Program for Environment Protection and Rehabilitation

ML 4132

For the proposed mining of waste rock

Prepared for Gemstones Australia
10 December 2015

By COOE Pty Ltd
Final version

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1. Declaration of Accuracy

I Des Murphy submit this document as the Program for Environment Protection & Rehabilitation for ML 4132. I have reviewed the program and can verify the accuracy of the document.

Signed: .....

Name: Des Murphy

Position: Director

Date: 9th December 2015

Consultants Statement of Accuracy: This Program for Environment Protection and Rehabilitation is based on information provided by the Client and Department of State Development and undertaken as a desktop study.

The information comprised of the 1990 Mining Development Program, Cowell Jade and the subsequent Development and Rehabilitation Program approved by the Department of Mines and Energy 15 February 1993. All databases and works cited are referenced within the main body of text or with figures and tables. No field verification was undertaken on any aspect of this document by the consultant.

2. Description of the Environment

ML4132 is located in the Jade Province near Mt. Ghearthy on the east coast of the Eyre Peninsula, 70 km north of the township of Cowell on Franklin Harbour, Figure 1. Details of ML4132 are provided in attachment 1.

Figure 1: Locality map of proposed rock mine on ML4132

2.1 Local Community

ML4132 is in the sheep and grain district but on what is considered as marginal area. The population in 2011 was 1,070. In addition to mining and agriculture the Cowell community supports, a service sector and fishing and oyster farming activities.

Three land owners are recorded near ML4132:

Section 111 hundred of Minbrie - RW & CA Jacobs
Section 116 hundred of Minbrie - LH & JA Schiller, live at Mt Ghearthy homestead
Section 111 hundred of Minbrie - LM & AR Tonkin

2.2 land Use

Some one hundred outcrops of jade have been mapped within nine square kilometres, designated by the Department of State Development as the “Cowell Jade Province”.

ML 4132 is one of twenty three Mineral Leases (ML) and two Extractive Mineral Leases (EML), most are intermittently mined for Jade, Talc and marble with waste rock being extracted from the EML on a campaign basis.

These mineral and extractive leases coexist with agricultural activities, mainly livestock with grain cropping on deeper soils.

2.3 Proximity to infrastructure and housing

The site is served by unsealed access tracks that link the site via public roads to the Lincoln Highway. The nearest house is the Mt Ghearthy homestead around 1.5 km to the north, north east of ML4132.

2.4 Amenity

Most of the gemstone workings and this proposed rock mine are remote and not visible from public roads. The only tracks near the quarries are from mine access and used by landowners to move livestock and equipment.

2.5 Noise, dust, air quality

The proposed rock mining activity will not require any additional blasting. Loading activities are likely to generate some dust and noise but the impact on neighbouring properties is considered to negligible.

2.6 Topography and landscape

The lease is on a relatively steep east facing slope of a tributary gully draining to the south, south west to Minbrie Creek. Figure 2 provides a topographic map and the approximate location of the proposed extractive activity.

