currently approved under ML1356 at Zeolite up until 1 August 2025 and incorporates the following key activities:

- Continued mining of the northern block at rate of up to 20,000 tonnes per annum (tpa),
- Operation of a processing plant to produce saleable crushed and screened product,
- ROM material is blasted zeolite rock in the 100 mm to 500 mm size range. This material is transported approximately 2.5 km by truck to the ‘off lease’ zeolite mineral processing plant located on Lot 34 in DP856002, and
- Rock and overburden produced from the north block mine will be transported to the north block mine waste emplacement area 50m to the east of the north block mine.

6.1.3 Mine Operations

Mine operations are undertaken using Conventional open cut mining methods.

Zeolite and overburden are drilled and blasted using contract services on a campaign basis. All blasts are monitored at either ’Escott homestead’ or the Zeolite processing site residence for ground vibration peak particle velocity (PPV) and blast overpressure.

At a production rate of up to 15,000 tpa zeolite, one annual blast is likely to meet production requirements for a 12-to-18-month period. Typical drill and blast campaigns involving up to 10,000 bcm of rock have to date utilised small diameter (89 to 102 mm) blast holes of between 6 and 12 metres in depth, in patterns varying between 3 and 4.5 metres subject to ground conditions. All explosives including ANFO, bulk emulsions, boosters and detonators are supplied by the blasting contractor. No permanent explosives storage is required onsite.

Drilling and blasting will be conducted by qualified contractors. All blasting will be conducted in accordance with a blast management plan to ensure the safety of any occupants of ‘Escott homestead’ and to minimise potential impacts from noise and vibration.

Conventional equipment including D7 to D9 size bulldozer, 30 to 50 tonne excavators, (with attachments including rock breaker, sieve and crusher buckets), frontend loader and both

“on road” and “off road” dump trucks (10 to 35 tonne capacity) will continue to be used to excavate and haul materials to run of mine (ROM) stockpiles at the processing plant or to the nominated overburden waste emplacements.

Any access tracks created for the mining phases follow specifications according to the relevant guidelines and are kept to a minimum and positioned so that they do not cause unnecessary damage. Once they are no longer being used, they will be rehabilitated according to the areas final land use domain.

A crushing and screening plant will be used to produce saleable crushed and screened product from low grade zeolite and waste material. Contract hiring of mobile plant from local suppliers will continue to be undertaken where possible and in accordance with mining campaigns to meet market demand for product.

In accordance with EPL No. 6378 - Condition L4, mining activities are carried out between the hours of 0700 and 1900 Monday to Friday and between 0700 and 1900 on Saturdays as required. No mining activities are conducted on Sundays and Public Holidays.

Zeolite will seek landholder consent and gain appropriate agreements regarding potential noise, dust and visual impacts at ‘Escott homestead’ associated with mine operations in the north block, including blasting and ROM haulage.

The two water tanks will remain unaffected by the mining activities but associated pipework, once located and if required will be relocated to minimise damage. Mine operations are undertaken using conventional open cut mining methods.

Any access tracks created for the mining phases follow specifications according to the relevant guidelines and are kept to a minimum and positioned so that they do not cause unnecessary damage. Once they are no longer being used, they will be rehabilitated according to the areas final land use domain.

6.1.4 Mine Production Schedule

The assumptions and principles that have been used to develop the LOM rehabilitation schedule are detailed in **Table 13**.

Table 13: Mine Production Schedule

Material	Unit	Year 1	Year 2	Year 3	Years 4 to 9	Years 9 to 13
Rock/overburden (waste rock)	m^3	17,000	17,000	11,000	8,000	TBD
Zeolite	t	15,000	17,500	20,000	22,500	TBD

Importantly, the staging of the open cut mining operations would be determined by the requirements of the minerals market. As these requirements are likely to vary over the LOM, the development sequence of the open cut, extraction rates and rehabilitation areas may vary.

ZAPL is currently mine optimisation planning activities, which may include infrastructure upgrades and conducting mining operating is additional areas. These works have not been included within the Forward Program. In conjunction with the mine optimisation planning, ZAPL has commenced works on establishing conceptual closure process. Outcomes of these activities may change the production schedule for Zeolite.

ZEOLITE MINE REHABILITATION MANAGEMENT

CURRENT STATUS OF MINING AND REHABILITATION

Plan 1A

LEGEND

- Project Approval Boundary
- Current Authorisation - ML1356

Disturbance

- Infrastructure Area
- Overburden Emplacement Area
- Active Mining Area (Open cut void)
- Water Management Area

Rehabilitation Phase

- Ecosystem and Land Use Development

Data sources:
NSW SS
Basemap: Maxar
Project Approval Boundary: © State Government of NSW and Department of Regional New South Wales 2019
High resolution imagery: Zeolite Mine - Stewart Surveys (2023)
Processing Plant - Wildsky Drone Survey (2022)

0 100 200 m

Coordinate System:	GDA2020 MGA Zone 56
Scale:	1:7,000 at A4
Project Number:	630.30206
Date Drawn:	17-Aug-2023
Drawn by:	JH

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ZEOLITE MINE REHABILITATION MANAGEMENT

CURRENT LANDFORM CONTOURS

Plan 1B

LEGEND

- Project Approval Boundary
- Current Authorisation - ML1356
- Contour

ML1356

Data sources:
NSW SS
Basemap: Maxar
Project Approval Boundary: © State Government of NSW and Department of Regional New South Wales 2019
High resolution imagery: Zeolite Mine - Stewart Surveys (2023)

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ZEOLITE MINE REHABILITATION MANAGEMENT PLAN

LOM PLAN 1 REHABILITATION AND DISTURBANCE AS END OF 2026

FIGURE 8

LEGEND

- Project Approval Boundary
- Mine Workings Extent
- Active Mine Disturbance

Final Landuse Domain

- Native Ecosystem

Data sources:
NSW SS
Basemap: Maxar
Project Approval Boundary: © State Government of NSW and Department of Regional New South Wales 2019
High resolution imagery: Zeolite Mine - Stewart Surveys (2023)

0 100 200 m

Coordinate System:	GDA2020 MGA Zone 56
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Drawn by:	JH

SLR

Path: H:\Projects-SLR\630-SrvNTL\630-NTL\630.30206.00000 Zeolite Australia\06 SLR Data\01 GIS\GIS\63030206_Zeolite_ForwardProgram_2023\63030206_Zeolite_ForwardProgram_2023.aprx\63030206_F8_LOMPlan1_RehabDisturbance_2026

ZEOLITE MINE REHABILITATION MANAGEMENT PLAN

LOM PLAN 2 REHABILITATION AND DISTURBANCE AS END OF 2031

FIGURE 9

LEGEND

- Project Approval Boundary
- Mine Workings Extent
- Active Mine Disturbance
- Ecosystem and Land Use Establishment

Final Landuse Domain

- Native Ecosystem

Data sources:
NSW SS
Basemap: Maxar
Project Approval Boundary: © State Government of NSW and Department of Regional New South Wales 2019
High resolution imagery: Zeolite Mine - Stewart Surveys (2023)

0 100 200 m

Coordinate System:	GDA2020 MGA Zone 56
Scale:	1:6,444 at A4
Project Number:	630.30206
Date Drawn:	17-Aug-2023
Drawn by:	JH

SLR

Path: H:\Projects-SLR\630-SrvNTL\630-NTL\630.30206.00000 Zeolite Australia\06 SLR Data\01 GIS\GIS\63030206_Zeolite_ForwardProgram_2023\63030206_Zeolite_ForwardProgram_2023.aprx\63030206_F9_LOMPlan2_RehabDisturbance_2031

ZEOLITE MINE REHABILITATION MANAGEMENT PLAN

LOM PLAN 3 REHABILITATION AND DISTURBANCE AS END OF 2036

FIGURE 10

LEGEND

- Project Approval Boundary
- Mine Workings Extent

Final Landuse Domain

- Native Ecosystem

Final Landform Feature

- Final Void

Data sources:
NSW SS
Basemap: Maxar
Project Approval Boundary: © State Government of NSW and Department of Regional New South Wales 2019
High resolution imagery: Zeolite Mine - Stewart Surveys (2023)

0 100 200 m

Coordinate System:	GDA2020 MGA Zone 56
Scale:	1:7,000 at A4
Project Number:	630.30206
Date Drawn:	17-Aug-2023
Drawn by:	JH

SLR

Path: H:\Projects-SLR\630-SrvNTL\630-NTL\630.30206.00000 Zeolite Australia\06 SLR Data\01 GIS\GIS\63030206_Zeolite_ForwardProgram_2023\63030206_Zeolite_ForwardProgram_2023.aprx\63030206_F10_LOMPlan3_RehabDisturbance_2036

6.2 Phases of Rehabilitation and General Methodologies

Achievement of the agreed post mining land use will be reached through a series of conceptual rehabilitation phases. As defined by the *Form and way: Rehabilitation Management Plan (large mines)* the rehabilitation phases are presented in **Table 14.**

Table 14: Rehabilitation Phases

Rehabilitation Phase	Description
Phase 1: Active Mining	This phase is associated with active mining operations across the domains.
Phase 2: Decommissioning	This phase of rehabilitation includes activities associated with the removal of mining infrastructure, unless agreed to be retained, and the removal, remediation or management of contaminated and hazardous materials.
Phase 3: Landform Establishment	This phase of rehabilitation consists of the processes and activities required to construct the approved final landform. In addition to profiling the surface of rehabilitation areas to the approved final landform profile this phase may include works to construct surface water drainage features, encapsulate problematic materials such as tailings, and prepare a substrate with the desired physical and chemical characteristics (that is, rock raking or ameliorating sodic materials).
Phase 4: Growth Medium Development –	This phase of rehabilitation consists of activities required to establish the physical, chemical and biological components of the substrate required to establish the desired vegetation community (including short-lived pioneer species) to ensure achievement of the approved or, if not yet approved, the proposed: • Rehabilitation objectives • Rehabilitation completion criteria, and • Final landform and rehabilitation plan This phase may include spreading the prepared landform with topsoil and/or subsoil and/or soil substitutes, applying soil ameliorants to enhance the physical, chemical and biological characteristics of the growth media, and actions to minimise loss of growth media due to erosion.
Phase 5: Ecosystem and Land Use Establishment	This phase of rehabilitation consists of the processes to establish the final land use following construction of the final landform. For vegetated land uses this rehabilitation phase includes establishing the desired vegetation community and implementing land management activities such as weed control.
Phase 6: Ecosystem and Land Use Development	This phase of rehabilitation consists of the activities to manage maturing rehabilitation areas on a trajectory to achieving the approved or, if not yet approved, the proposed: • Rehabilitation objectives • Rehabilitation completion criteria, and • Final landform and rehabilitation plan For vegetated land uses this phase may include processes to develop characteristics of functional self-sustaining ecosystems, such as nutrient recycling, vegetation flowering and reproduction, and increasing habitat complexity, and development of a productive, self-sustaining soil profile. This phase of rehabilitation may include specific vegetation management strategies and maintenance such as tree thinning, supplementary plantings and weed management.
Phase 7: Rehabilitation Completion (sign-off)	The final phase of rehabilitation when a rehabilitation area has achieved the final land use for the mining area: • As stated in the approved rehabilitation objectives and the approved rehabilitation completion criteria, and • As spatially depicted in the approved final landform and rehabilitation plan Rehabilitation areas may be classified as complete when the RR has determined in writing that rehabilitation has achieved the final land use following submission of the relevant application by the lease holder.

6.2.1 Active Mining Phase

Appropriate measures and strategies are implemented during the active phase of mining to enhance rehabilitation outcomes. Works in this phase are summarised below.

6.2.1.1 Soils and Materials

Management protocols for soils and subsoils are implemented to minimise risks and enable soil resources within disturbance areas to be characterised, stripped, stockpiled and re-used appropriately. The management protocols also enable consideration of the main soil types observed within the project disturbance boundary and any specific constraints or management measures to be adopted for each soil type.

Seasonal and weather conditions when salvaging biological resources is considered during clearing. No clearing will occur during adverse weather conditions.

Soil Resources

Soil characterisation has not yet been undertaken for Zeolite.

Soil Resources Balance

Estimated topsoil volumes available for rehabilitation include:

- North block: 260 m3 or 300 tonnes of topsoil materials assuming 10mm depth. Assuming 70% recovery approximately 200 tonnes could be pre-stripped and stockpiled.
- Waste emplacements, stockpiling and processing sites (Approximately 2.4 ha): 480 m3 or 500 tonnes of topsoil materials assuming 20mm depth. Assuming 70% recovery 350 tonnes could be pre-stripped and stockpiled.

A topsoil inventory review will be undertaken in 2024 to confirm topsoil suitability and availability for rehabilitation activities.

Management

- Management of topsoil is detailed in the Rehabilitation Plan prepared for Zeolite. Key measures include:
- The area to be stripped of soil will be surveyed and clearly demarcated;
- Where practical, stripped material will be placed directly onto rehabilitation areas to avoid the requirement for stockpiling and costs with double handling;
- As part of the planning process, temporary drainage, sediment control and structures to prevent erosion will be implemented for each area if required stockpiles will be constructed as low and spread out as possible, preferably <2m in height.
- Weeds will be actively managed
- This does increase the footprint and provides greater surface area for weed colonisation. However, seeding the stockpile itself with target vegetation species or sterile cover species as soon as possible will reduce weed infestation and erosion. The roots will assist in maintaining a viable microbial community and the plants will provide organic matter after re-spreading. Depending on the length of time stockpiling occurs, some species may even set seed — thereby replacing the original seed bank which can deteriorate and become unviable over time.
- Topsoil stockpiles need to have erosion and sediment controls in place at least until the stockpile is used, or it re-vegetates naturally. Controls may include Installation and maintenance of flow, erosion, and sediment control structures
- Diversion of clean water around Site and back into natural flow channels
- Mulching or the installation of biodegradable blankets on high-erosion risk areas, and
- Planting of sterile cover species e.g., Sterile Rye Corn.

Where topsoil is unavailable or of insufficient quality, subsoil spoil may be able to be ameliorated to form a suitable growing media.

6.2.1.2 Flora

Resources

Salvage of flora resources is limited due to the scattered trees and dead timber located on the site as well as the management practice of avoiding clearing of mature tress wherever possible.

However, where possible, felled trees and dead timber will be salvaged and re-distributed within rehabilitation areas to enhance the bushland habitat values.

Seed is also salvaged as a resource:

- Native seed collection is undertaken opportunistically and where practicable. Seed collection is generally undertaken by suitable experienced or qualified person, and
- Natural regeneration has been shown to be successful, with sufficient seed bank reserves observed.

Seed will be purchased from local suppliers to supplement seed collected as required.

Management

Risks of impacts to flora are avoided, mitigated and managed through the implementation of clearing protocols. Clearing protocols will include:

- Clearly identifying vegetation to be retained within on all design, construction and operational drawings,
- The removal of mature trees should be avoided wherever possible,
- Stockpiling, storage, disposal or mixing of materials/liquids, parking of vehicles or machinery or positioning of sheds or offices within the drip lines of trees on-site will be avoided,
- Protection of trees will be in accordance with Australian Standards 4970-2009 *'Protection of Trees on Development Sites',*
- Topsoil and any woody debris displaced by mining operations to be retained to allow for its re-establishment in disturbed areas during the rehabilitation phase to assist re-colonisation from soil seed banks,
- Weed control techniques such as vehicle wash-downs, ongoing monitoring and treatment if required,
- Erosion and sedimentation controls,
- Ensure that the placement of any mine related infrastructure minimises impacts to the surrounding vegetation i.e., locate infrastructure and access tracks so that a minimal number of mature trees are removed,
- Prior to clearing, a qualified ecologist is consulted regarding clearing method, to assist in the relocation of any displaced fauna species and to ensure that clearing works do not unnecessarily encroach on adjacent native vegetation, and
- A site Rehabilitation Plan has been prepared that allows for the disturbed areas on site to be effectively restored in parts to a functioning Box-Gum Woodland when mining operations on the site have ceased. In accordance with the ML conditions, any trees felled, bark stripped, cut, ringbarked, or destroyed will be done so with the permission of the land lease holder and will not done so unless necessary for

operations. The right approvals and licenses will be gained before using any removed timber.

6.2.1.3 Fauna

Management

Fauna is managed to during the active mining phase to minimise impacts and ensure rehabilitation objectives and outcomes related to biodiversity are achieved.

Prior to clearing, a qualified ecologist is consulted regarding the clearing method, to assist in the relocation of any displaced fauna species and to ensure that clearing works do not unnecessarily encroach on adjacent native vegetation.

Resources

Salvaged habitat features will be used throughout rehabilitation and offsets to create habitat to achieve the specific fauna outcomes.

6.2.1.4 Rock and Overburden Emplacement

Zeolite will continue to be mined with an overburden to zeolite ratio of 3:1 to a depth of 30m.

Rock and overburden are placed on the mine waste emplacement area 50 m to the east of the north block open pit **(Figure 2**). Overburden is used as backfill for the previous mining area (PMA) and the north block open pit itself to reduce the operations disturbance footprint.

The pre-existing emplacement areas for rock and overburden, located to the south of ML 1356, which were used during mining of the PMA 25 have undergone rehabilitation.

6.2.1.5 Waste Management

Wastes produced at Zeolite comprise of:

- General domestic-type wastes from on-site buildings and routine maintenance consumables,
- Scrap building materials,
- Batteries, tyres, vehicle parts,
- Oils and grease, and
- Sewage.

Domestic-type wastes will be collected and disposed of by a licensed waste disposal contractor, with recyclable materials separated, where possible.

Staff onsite will be equipped to manage hydrocarbon waste, such as spills. Spill kits are available to contain and deal with spills immediately. Hydrocarbon waste is disposed of off-site by a licenced contractor.

Waste management education and training programs for all staff on site will encompass issues ranging from waste reduction, through to correct disposal of waste materials.

6.2.1.6 Geology and Geochemistry

The Zeolite Mine is close to a zeolitized tuff with an interbedded sequence of sandstone and conglomerate. Mineable reserves have been identified to a depth of 40m.

6.2.1.7 Materials Prone to Spontaneous Combustion

The risk of a spontaneous combustion event at Zeolite is negligible given the geology and geochemistry of the site. Materials prone to spontaneous combustion (particularly adjacent coal measures) are not exposed by mining activities at Zeolite.

A detailed spontaneous combustion assessment, specific for Zeolite will be undertaken in 2024.

6.2.1.8 Materials Prone to Generating Acid Mine Drainage

The risk of acid mine drainage at Zeolite is negligible given the geology and geochemistry of the site. Materials prone to generate acid mine drainage (particularly adjacent coal measures) are not exposed by mining activities at Zeolite.

A detailed acid mine drainage assessment, specific for Zeolite will be undertaken in 2024.

6.2.1.9 Ore Beneficiation Waste Management (Reject and Tailings)

Zeolite operations do not result in the production of rejects or tailings. Options for small quantities of overburden (crushed rock and aggregates) suitable for drill hole stemming, road and construction use are being investigated.

6.2.1.10 Erosion and Sediment Control

Key sources of erosion and sedimentation are generally related to surface water runoff from exposed surfaces, including cleared areas, stockpiles (soil and waste rock) and unsealed roads, and to a lesser degree caused by wind erosion from emplacement areas and stockpiles.

Erosion and sediment control (ESC) at Zeolite is managed in accordance with the Managing Urban Stormwater Volume 1: Soils and Construction (Landcom 2004), Managing Urban Stormwater Volume 2E: Mines and Quarries (DECC 2008a) and the conditions of ML 1356.

6.2.1.11 Ongoing Management of Biological Resources for Use in Rehabilitation

Biological resources such as native seeds and habitat features ((stag trees, fallen logs and large flat rocks) will be managed to ensure viability for use in rehabilitation. Management measures include but are not limited to the management of weeds, effective storage, regular inspections and maintenance programs.

6.2.1.12 Mine Subsidence

Zeolite is in an area where no historic underground mining has been undertaken. Subsequently, no specific management controls or monitoring programs are considered necessary.

6.2.1.13 Management of Potential Cultural and Heritage Issues

Assessments to date (record search and visual inspection) indicate that no Aboriginal objects or sites have been identified in the area investigated.

However, the following procedure is available in the event of a chance find:

- All relevant staff and contractors will be made aware of their statutory obligations for heritage under NSW NPW Act (1974) and the NSW Heritage Act (1977), which may be implemented as a heritage induction.

- The due diligence assessment must be kept by Zeolite so that it can be presented, if needed, as a defence from prosecution under Section 86(2) of the National Parks and Wildlife Act 1974.
- If unrecorded Aboriginal object/s are identified in the Project Area during works, then all works in the immediate area must cease and the area should be cordoned off. Heritage NSW will be notified so that the site can be adequately assessed and managed.
- In the unlikely event that skeletal remains are identified, work must cease immediately in the vicinity of the remains and the area must be cordoned off. The proponent must contact the local NSW Police who will make an initial assessment as to whether the remains are part of crime scene or possible Aboriginal remains. If the remains are thought to be Aboriginal, Heritage NSW will be contacted. Heritage NSW, Heritage Consultants and local Aboriginal groups will be consulted to determine if the remains are Aboriginal or not; and a management plan must be developed in consultation with the relevant Aboriginal stakeholders before works recommence.
- If, during development works, suspected European cultural heritage material is uncovered, work should cease in that area immediately. Heritage NSW will be notified and works only recommence when an approved management strategy has been developed.

6.2.1.14 Exploration Activities

Exploration activities will be undertaken in accordance with the requirements of the *Exploration Code of Practice: Rehabilitation and the conditions of ML 1356:*

- All cored holes will be accurately surveyed and permanently marked in accordance with Department guidelines so that their location can be easily established,
- All holes cored or otherwise will be sealed to prevent the collapse of the surrounding surface,
- All drill holes will be permanently sealed with cement plugs to prevent surface discharge of groundwaters,
- If any drill hole meets natural or noxious gases it will be plugged or sealed to prevent their escape,
- If any drill hole meets an artesian or sub-artesian flow it will be effectively sealed to prevent contamination of aquifers,
- Once any drill holes ceases to be used the hole will be sealed in accordance with Departmental guidelines. Alternatively, the hole will be sealed as instructed by the Resources Regulator, and
- Once any drill hole ceases to be used the land in its immediate vicinity will be left in a clean, tidy and stable condition.

6.2.2 Decommissioning

The Decommissioning Phase encompasses all works required to prepare land for rehabilitation including removal of any unnecessary built infrastructure, foundation and hardstand materials, services, equipment and materials including wastes and contamination.

Decommissioning, demolition, and removal of infrastructure from the mine site will generally be undertaken during the mine closure phase. Any infrastructure including dams, roads and

buildings which is beneficial for future use by post mining landowners may be left in place subject to relevant landowner agreements and regulatory approvals.

Decommissioning and demolition activities will be appropriately planned and documented to ensure that appropriate approvals are in place for the works.

Further detail regarding demolition activities will be determined as the operation approaches closure. Detail in this regard will be reported in the Forward Program.

Following decommissioning, ZAPL will undertake to relinquish the mining authorisations and have the bonds addressed through site Rehabilitation Cost Estimate released.

6.2.2.1 Site Security

Site security measures will be implemented during and following the decommissioning process to prevent access by members of the public and secure rehabilitation areas, including any heritage places or objects and any retained infrastructure items. Site security measures include:

- Site sign-in and induction processes,
- Maintenance of existing security fences and signage, and
- Restricted offroad access to rehabilitated areas.

6.2.2.2 Infrastructure to be Removed or Demolished

Site features, services and structures to be decommissioned and demolished to achieve the final land use are described in **Table 15**.

Table 15: Infrastructure to be Decommissioned

Code	Mining Domain	Description
1	Infrastructure	• Haul Road

Demolition work on site will be carried out in accordance with Australian Standard AS 2601-2001: The Demolition of Structures, or its latest version.

The Detailed Mine Closure Planning process conducted over the life of mine, will further identify key actions, assessments, studies, detailed designs, and regulatory approvals required to decommission and/or demolish built infrastructure.

6.2.2.3 Buildings, Structures and Fixed Plant to be Retained

Site features, services and structures to be retained for future use as part of the final land use are described in **Table 16.**

Table 16: Infrastructure to be Retained

Code	Mining Domain	Description
1	Infrastructure	Housing (Non Associated)
		Minor roads
3	Water Management Area	Water tanks Dams

The Detailed Mine Closure Planning process conducted over the life of mine will

- Identify and obtain necessary approvals,

- Determine the structural integrity of the building/structure/infrastructure to be retained,
- Identify the associated short-term and long-term risks to public safety and the environment from the structures remaining in place, which should identify potential modes of failure,
- Address any potential residual risks such as potential for structures to fail,
- Engage (where required) a suitably qualified engineer to verify that any risks have been satisfactorily addressed.

6.2.2.4 Management of Carbonaceous / Contaminated Material

Carbonaceous Material

Zeolite is an open cut mineral mine and does not produce material with high rates of carbonaceous materials or properties. Subsequently, carbonaceous material is not applicable to Zeolite.

Contaminated Material

Contamination assessments will be completed as part of the detailed mine closure planning and decommissioning processes:

- Zeolite will engage a suitably experienced and qualified expert to conducted contamination and remediation assessments,
- Phase 1 and Phase 2 (where required) assessments will be undertaken for all features, services and structures within the Infrastructure Area domain,
- Subject to the findings and recommendations of the Phase 1 assessment, a targeted Phase 2 assessment will be completed, and
- If contamination is identified, a Remedial Action Plan will be developed, detailing remediation strategies for potential contamination.

Contaminated materials with be managed so that remedial works are completed prior to rehabilitation being completed within the relevant domains.

6.2.2.5 Hazardous Material

During decommissioning, hazardous materials (hydrocarbons and chemicals) will be managed and stored in accordance with regulatory requirements. Removal of hazardous materials will be undertaken by a licensed waste disposal contractor and disposed / recycled at a licensed waste facility. In the context of this site, it is unlikely that an abundance of hazardous material will become present.

6.2.2.6 Underground Infrastructure

Zeolite is an open cut mine and does not have any portals, decline entries, shafts, underground workings, underground equipment, or subsidence monitoring lines. Subsequently, underground infrastructure is not applicable to Zeolite.

6.2.3 Landform Establishment

Landform establishment is the process of shaping the final landform to a safe, stable and non-polluting landform that is appropriate for the desired final land use and consistent with the surrounding landscape. The final landform for the Zeolite is shown on the Final Landform Plan in Section 5.

6.2.3.1 Water Management Infrastructure

Water managements infrastructure will be installed as required within the final landform. Contour and catch drains are designed to collect surface runoff from rehabilitation or disturbed areas.

Water management structures that will remain following mine closure are detailed in Figure 5 1.

6.2.3.2 Final Landform Construction: General Requirements

The general requirements for final landform construction include:

- Maintain safe access or restrict access as required in and around rehabilitated areas for all persons and stock;
- Limited occurrences of erosion events, consistent with what would be expected had the area not been disturbed;
- Seek guidance in regard to erosion and sediment controls, rehabilitation earthworks, topsoil management and revegetation activities;
- Rehabilitate all mined land to its original rough grazing land capability;
- Landform rehabilitation to achieve safe, stable, non-polluting and sustainable landforms. Slopes greater than 1 in 3 may require additional protection to restrict access including rock placement, bund walls or fencing as agreed with the landholder;
- Mine voids to remain in part as functional water storages;
- Revegetate to achieve 75% ground cover of existing grass and groundcover species as recorded in Rehabilitation Plan - Species List and as shown on pre-mining photographs or selected analogue sites;
- Adopt an initial target to revegetate 20% of mined land with native species to encourage the regeneration of characteristics from the surrounding area. Regeneration of the Box Gum Woodland EEC, and
- Consultation with Landowner required.

6.2.3.3 Final Landform Construction: Reject Emplacement Areas and Tailings Dams

Zeolite does not have any reject emplacement areas or tailings dams. Subsequently, management of rejects within the final landform is not applicable.

6.2.3.4 Final Landform Construction: Final Voids, Highwalls and Low Walls

- Construction of the final void will include: The western batters of the mine void(s) are benched at 12 metre intervals with 8-metre-wide berms remaining, forming an overall slope angle of approximately 45 degree
- The eastern batters cut in overburden will be mined/battered back to approximately 1:3 and grassed, forming safe slopes down to the water filled void for grazing, and
- The 1:10 access ramps will remain. Drainage will be re-directed back into the mined-out voids that will retain surface water run-off.

6.2.3.5 Final Landform Construction: Infrastructure Areas and / Overburden Emplacement Area

Construction of the overburden emplacement area will include:

- Backfilling of all small excavations and costeans with waste material, covering with available stockpiled topsoil, contour ripping prior to seeding
- Battering/backfilling of larger northern and southern excavations (once remaining blasted zeolite mined) to form small depressions with 1 in 3 slopes
- Clean up/batter all waste emplacement areas and spread with available topsoil
- Re-establish drainage in and around re-contoured, disturbed areas to drain into existing water filled mine voids and farm surface water management system

6.2.3.6 Final Landform Construction: Creek / River Diversion Works

The Zeolite final landform does not include creek or diversion works. Subsequently, construction of creek/river diversion works is not applicable to Zeolite.

6.2.4 Growth Medium Development

In the context of this RMP, growth medium development encompasses activities to reinstate soils with the initial physical, chemical and biological characteristics required to establish the desired vegetation community.

Characterisation

Soil sampling has been conducted to establish the quality of topsoils and determine soil amelioration requirements. Soil amelioration will be undertaken according to **Table 17**.

Table 17: Generic Soil Amelioration Rates

Soil Parameter	Value	Action	Rate
PH	Low PH < 5.0	Application of Gypsum	2.5 t/Ha initially 3-5 t/Ha
		Application of organic matter	3-5 t/Ha
	High PH > 8.0	Application of Lime	1 t/Ha initially
EC	>4 mS/cm	Application of Gypsum	Minimum 2.5 t/Ha
CEC	Individual cation deficiencies	Application of lime	1 t/Ha initially
EAT (Emerson Aggregate Test)	Dispersion classes 1, 2, 3 and 5	Application of Gypsum Addition of organic matter Bury dispersive soils beneath topsoil	2.5 t/Ha initially 3-5 t/Ha

Topsoil Respreading

Topsoil will be spread onto areas requiring rehabilitation to a nominal depth of 100-200 mm for rehabilitation areas;

Soil testing results (Table 6 5) will be used to determine if physical and/or chemical amelioration is required, and the rates and method of application. The spreading of soil, addition of soil ameliorants, fertiliser, and application of seed will be carried out where possible in consecutive operations to reduce the potential for soil loss to wind and water erosion.

All soils will be ripped prior to seeding. This will be conducted on the contour where possible and will be managed to minimise the potential for unsuitable spoil material being ripped up to the surface;

Seed Bed Preparation

Seedbed preparation will be undertaken to ensure optimum establishment and growth of vegetation. All top-dressed areas will be contour ripped (after top-dressing) to create a “key” between the soil and the subsoil / capping prior to placement of materials.

Ripping will be undertaken along the contour, where possible and preferably when soil is moist and immediately prior to sowing. The spread top-dressed surface will be scarified with the contour immediately prior to seeding to reduce runoff and increase infiltration. Deep ripping lines every 20 m with the contour will occur in areas of poor water infiltration.

6.2.5 Ecosystem and Land Use Establishment

In the context of this RMP, ecosystem establishment includes activities to establish the desired floristic composition (species diversity and density) and habitat features. The phase incorporates management actions such as weed and feral pest control to achieve species establishment and growth to juvenile communities, and habitat augmentation.

Revegetation activities will be planned to occur after the completion of reshaping, topdressing with growth media and construction of drainage structures.

The primary post mining land use for this mine site will be Box Gum woodland to facilitate a range of final land uses.

6.2.5.1 Tube Stock Planting

There is no tube stock Planting currently undertaken at the Zeolite rehabilitation site. If required, Tube stock planting will be undertaken in accordance with the Rehabilitation Plan.

6.2.5.2 Weed Control

Site Weed Infestations

To date there are no major weed infestation within the Site. Throughout the pasture there will be introduced species and potentially some noxious weeds. St Johns’ Wort (Hypericum perforatum) a declared noxious weed in the Liverpool Plains LGA occurs within the Site and will require control. Zeolite Mine staff will monitor the Site to determine the need for weed control measures. Any weeds of national significance, noxious weeds or environmental weeds will be controlled.

Weed Management

Weed removal shall include any species likely to significantly invade bushland, prevent natural regeneration, or impede native seedling growth. Priority shall be given to species listed as Weeds of National Significance (WoNS) and Noxious Weeds.

Weed management measures will include be appropriate to the weed type, growth form, ecology, and to the existing site condition and include reactive and preventative measures. Detailed measures to management weeds are detailed in the Rehabilitation Plan.

6.2.6 Ecosystem and Land Use Development

For the purposes of this RMP and all domains the ecosystem and land use development phase represent those activities required to develop sustainable ecosystems that have characteristics comparable to similar undisturbed vegetation associations in the area.

Activities are generally ongoing maintenance and land management activities and rehabilitation monitoring. Ongoing environmental management to minimise rehabilitation risks include:

- Comparing specific ecosystem characteristics such as soil profile development, floristic composition and structure and faunal diversity and abundance with the characteristics of appropriate analogue sites, and
- Undertaking adaptive management and remedial works where characteristics of the rehabilitation are not trending toward desired outcomes.

Rehabilitation monitoring will be undertaken throughout the ecosystem and land use development phase until it can be demonstrated that rehabilitation areas have met all conditions for relinquishment. Rehabilitation maintenance activities will be identified by rehabilitation monitoring and ongoing requirements will be reported annually in the Forward Program.

6.2.7 Rehabilitation Completion (Sign-Off)

Rehabilitated areas will be progressively signed-off by the Resources Regulator as they meet the rehabilitation criteria outlined in Section 4, in accordance with the *Guideline: Achieving Rehabilitation Completion (Sign-off).*

6.3 Rehabilitation of Areas Affected by Subsidence

Zeolite is in an area where no historic underground mining has been undertaken. Subsequently, mine subsidence is not applicable to Zeolite.

7.0 Rehabilitation Quality Assurance Process

A Rehabilitation Quality Assurance Process (RQAP) will be implemented throughout the Rehabilitation process. This will include details of inspections, monitoring and record keeping which will be required to ensure that:

- Rehabilitation is being implemented in accordance with the nominated methodologies; and
- Identified risks to rehabilitation are being adequately addressed at each phase of rehabilitation.

Zeolite will implement the RQAP through every phase of rehabilitation to confirm that the rehabilitation strategies outlined in this RMP have been completed in accordance with the nominated methodologies. The RQAP will also include inspections and documentation to verify that each phase of demolition and rehabilitation has been completed and has met the completion criteria detailed in Section 6. Documentation to be maintained would include (but not limited to):

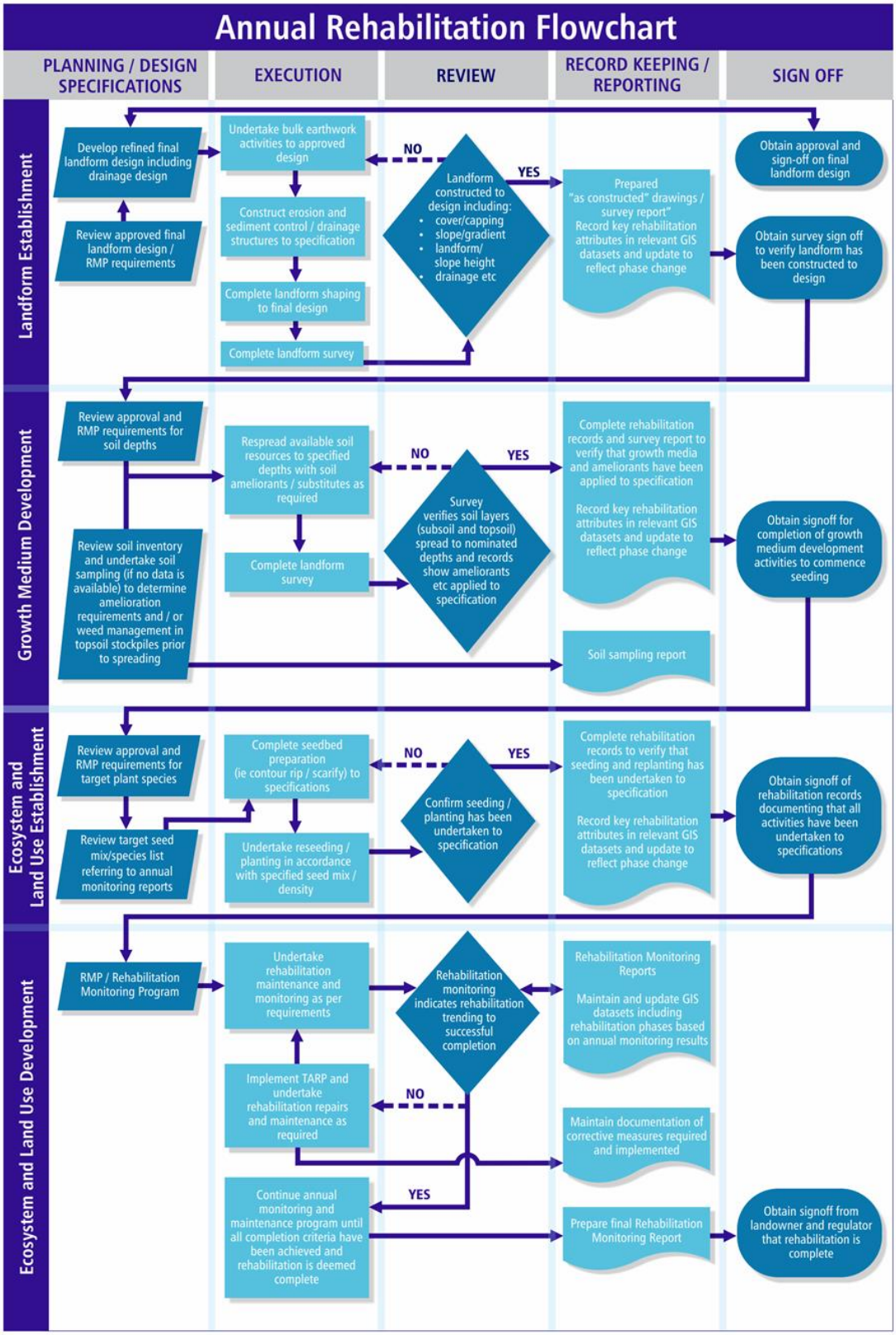
- **Phase 1 – Active Mining**
  - Documentation of pre-clearance surveys and GDPs.
  - Resource salvage records (soil, rocks, habitat trees).
  - Dumping plans and surveys.
  - Detailed Landform designs.
- **Phase 2 – Decommissioning**
  - Documentation of boreholes sealing and sign off by the Resources Regulator.
  - Inspection and demolition reports to confirm all infrastructure to be demolished has been removed.
  - Documentation to identify the future landowner responsible for the ongoing upkeep and management of retained infrastructure.
  - Validation testing to ensure any contamination has been appropriately remediated and/or removed.
- **Phase 3 – Landform Establishment**
  - Survey and preparation of as constructed drawings of final constructed slopes, landforms and water drainage structures.
  - Verification reporting to confirm the specified depth of capping has been implemented (i.e., aerial surveys).
- **Phase 4 – Growth Medium Development**
  - Maintenance of a topsoil inventory to document stripped, stockpiled and re-spread resources.
  - Site records of re-spread topsoil, ameliorants, fertiliser etc.
  - Soil testing results to confirm appropriate soil geochemical parameters for plant establishment.
- **Phase 5 – Ecosystem and Land Use Establishment**
  - Documentation of reseeding or planting activities undertaken, such as date of planting, weather conditions, seeding rates and/or planting rates.

- Site inspections and monitoring of rehabilitated areas to allow early identification of any emerging threats to rehabilitation.

- **Phase 6 – Ecosystem and Land Use Development**
  - Inspections of temporary and permanent erosion and sediment controls.
  - Inspections to identify potential weed infestations.
  - Documentation of Rehabilitation Monitoring.
  - Documentation of weed and feral animal management and eradication programs and follow-up inspections.

Zeolite have developed a Rehabilitation Quality Checklist to be signed off after each phase of rehabilitation prior to proceeding to the next phase (**Figure 13**).

Figure 13: Rehabilitation Quality Assurance Process



8.0 Rehabilitation Monitoring Program

Zeolite is a relatively small mine site in terms of size, they are unable to appropriately rehabilitate during the active mining phase due to a lack of space.

Zeolite in consultation with an appropriately qualified Ecologist will develop and implement a monitoring program that will focus on ensuring rehabilitation objectives and completion criteria have been met, as well as having a specific focus on erosion and sedimentation monitoring. Zeolite will develop this program before in 2023.

8.1 Analogue Site Baseline Monitoring

Analogue sites will be used as a baseline to compare and monitor performance in meeting various rehabilitation criteria, in particular revegetation. Studies previously conducted have used analogue sites in determining baseline values for the existing ecological community. These studies, and sites (where possible) will be used for future comparisons to determine the progress of rehabilitation efforts.

8.2 Rehabilitation Establishment Monitoring

Zeolite currently do not have any established rehabilitation monitoring. Previous rehabilitation done at the site in ML 1356 and former PMA 25 have been signed off by the Resource Regulator and no longer require monitoring.

Monitoring of rehabilitation references sites will be commenced in 2023.

8.3 Measuring Performance against Rehabilitation Objectives and Rehabilitation Completion Criteria

The monitoring program developed by Zeolite will include ongoing monitoring of erosion and revegetation works, photo monitoring of rehabilitation, annual walk over inspections/monitoring and a final assessment of the rehabilitation areas to establish that they have satisfied the rehabilitation objectives and completion criteria.

8.3.1 Rehabilitation Performance

A final assessment of the rehabilitation will be conducted to establish that the rehabilitation has met the completion criteria. This will be conducted by an experienced ecologist and will involve the assessment of a reference site in an undisturbed area and the assessment of a site within the rehabilitation areas to determine if the rehabilitation is trending towards the conditions that are occur within the undisturbed areas.

9.0 Rehabilitation Research, Modelling and Trials

9.1 Current Rehabilitation Research, Modelling and Trials

Two analogue sites have been established. These sites will be used to compare and monitor performance in meeting various rehabilitation criteria, in particular revegetation criteria as outlined in Appendix A. Studies previously conducted have used analogue sites in determining baseline values for the existing ecological community. These studies, and sites (where possible) will be used for future comparisons to determine the progress of rehabilitation efforts.

10.0 Intervention and Adaptive Management

Where rehabilitation performance is not trending toward the nominated completion criteria this may indicate that there is a potential threat to long term rehabilitation success. Threats to rehabilitation may include events such as extended periods of drought, bushfire events, or pressures from weeds and feral/pest animals.

A Rehabilitation and Closure Trigger Action Response Plan (TARP) has been developed to provide a framework to manage potential key risks to rehabilitation. The Rehabilitation and Closure TARP includes:

- Identification of the principal contributing factors and impacts for each major risk to rehabilitation,
- Identification of upper limits (trigger values) for causes and impacts that are considered to represent an unacceptable level of risk; and
- Identification of appropriate responses to mitigate or remediate the causes and impacts, including a notification protocol.

The Rehabilitation and Closure TARP provides management responses for lower (first tier) and upper (second tier) trigger values. First tier trigger values identify opportunities for closer monitoring or early intervention that may mitigate potential impacts before notable impact to rehabilitation occurs. Second tier trigger values identify when indicators have reached a threshold that requires more substantive or widespread remedial actions to remediate or mitigate rehabilitation failure.

Should any trigger conditions be met resulting in the requirement for intervention or adaptive management, actions will be reported in the Annual Rehabilitation Report. Zeolite will notify the Resource Regulator and other relevant stakeholders of any incident (such as bushfire or disease) that results in major impacts to rehabilitation that are likely to significantly impact the potential to achieve rehabilitation success.

The Rehabilitation and Closure TARP is provided in **Table 18**, and will be revised as conditions at Zeolite change or new risks to rehabilitation are identified

Table 18: Trigger Action Response Plan

Aspect/Category	Key Element	Element Number	Tripper/Response	Condition Green	Condition Red
Final Landform	Stability of final landform	**1**	Trigger	The final landform maintains a safe level of stability	Inspection of final landform reveals that the final landform does not maintain an acceptable level of stability.
			Response	No Response needed	• Arrange for further inspection. • Arrange consultation with suitably qualified professional and provision of possible solutions. • Carry out suitable solution following consultation with department.
	Shape of final landform	**2**	Trigger	Final landform has conformed to the approved and agreed upon shape	Final Landform does not conform to the approved shape.
			Response	No response needed	Reshape the final landform until shape complies with the previously approved landform shape.
Surface Water, Sediment and Erosion Controls	Failure of erosion controls	**3**	Trigger	There is no evidence of erosion or sedimentation pollution in rehabilitated areas	Inspections of rehabilitated areas show that the final landform is polluting the surrounding areas through erosion and sedimentation
			Response	No response needed	• Provide reinforcement to erosion control systems, targeting areas of weakness identified by trigger. • Arrange consultation with suitable qualified professional and provision of possible solutions. • Carry out solutions proposed because of consultation activities.
Surface Water Management	Failure of surface water management	**4**	Trigger	There is no evidence of uncontrolled surface water	There is evidence of uncontrolled surface water
			Response	No response needed	• Review surface water management protocols and structures. • Repair or improve surface water management protocols and structures where required.

Aspect/Category	Key Element	Element Number	Tripper/Response	Condition Green	Condition Red
					• Arrange consultation with suitably qualified professional and provision of possible solutions.
Sustainability	Sustainability of rehabilitated ecosystem Impacts of weeds	**5**	Trigger	Biodiversity monitoring shows that species targets are being met through rehabilitation procedures	Biodiversity species numbers are significantly lower than the predetermined species target. The targets will not be met
			Response	No response needed	• Arrange consultation with suitable qualified professional and provision of possible solutions • Plant additional vegetation as required • Improve substrate quality • Introduce further weed control measures.
Hazards	Impacts of Weeds	**6**	Trigger	There is no evidence suggesting an increase in the number of weeds at the rehabilitated site	Assessment of rehabilitated areas reveals a significant increased number of weeds
			Response	No response needed	• Introduce further weed control measures. • Consult a qualified professional for their possible solutions
	Bushfire	**7**	Trigger	There is no evidence suggesting the site is at an increased danger of a bushfire	An assessment of circumstances suggests the site danger of a bushfire has increased significantly
			Response	No response needed	• Prevent or minimise use of flammable substances • Compliance with bush fire management provisions of the Liverpool Plain Shire Council

11.0 Review, Revision and Implementation

11.1 Review and Revision of the Plan

The Plan will be reviewed and if required revised in the event of the following:

- An amendment to the rehabilitation objectives, completion criteria or proposed final land use,
- Changes to risks, risk control measures or rehabilitation strategies being identified during the completion of rehabilitation risk assessment or additional investigations,
- When directed to by the RR Secretary; and
- When triggered by consent conditions (Annual Reviews, Independent Environmental Audits, Incident Reports, Modifications.

11.2 Implementation

The process for ensuring that mining and rehabilitation are conducted in accordance with the RMP is the preparation and implementation of an Annual Rehabilitation Plan. The Annual Rehabilitation Plan is prepared and managed by the Rehabilitation and Closed Mine Manager and approved by the Mine Manager.

Appendix A Rehabilitation Plan (2014)

Escott Zeolite Mine

Rehabilitation Management Plan

Zeolite Australia Pty Ltd

SLR Project No.: 630.30206.00000

18 August 2023

Rehabilitation Plan

Escott Zeolite Mine

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Report Number: 116117
Version / Date: Final/March

IMPORTANT NOTE

We have prepared this report for the sole purposes of Zeolite Australia Pty Limited ("**Client**") for the specific purpose of only for which it is supplied ("**Purpose**"). This report is strictly limited to the purpose and the facts and matters stated in it and does not apply directly or indirectly and will not be used for any other application, purpose, use or matter.

In preparing this report we have made certain assumptions. We have assumed that all information and documents provided to us by the Client or as a result of a specific request or enquiry were complete, accurate and up-to-date. Where we have obtained information from a government register or database, we have assumed that the information is accurate. Where an assumption has been made, we have not made any independent investigations with respect to the matters the subject of that assumption. We are not aware of any reason why any of the assumptions are incorrect.

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Document Status

Version	Purpose of Document	Orig	Review	Review Date
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Approval for Issue

Name	Signature	Date
Ziggy Andersons		17/03/2014

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1.0 Introduction

1.1 Purpose

Escott Zeolite mine engaged RPS to provide them with a plan for the rehabilitation of mined areas within the Mine Lease 1356 (the Site). The purpose of this rehabilitation plan is to provide practical advice for the rehabilitation of the proposed mine area with the aim of restoring the mine lease to a safe, stable, sustainable landform and to an agreed land use of grazing.

The objectives of site rehabilitation remain as stated in the EIS prepared by R.W. Corkery & Co. Pty Limited, (1988) being stability of the final landform and minimization of ongoing maintenance at the site.

Rehabilitation concepts include;

- Rehabilitation to be consistent with a post mining land use capability appropriate to grazing
- Disturbed areas and waste emplacements will be shaped, topsoiled and revegetated with grass species
- The final void of the open cuts will remain as a functional water storage for stock watering post mining
- Mine access roads to remain where appropriate for ongoing agricultural access purposes

1.2 Project Description

Mining Lease ML 1356 occupies an area of 96.96 ha (excluding the 2 ha of former PMA 25) and is located within parts of freehold land described as Lots 215, 235 and 163 in DP 751017. This land is owned by Werris Creek Coal Pty Limited and is located in the Parish of Grenfell, County of Buckland in the Liverpool Plains Shire Council (LPSC), Local Government Area (LGA). Access to ML 1356 is via Escott Road, sections of Crown Road then by mutual agreement with the landowner across Lots 163 and 215 in DP 751017.

The land is zoned RU1 - Primary Production in accordance with the Liverpool Plains Local Environmental Plan 2011. Extractive industries and open cut mines are permitted developments with consent. Land use capability has been assessed as Class 4 on lower slopes and predominately Class 7 covering the rough grazing land over rocky, outcrop with steep slopes.

Conventional open cut mining methods will continue to be employed at the Escott Zeolite Mine during this, 2011-2018 MOP period. Additional market opportunities including overseas developments have the potential to increase mine production to up to 15,000 tonnes per annum in the next 3 years of this 7 year MOP period.

During this MOP period rehabilitation of a total of 2.99 ha including 1.55ha within the former PMA 25 together with the 1.44 ha of area within ML 1356 immediately north, south and west of PMA 25 will be completed and then subject to on-going, minor maintenance assuming rehabilitation objectives have been achieved.

1.3 Site Ecology

The Site is predominantly native pasture species with scattered trees that fits the description of Box-Gum Woodland. Despite the disturbance that has occurred as a result of previous clearing activities and cultivation over portions of the survey area, Box-Gum Woodland on the Site is consistent with the broad definition within the Final Determination of Box-Gum Woodland EEC (NSW Scientific Committee, 2002). RPS has established that the Box-Gum Woodland EEC covers the entire Site and is consistent with the broad definition within the Final Determination of the EEC.

The predominantly native groundcover on the Site suggests that the Box-Gum Woodland EEC is in a relatively good condition despite the paucity of canopy trees, and would ultimately respond favourably to regeneration efforts. The condition of the EEC was generally uniform across the Site and extended into surrounding areas to the north, south and west. These areas provide sufficient seed bank reserves to suggest that assisted natural regeneration of Box-Gum Woodland would be successful in the highly modified areas to the north-east of the Site.

1.4 Target vegetation

The vegetation that exists on the Site, Box-Gum Woodland, will support the agreed final land use of grazing. Box-Gum Woodland will support grazing therefore all plants species to be used in revegetation will be reflective of the composition of the community within the Site and the general locality.

The Department of the Environment, Water, Heritage, and the Arts has developed *A Guide to Managing Box Gum Grassy Woodlands* (Rawlings et al. 2010) which is an invaluable resource that should be consulted for all ecological management activities within the Site.

2.0 Rehabilitation

2.1 Clearing protocols,

All vegetation to be retained within the Site shall be clearly identified on all design, construction and operational drawings. The removal of mature trees should be avoided wherever possible. If any animals are seen to flee during felling they should be left to do so, if there are any injured animals a wildlife carer should be contacted and the animal taken to a vet for assessment. After felling trees should be left overnight to allow any animals that may be present within the trees to relocate

To ensure no disturbance to trees that may impact upon their health occurs protection of existing trees shall be implemented in accordance with Australian Standards 4970-2009 '*Protection of Trees on Development Sites'*. At no time will there be stockpiling, storage, disposal or mixing of materials/liquids, parking of vehicles or machinery or positioning of sheds or offices within the drip lines of trees on-site.

2.1.1 Salvaging and re-using material from the Activity Site

Salvaging and re-using material from the Site is an ecologically sound strategy to minimise waste and to recycle materials that may otherwise require disposal.

Trees and dead timber can be salvaged and re-distributed within rehabilitation areas to enhance the bushland habitat values. Dead wood provides food and habitat for a number of insects and reptiles, which in turn provide food for other fauna species. In addition woody debris acts as a sediment control and water trap which creates microclimates that aid in seed germination.

2.2 Topsoil Stripping

Topsoil is the uppermost layer of soil and is very important from an ecological perspective as it contains the highest amount of nutrients, organic matter, microorganisms, as well as the soil seed bank, and is where the majority of biological soil activity occurs. The conservation and handling of topsoil is important when undertaking developments as it is invaluable for re-vegetation activities and is the second most valuable resource after the zeolite. Biologically, the value of stockpiled topsoil is largely determined by the length of time that soil will be stockpiled and the physical shape of the stockpile (Kiepert *et al.* 2002).

Topsoil contains various amounts of dormant seeds from the vegetation that occupies the Site. This 'soil seedbank' contains propagules from many of the plants that naturally occur within that area. Therefore, it is highly advantageous to conserve this seedbank so that it can be re-used at a later date for rehabilitating disturbed areas. To ensure the preservation of the species from a particular locality it is recommended that where there is a change in vegetation due to elevation or soil type and quality the topsoil stripped from these locations should be stockpiled separately to be respread where the site conditions are similar to those that the topsoil was stripped from.

Topsoil is to be removed from the newly cleared areas using appropriate machinery such as a dozer, excavator, or scraper. It is suggested that topsoil be removed to a maximum of 200 millimetres where it occurs in those depths. Topsoil should be stripped from wherever there will be repeated vehicle movements or excavations and the surface gravelled where appropriate. Where possible stripped topsoil will be immediately respread over rehabilitation areas, where this is not possible the topsoil will be stockpiled for later use in the rehabilitation phase, ideally adjacent to where it will be respread.

2.2.1 Topsoil Volumes

An estimated 260 m3 or 300 tonnes of topsoil materials assuming 10mm depth of topsoil may be available from this area of which some 200 tonnes could be prestripped and stockpiled assuming 70% recovery. Site investigations will be undertaken to confirm quantities to maximise retention of these important soil seed banks.

A further area of up to 2.4 ha down slope of the mine excavation will be progressively stripped to establish waste emplacements, stockpiling and processing sites. An estimated 480 m3 or 500 tonnes of topsoil materials assuming 20mm depth of topsoil may be available from this area of which some 350 tonnes could be pre-stripped and stockpiled assuming 70% recovery.

2.2.2 Stockpile management

To maximise the preservation of the biological aspects of topsoil, stockpiles should be constructed as low and spread out as possible, preferably <2m in height (Kiepert, *et al*, 2002). This does increase the footprint and provides greater surface area for weed colonisation. However, seeding the stockpile itself with target vegetation species or sterile cover species as soon as possible will reduce weed infestation and erosion. The roots will assist in maintaining a viable microbial community and the plants will provide organic matter after re-spreading. Depending on the length of time stockpiling occurs, some species may even set seed — thereby replacing the original seed bank which can deteriorate and become unviable over time.

Topsoil stockpiles will need to have erosion and sediment controls in place at least until the stockpile is used, or it re-vegetates naturally. Sediment controls shall be installed in accordance with best practice. Stockpiling of materials should occur within already disturbed areas and not within retained vegetation. Topsoil stockpiles will be located away from watercourses and key stormwater flow paths to limit potential transport of these substances into the watercourses via runoff

Erosion and sediment control measures shall be implemented to minimise adverse effects as a result of an increased likelihood of erosion and sediment transportation. Erosion and sediment control measures include:

- Installation and maintenance of flow, erosion, and sediment control structures;
- Diversion of clean water around Site and back into natural flow channels;
- Mulching or the installation of biodegradable blankets on high-erosion risk areas; and
- Planting of sterile cover species e.g. Sterile Rye Corn.

2.3 Rehab Preparation

2.3.1 Reshaping

Reshaping of mine workings will involve backfilling of all small excavations and costeans with waste material, covering with available stockpiled topsoil, and then contour ripping prior to seeding. As per the Escott Zeolite Mine Mining Operation Plan (MOP) reshaping will involve:

- Battering / backfilling of larger northern and southern excavations (once remaining blasted zeolite mined) to form small depressions with 1 in 3 slopes.
- Drill and blast faces in and around existing water filled excavations as required and where practical within PMA 25 (in particular northern most face) to form final 1 in 3 slopes.
- Clean-up / batter all waste emplacement areas and spread with available topsoil
- Re-establish drainage in and around re-contoured, disturbed areas to drain into existing water filled mine voids and farm surface water management system

- Maintain safe access or restrict access as required in and around rehabilitated areas for all persons and stock.1 in 3 minimum slopes

The western batters of the mine void(s) are benched at 12 metre intervals with 8 metre wide berms remaining to form an overall slope angle of approximately 45 degrees.

The eastern batters cut in overburden will be mined/battered back to approximately 1:3 and grassed forming safe slopes down to the water filled void(s) for grazing. The 1:10 access ramps will remain for easy vehicular access. Drainage will be re-directed back into the mined out voids that will retain surface water run-off

2.3.2 Soil Ameliorants

Soil sampling should be conducted to establish the quality of topsoils and whether soil ameliorants will be required. A number of representative sites will need to be sampled within the mine lease to ensure a representation of the soils; soil testing will only need to be conducted once with all data collected applied to future rehabilitation works. There are a number of soil testing practitioners within the region that could conduct the soil test relatively cheaply. Samples should be taken from the topsoil layer (0 – 15cm) and the upper subsoil layer (15-30 cm) where it occurs to examine soil properties and determine which ameliorative actions are required during the rehabilitation process (**Table 1**).

Chemical soil tests include the following:

- Electrical Conductivity (EC). If soils are found to be above 4mS/cm, they are classified as saline. Most saline soils have salt concentrated in a particular horizon, (hence testing soil horizons independently). Saline soils restrict plant growth and can be more prone to erosion. Application of gypsum, mulching (addition of organic matter) and planting of salt tolerant species are options for reducing the effect of soluble salts;
- Unusually high or low pH will affect plant growth and erosion. Acidic soils with pH below 5.0 can be ameliorated by the addition of lime. Application at rates of 1 tonne/ha are recommended initially. This has been demonstrated to raise pH levels by 0.5 to 0.7 units on sandy loam soils in medium to high rainfall areas (>325mm). Alkaline soils with pH above 8 can be acidified by the addition of organic matter such as mulches and long term, the planting of legume species.
- Dispersive soils return Emerson Aggregate Test scores of 1, 2, 3 and 5 which indicates complete or some dispersion. Dispersive soils are susceptible to tunnelling and erosion depending on water and salt content. Application of gypsum is standard treatment as calcium and magnesium displaces other cations which cause clay particles to disperse in water. Alkaline soils can also be ameliorated by the addition of organic matter.
- Cation Exchange Capacity relates to the ability of a soil to adsorb positively charged ions such as Ca, Mg, Al, Na, Mn, H and K from the soil water solution. High CEC levels can indicate salinity or imbalances that may lead to plant toxicities. Amelioration as per pH may rectify any imbalances. Aluminium becomes toxic at low pH, while other cations become unavailable to plants at high pH.

Table 1 Soil amelioration rates.

Soil Parameter	Value	Action	Rate
pH	High pH>8.0	Application of Gypsum Application of organic matter	2.5t/Ha initially 3-5 t/Ha
	Low pH<5.0	Application of Lime	1 t/Ha initially
EC	>4 mS/cm	Application of Gypsum	Minimum 2.5 t/Ha
CEC	Individual cation	Application of Lime	1 t/Ha initially

Soil Parameter	Value	Action	Rate
	deficiencies		
EAT (Emerson Aggregate Test)	Dispersion classes 1, 2, 3 and 5	Application of Gypsum Addition of organic matter Bury dispersive soils beneath topsoil	2.5t/Ha initially 3-5 t/Ha

2.3.3 Topsoil Spreading

Add soil ameliorants to the soil surface of respread topsoil so that they can be incorporated during the seed bed preparation. Products like Gypsum if not properly mixed with topsoil can be rapidly washed from the soil surface during rain.

Contour ripping the topsoil to ameliorate the effects of compaction from heavy machinery. If the Site contains dispersive soils ripping should not occur below the depth of the re-spread topsoil. Mixing and de-compaction of underlying dispersive subsoils can increase dispersion. Where the underlying substrate is not dispersive ripping should be deep enough to just break up the interface between the topsoil and underlying spoil.

3.0 Revegetation Techniques

The goal of revegetation is to revegetate the Site with Box-Gum Woodland which occurs within the Site and throughout the region. This will be achieved by assisting the community to self establish, direct seeding, and the planting of tubestock.

3.1 Revegetation from Seed

A major component of the White-Box Woodland community is the groundcover component. Due to the complexity and nature of this component direct seeding is the most effective and efficient method of revegetation and will supplement the soil seedbank and seed dispersing from surrounding vegetation. This component of the community will be the quickest to become established and should be used for erosion control purposes.

By managing stripped topsoil correctly groundcover and shrub species (if they are present within the soil seed bank) will quickly establish once topsoil is respread. The groundcover species from the box woodland community produce large numbers of seeds that are dispersed by wind and can travel considerable distances. Therefore colonisation from surrounding vegetation is highly likely to occur which will provide the diversity that may be lost during storage of topsoil or that is not available as seed.

The aim of direct seeding is to speed up colonisation of respread topsoil to reduce erosion and limit the ability for weed species to become established. Seed should be sourced from species and plants that occur within the locality ideally, but not from outside the region. If this seed is not available the sowing of sterile cover crops should be planted instead which will act to stabilise topsoil and introduce organic matter and cover that will assist native species to self-colonise.

3.1.1 Seed Collection

Within the site there is a sufficient number and diversity of tree species for the seeds to be collected from the site. This should be done opportunistically as seeding times can be highly variable. Seeds should be collected and placed in paper bags in a dry spot out of direct sunlight for drying, once dry many seed pods will release their seeds which can then be stored in a cool dry place in an air tight container for later sowing. Some species require seed preparation to allow them to germinate but the majority including Eucalypts can be sown directly into the ground.

For large areas seed can be spread from an agricultural seeder, for smaller areas seed can be spread by hand. Smaller shrub species should be included into the groundcover seed mix at relatively low concentrations. A list of species recorded from the Site is provided in **Appendix 1** and should be used as a guide for species selection

3.2 Tubestock Planting

As it is a woodland community the density of the tree and shrub component of the community is relatively sparse. In consideration of the 2.99 ha that will require rehabilitation post mining, the planting of tube stock for the tree, and where they are available, the shrub layer will be the most effective method of revegetation. The details below apply to this methodology.

3.2.1 Mulching

Mulch should be applied around any planted trees using weed-free woodchip or hay mulch. All mulch shall be free of contaminants such as weed seeds and propagules and non-biodegradable material — such as litter and building rubble. Mulch will be established to a minimum depth of 75 millimetres around trees. Mulch

has been shown to increase the survivorship of plants in soils with poor water holding ability, however, it will limit the likelihood of both native and weed species regenerating. Therefore, it is recommended that once tubestock becomes established, mulching should not reoccur to encourage seed germination of native plants.

3.2.2 Plant Stock

Naturally occurring remnant vegetation, preferably from the Site or local area, is the best source of seed and/or vegetative material for revegetation. Generally, these plants will have evolved to suit local environmental conditions and have a desirably broad genetic base. Ecologically and genetically, local seed complements other plants and animals in the area, and poses the least potential threat of genetic contamination. A licensed nursery can complete the seed collection, germination, and supply of tubestock. Tamworth Native Nursery is a local nursery that would have experience in the local ecology, the appropriate licenses, and the capacity to supply a project of this nature.

3.2.3 Planting

Planting should occur during spring to allow for plants to become acclimated to the Site before drier hotter conditions occur over summer. Better results will occur if regular watering occurs for at least the first month, especially in the drier, warmer months.

3.2.4 Fertilisers

Given that locally occurring native species will be planted, the use of fertiliser during planting works is optional. Pellet forms of fertiliser with low levels of Phosphorus are available for use within native rehabilitation (planting) areas.

3.2.5 Tree Guards and Fencing

Tree guards should be utilised where a high level of grazing of seedlings is occurring or tubestock require an unsustainable amount of watering. Tree guards protect individual plants from herbivory by kangaroos, rabbits, and other feral animals as well as protect the tree and soil from desiccating winds. The need for use of tree guards will be determined on a case-by-case basis.

3.3 Maintenance

Upon completion of the staged rehabilitation works maintenance will be required. This maintenance is predominantly to ensure that rehabilitation works have been successful and, if not, controls are put in place to ensure that they are. Maintenance will only be necessary until rehabilitation becomes self-sustaining and will be required for a minimum of a year after rehabilitation. Maintenance will constitute weed control, plant replacement, irrigation and pest control where required.

3.3.1 Consolidation and Weed Removal

The Site may need several visits to remove weeds that are regenerating and/or have grown in response to the disturbance and are competing with regenerating native plants. A system of weed removal must be undertaken to remove weed seedlings and regrowth. These visits are essential; otherwise the weeds will re-establish and out-compete the regenerating/replanted natives.

3.3.2 Plant Replacement

Plant replacement should take place in areas where rehabilitation has failed, been damaged or is suffering from pests and/or disease.

Plants lost or damaged should be replaced to maintain the original planted stock and recommended plant densities. Initial and careful consideration of the health of tubestock prior to its purchase should negate stock losses.

3.3.3 Irrigation

Watering of seedlings should be continued as required until all plants are established. Weather and site conditions will determine the frequency of watering for plants over the maintenance period to ensure they do not perish. Moisture levels and plant health should be monitored weekly during drier periods.

Watering should be undertaken early morning or late afternoon to avoid the hottest part of the day and minimise water loss.

4.0 Weed Control

4.1 Site Weed infestations

To date there are no major weed infestation within the Site. Throughout the pasture there will be introduced species and potentially some noxious weeds. St Johns' Wort (*Hypericum perforatum*) a declared noxious weed in the Liverpool Plains LGA occurs within the Site and will require control. Escott Zeolite Mine staff will monitor the Site to determine the need for weed control measures. Any weeds of national significance, noxious weeds or environmental weeds will be controlled.

4.2 Weed Management

Weed removal shall include any species likely to significantly invade bushland, prevent natural regeneration, or impede native seedling growth. Priority shall be given to species listed as Weeds of National Significance (WoNS) and Noxious Weeds. Weeding techniques should be appropriate to the weed type, growth form, ecology, and to the existing site conditions. Wherever possible, weed removal should be carried out prior to annual seed set.

It is not possible to remove a weed from a site on a single occasion, as weeds have a persistent seedbank that can remain viable for long periods of time. Seeds will germinate rapidly after the parent plant has been removed due to increases in light and habitat availability. It is therefore very important that the Site be revisited following the initial weeding for follow-up weeding, as cleared areas containing even moderately disturbed soil are highly conducive to weed invasion.

Secondary weeding will be undertaken as required. The secondary weeding will aim to remove the weeds that have germinated since the previous site visit. This is likely to consist of spraying with herbicide or removal by hand, as any weeds present will be small and easily eradicated. At the completion of this stage, there should be minimal weeds remaining.

4.2.1 Preventative Measures

Preventative measures for weeds are generally limited to reducing the spread of weeds throughout the Site and prevention of the transportation of weeds into the Site from external sources. Generally likely causes of weed spread within the Site are:

- Equipment brought onto Site contaminated with weed seeds;
- Vehicle transporting seeds within the Site along access roads and tracks; and
- Spread of weed seed or propagules on clothing and boots.

Active control of the above points as part of an integrated strategy will ameliorate the spread of weeds within the Site and surrounds. Those weeds that bypass these strategies or naturally disperse into the Site should be controlled utilising weed management procedures. To address the movement of weeds within the Site, the implementation of hygiene protocols and restricting movement outside of constructed roads is the most effective strategy.

To control the spread of weeds to and from the Site a hygiene protocol will be established. This will involve ensuring all vehicles and machinery are free from plant material and built up mud / dirt that may carry weed seed before they come and go from the Site.

All civil plant machinery transported to the Site must be inspected to ensure that it has been cleaned of foreign soil and vegetative matter prior to arrival. This will also apply to any equipment to be removed from the Site to prevent weeds being transported off-site.

4.2.2 Weeds of National Significance

Weeds of National Significance (WoNS) are species targeted for sustained nationally coordinated action under the Australian Weeds Strategy. This strategy provides for national management to eradicate WoNS species from parts of the country where Australia's productive capacity & natural ecosystems are affected.

Each WoNS has a strategic plan that outlines strategies and an action required to control the weed, and identifies those responsible for each action. Individual landowners and managers are ultimately responsible for managing WoNS species. State and territory governments are responsible for overall legislation and administration.

WoNS species must be identified for the locality and considered under the weed management activities carried out within the Site. A full list of WoNS is provided in **Appendix 2.**

4.2.3 Listed Noxious Weeds in Liverpool Plains LGA

The NSW Department of Industry & Investment under the Noxious Weeds Act, (1993) lists Noxious Weed declarations for all Local Government Areas. Similarly to WoNS, these weeds must be identified for the locality and considered under the weed management activities carried out within the Site. A full list of declared noxious weeds for the LPSC LGA is included in **Appendix 2.**

4.2.3.1 Weed control classes

The following weed control classes may be applied to a plant by a weed control order:

(1) Class 1, State Prohibited Weeds.

(2) Class 2, Regionally Prohibited Weeds.

(3) Class 3, Regionally Controlled Weeds.

(4) Class 4, Locally Controlled Weeds.

(5) Class 5, Restricted Plants.

The characteristics of each class are as follows:

(a) Class 1 noxious weeds are plants that pose a potentially serious threat to primary production or the environment and are not present in the State or are present only to a limited extent.

(b) Class 2 noxious weeds are plants that pose a potentially serious threat to primary production or the environment of a region to which the order applies and are not present in the region or are present only to a limited extent.

(c) Class 3 noxious weeds are plants that pose a serious threat to primary production or the environment of an area to which the order applies, are not widely distributed in the area and are likely to spread in the area or to another area.

(d) Class 4 noxious weeds are plants that pose a threat to primary production, the environment or human health, are widely distributed in an area to which the order applies and are likely to spread in the area or to another area.

(e) Class 5 noxious weeds are plants that are likely, by their sale or the sale of their seeds or movement within the State or an area of the State, to spread in the State or outside the State.

A noxious weed that is classified as a Class 1, 2 or 5 noxious weed is referred to in this Act as a ***notifiable weed*** and a range of restrictions on their sale and movement exist.

4.2.4 Other Known or Likely Weeds

In addition to the abovementioned WoNS and Noxious Weeds, there will be further weeds of local significance that should be considered during weed management activities. In addition, any existing escapee garden plant species (non endemics) should be controlled, as they can result in local infestations out competing native species and may have a negative impact upon native bushland and natural resources such as waterways, creeks and rivers.

4.3 Weed Control Methods

As the site is certified as organic by Australian Organic Limited chemicals are not permitted to be used within the site therefore alternative methods of weed control will need to be applied. Slashing and mechanical removal are the simplest form of chemical weed control but can be prohibitive over rough rocky terrain or where there is large area to cover. Weeding with heat or changing soil conditions so that they don't favour weed species is the next most viable options.

4.3.1 Non Chemical Based Weed Control

Flame weeding uses LP gas as a direct flame or an infrared burner to contact plants and produce heat that will vaporise water in the plant cells. This allows moistures loss from the plants and inhibits photosynthesis. Flame weeders are commonly used in horticulture on tractors mounted units. Handheld wands are also available for individual plants. The main disadvantage of flame weeding is the danger of fire and cost of gas.

Steam weeding has been used in many horticultural applications. Steam has the advantage of being more effective at killing plants than flame weeding. Generally though steam weeders require significant energy inputs to heat the water and they can require significant amounts of water.

Vinegar (Acetic acid) has been found to be useful herbicide for broadleaf weeds and grasses. Generally the acetic acid content in vinegar is about 5% but a level of 10% is needed to treat most weeds. One proprietary brand also has 4% salt with the acetic acid. Trials have shown that 10-20 concentrations of vinegar are effective on broadleaf weed but less successful on grasses. While vinegar may seem to be innocuous, at a concentration of 10% acetic acid it will cause skin irritation, have fumes and can cause eye irritation/damage.

There are a number of publications that indicate the soil conditions that can favour particular types of plants. Some weeds such as African Lovegrass have the ability to grow over a huge range of soil types but other weeds can have specific soil requirements such as low Calcium or phosphorus. The '*Guide to managing Box Gum Grassy Woodlands'* (Rawlings et al 2010) published by the Department of the Environment, Water, Heritage and the Arts outlines a number of weed management strategies and should be consulted for all management actions within Box Gum Grassy Woodland.

5.0 Completion

5.1 Completion Criteria

Rehabilitation will be occurring progressively with the final goal being to leave the site in a safe, stable and sustainable state that can support the final land use of grazing. Targets for rehab include:

- Ensuring the banks of all mine voids to be used as water storage have a grade of 1 in 3 or less to prevent people or stock from getting trapped in the water;
- No excessive erosion is occurring;
- That the condition of the vegetation on the rehabilitated areas is trending towards the conditions that occur in the same vegetation type in the locality; and
- That the site can support grazing activities.

5.2 Monitoring

Monitoring of the rehab will include ongoing monitoring of erosion and revegetation works, photo monitoring of rehabilitation and a final assessment of the rehabilitation areas to establish that they have satisfied the rehabilitation objectives.

Erosion control measures will be inspected following periods of high rainfall to ensure they are working as intended and can be assessed for the need for repairs. Following any rehabilitation works the sites will be inspected weekly to ensure no erosion is occurring and to determine if any tubestock planted require watering or if they require fencing or grow tubes if herbivory is occurring.

Photo monitoring points will be established within/adjacent to areas of rehabilitation and will be permanently marked with a star picket. Photos will be taken facing the same directions at the same height and at the same time of year. Photo monitoring should occur once a year to track the progress of rehabilitation.

A final assessment of the rehabilitation should be conducted to establish that the rehabilitation has met the completion criteria. This will be conducted by an experienced ecologist and will involve the assessment of a reference site in an undisturbed area and the assessment of a site within the rehabilitation areas to determine if the rehabilitation is trending towards the conditions that are occur within the undisturbed areas.

6.0 References

Gordon Atkinson & Associates Pty Ltd. (2012), *Escott Zeolite Mine Mining Operation Plan*, report prepared for Zeolite Australia Pty Ltd.

R.W. Corkery & Co. Pty Limited, (1988) - Environmental Impact Statement For The Mining Of Zeolite-Bearing Rock At “Escott”, Werris Creek, NSW

Kiepert, N., Grant, C., Duggin, J. and Lockwood, P. (2002) The effect of different stockpiling procedures on topsoil charateristics in open cut coal mine rehabilitation in the Hunter Valley, New South Wales. Australian Coal Association Research Program, ACARP Project C92029 – Interim Report.

Rawlings, K., Freudenberger, D., and Carr, D. (2010), *A Guide to Managing Box Gum Grassy Woodlands,* Department of the Environment, Water, Heritage and the Arts, Canberra.

Appendix 1

Site Flora Species List

Scientific Name	Common name	Form
Bothriochloa decipiens var. decipiens	Pitted Bluegrass, Redleg Grass	Grass
Brachychiton populneus subsp. populneus	Kurrajong	Tree
Bursaria spinosa	Black Thorn	Shrub
Calotis lappulacea	Yellow Burr Daisy	Groundcover
Chloris truncata	Windmill Grass	Grass
Chloris ventricosa	Tall Chloris	Grass
Cynodon dactylon	Common Couch	Grass
Einadia hastata	Berry Saltbush	Groundcover
Enneapogon nigricans	Niggerheads	Groundcover
Eucalyptus albens	White Box	Tree
Eucalyptus blakeleyi	Blakeley's Red Gum	Tree
Glycine tabacina	Twining Glycine	Vine
Juncus usitatus	Common Rush	Groundcover
Pandorea pandorana	Wonga Vine	Vine

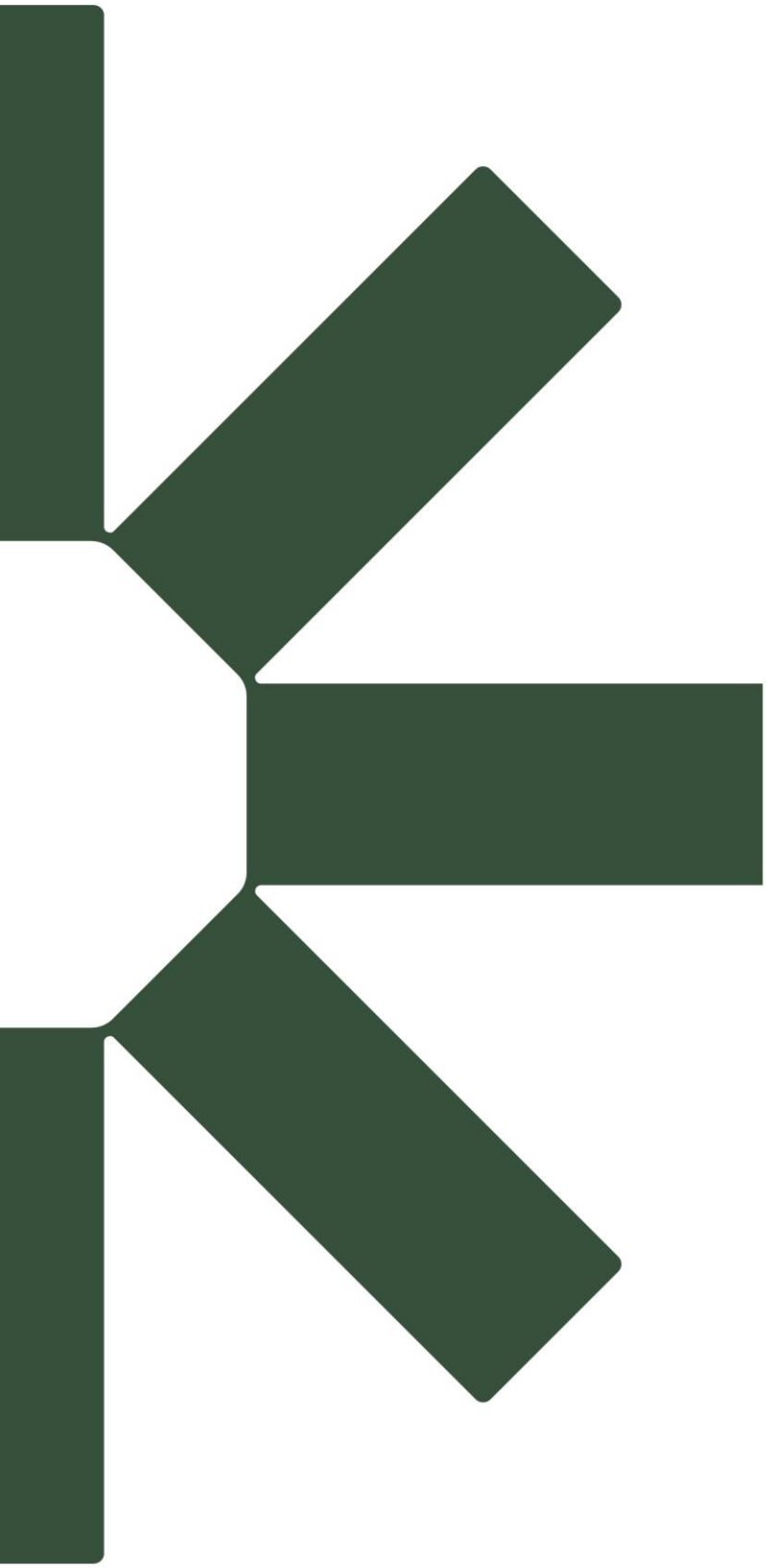
Appendix 2

Weeds of National Significance and LPSC Noxious Weeds

Common Name	Scientific Name	Class	WoNS
African boxthorn	*[Lycium ferocissimum]*	4	X
African feathergrass	*Pennisetum macrourum*	5	
African turnip weed	*[Sisymbrium runcinatum]*	5	
African turnip weed	*Sisymbrium thellungii*	5	
Alligator weed	*Alternanthera philoxeroides*	2	X
Anchored water hyacinth	*Eichhornia azurea*	1	
Annual ragweed	*Ambrosia artemisiifolia*	5	
Arrowhead	*Sagittaria montevidensis*	4	
Artichoke thistle	*Cynara cardunculus*	5	
Athel pine	*Tamarix aphylla*	5	X
Bathurst/Noogoora/Hunter/South American/Californian/cockle burr	*Xanthium species*	4	
Bear-skin fescue	*Festuca gautieri*	5	
Black knapweed	*Centaurea nigra*	1	
Blackberry except cultivars Black satin, Chehalem Chester, Thornless Dirksen, Thornless Loch Ness, Murrindindi Silvan, Smooth stem Thornfree	*Rubus fruticosus aggregate species*	4	
Boneseed	*Chrysanthemoides monilifera subspecies monilifera*	2	X
Bridal creeper	*Asparagus asparagoides*	4	X
Broomrapes Includes all Orobanche species except the native O. *Cernua* variety australiana and *O. Minor*.	*Orobanche species*	1	
Burr ragweed	*Ambrosia confertiflora*	5	
Cabomba Includes all Cabomba species except *C. furcata*.	*Cabomba species*	5	X
Cayenne snakeweed	*Stachytarpheta cayennensis*	5	
Chilean needle grass	*Nassella neesiana*	4	X
Chinese violet	*Asystasia gangetica subspecies micrantha*	1	
Clockweed	*Gaura parviflora*	5	
Columbus grass	*Sorghum x almum*	4	
Corn sowthistle	*Sonchus arvensis*	5	
Dodder Includes All Cuscuta species except the native species *C. australis, C. tasmanica and C. victoriana*	*Cuscuta species*	5	
East Indian hygrophila	*Hygrophila polysperma*	4	
Espartillo	*Amelichloa brachychaeta, Amelichloa caudata*	5	
Eurasian water milfoil	*Myriophyllum spicatum*	1	
Fine-bristled burr grass	*Cenchrus brownii*	5	
Fountain grass	*Pennisetum setaceum*	5	
Galenia	*Galenia pubescens*	4	
Gallon's curse	*Cenchrus biflorus*	5	
Giant Parramatta grass	*Sporobolus fertilis*	3	
Glaucous starthistle	*Carthamus glaucus*	5	
Golden dodder	*Cuscuta campestris*	4	
Golden thistle	*Scolymus hispanicus*	5	
Green cestrum	*Cestrum parqui*	3	
Harrisia cactus	*Harrisia species*	4	
Hawkweed	*Hieracium species*	1	
Heteranthera	*Heteranthera reniformis*	1	

Common Name	Scientific Name	Class	WoNS
Horsetail	*Equisetum species*	1	
Hydrocotyl	*Hydrocotyl ranunculoides*	1	
Hymenachne	*Hymenachne amplexicaulis and hybrids*	1	X
Johnson grass	*Sorghum halepense*	4	
Karroo thorn	*Acacia karroo*	1	
Kochia except *Bassia scoparia subspecies trichophylla*	*Bassia scoparia*	1	
Koster's curse	*Clidemia hirta*	1	
Lagarosiphon	*Lagarosiphon major*	1	
Lantana	*Lantana species*	4	X
Leafy elodea	*Egeria densa Egeria densa*	4	
Lippia	*Phyla canescens*	4	
Long-leaf willow primrose	*Ludwigia longifolia*	4	
Long-style feather grass	*Pennisetum villosum*	4	
Mesquite	*Prosopis species*	2	X
Mexican feather grass	*Nassella tenuissima*	1	
Mexican poppy	*Argemone mexicana*	5	
Miconia	*Miconia species*	1	
Mikania	*Mikania micrantha*	1	
Mimosa	*Mimosa pigra*	1	X
Mossman River grass	*Cenchrus echinatus*	5	
Mother-of-millions Species included are *Bryophyllum delagoense Bryophyllum x houghtonii Bryophyllum pinnatum*	*Bryophyllum species*	4	
Nodding thistle	*Carduus nutans*	4	
Pampas grass	*Cortaderia species*	4	
Parkinsonia	*Parkinsonia aculeata*	2	X
Parthenium weed	*Parthenium hysterophorus*	1	X
Paterson's curse, Vipers bugloss, Italian bugloss	*Echium species*	4	
Perennial ragweed	*Ambrosia psilostachya*	4	
Pond apple	*Annona glabra*	1	X
Prickly acacia	*Acacia nilotica*	1	X
Prickly pear	*Cylindropuntia species*	4	X
Prickly pear Includes all *Opuntia* species except *ficus-indica*.	*Opuntia species*	4	X
Red rice	*Oryza rufipogon*	5	
Rhus tree	*Toxicodendron succedaneum*	4	
Rubber vine	*Cryptostegia grandiflora*	1	X
Sagittaria	*Sagittaria platyphylla*	5	X
Salvinia	*Salvinia molesta*	2	X
Scotch broom	*Cytisus scoparius*	4	X
Scotch, Stemless, Illyrian and Taurian thistles	*Onopordum species*	4	
Senegal tea plant	*Gymnocoronis spilanthoides*	1	
Serrated tussock	*Nassella trichotoma*	3	X
Serrated tussock	*Nassella trichotoma*	4	X
Siam weed	*Chromolaena odorata*	1	
Silk forage sorghum	*Sorghum species hybrid cultivar*	4	
Silverleaf nightshade	*Solanum elaeagnifolium*	3	X
Smooth-stemmed turnip	*Brassica barrelieri subspecies oxyrrhina*	5	
Soldier thistle	*Picnomon acarna*	5	
Spiny burrgrass	*Cenchrus incertus*	4	
Spiny burrgrass	*Cenchrus longispinus*	4	

Common Name	Scientific Name	Class	WoNS
Spotted knapweed	*Centaurea stoebe subspecies micranthos Centaurea stoebe subspecies micranthos*	1	
St. John's wort	*Hypericum perforatum*	3	
Star thistle	*Centaurea calcitrapa*	4	
Sweet briar	*Rosa rubiginosa*	4	
Texas blueweed	*Helianthus ciliaris*	5	
Tropical soda apple	*Solanum viarum*	2	
Water caltrop	*Trapa species*	1	
Water hyacinth	*Eichhornia crassipes*	2	X
Water lettuce	*Pistia stratiotes*	1	
Water soldier	*Stratiotes aloides*	1	
Willows Includes all Salix species except *S. babylonica, S. x reichardtii, S. x calodendron*	*Salix species*	5	
Witchweed Striga species except the native *Striga parviflora*.	*Striga species*	1	
Yellow burrhead	*Limnocharis flava*	1	
Yellow nutgrass	*Cyperus esculentus*	5	



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