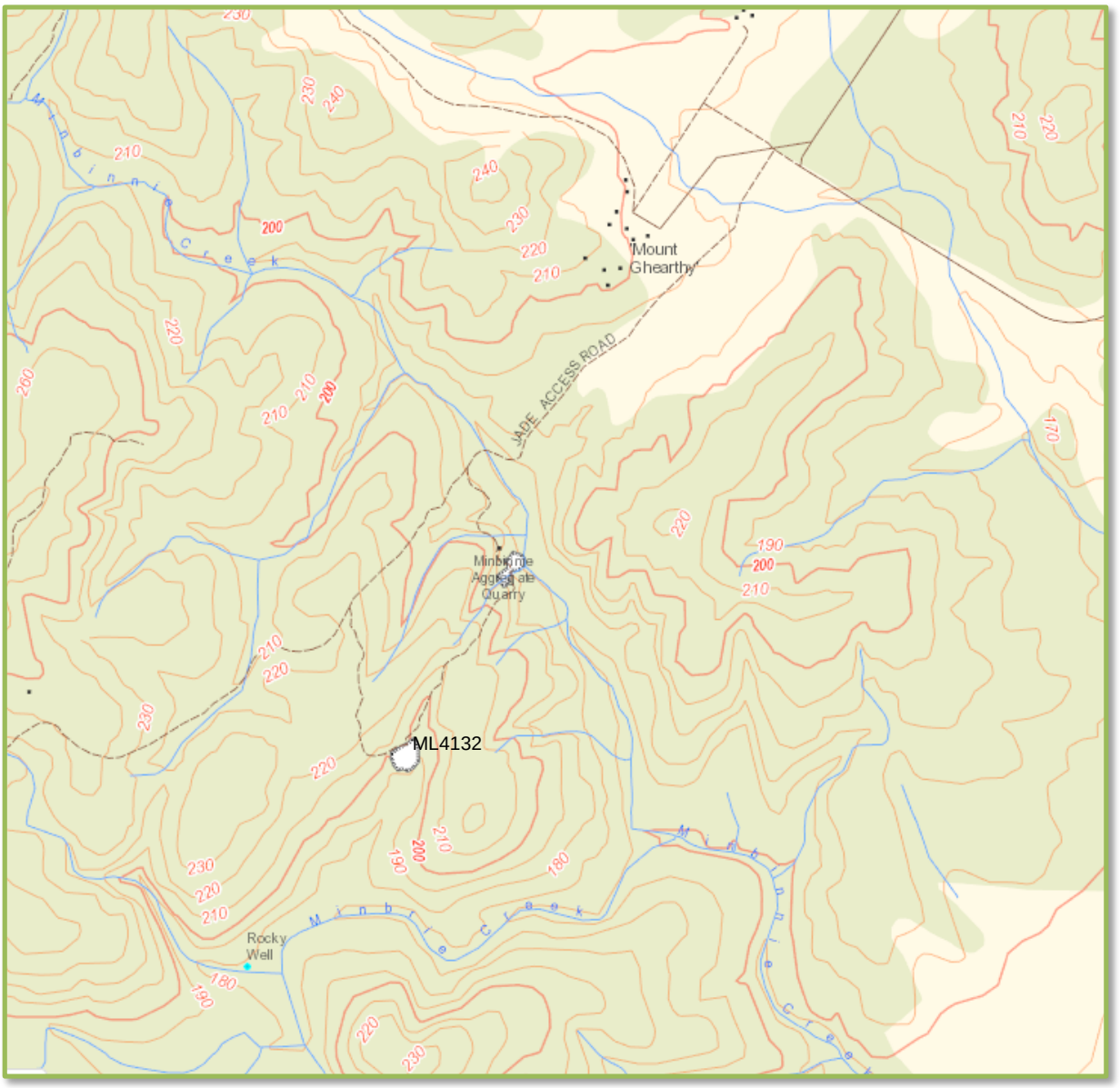

Figure 2: Topographic map of Mt Ghearthy and ML4132.

2.7 Climate

The climate is classified as Mediterranean with highly variable annual rainfall. The Bureau of Meteorology has 131 years of records for Cowell with an annual rainfall total range from 127 mm to 552 mm with an annual average of 281 mm. Most rain falling between May and November, Figure 3.

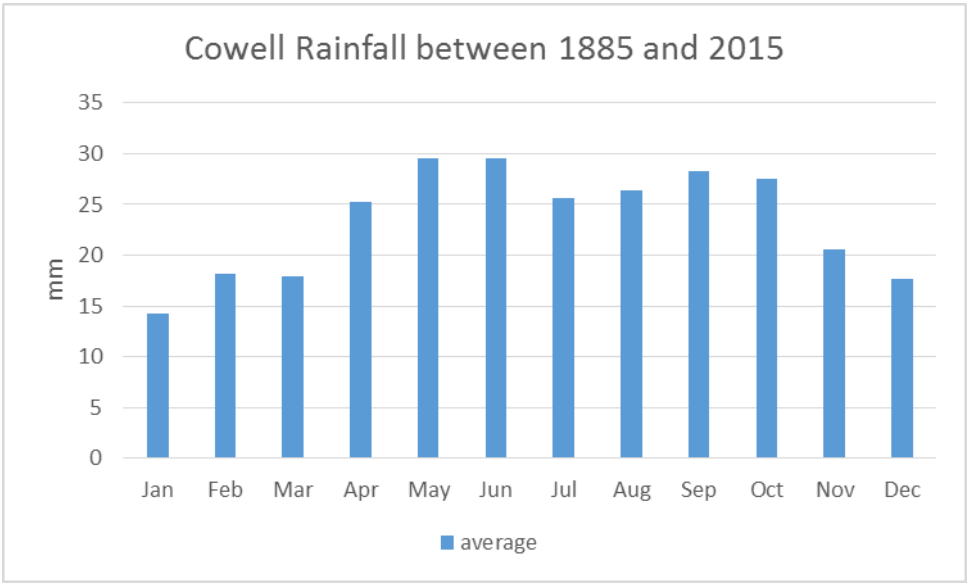

Figure 3: Cowell annual rainfall between 1885 and 2015

Highest monthly average temperature recorded by the BOM at Cleve (49 km south west of ML4132) is 32.8 °C in January and coolest is 13.2 °C in June, at 32.8. No temperature statistics were available for Cowell.

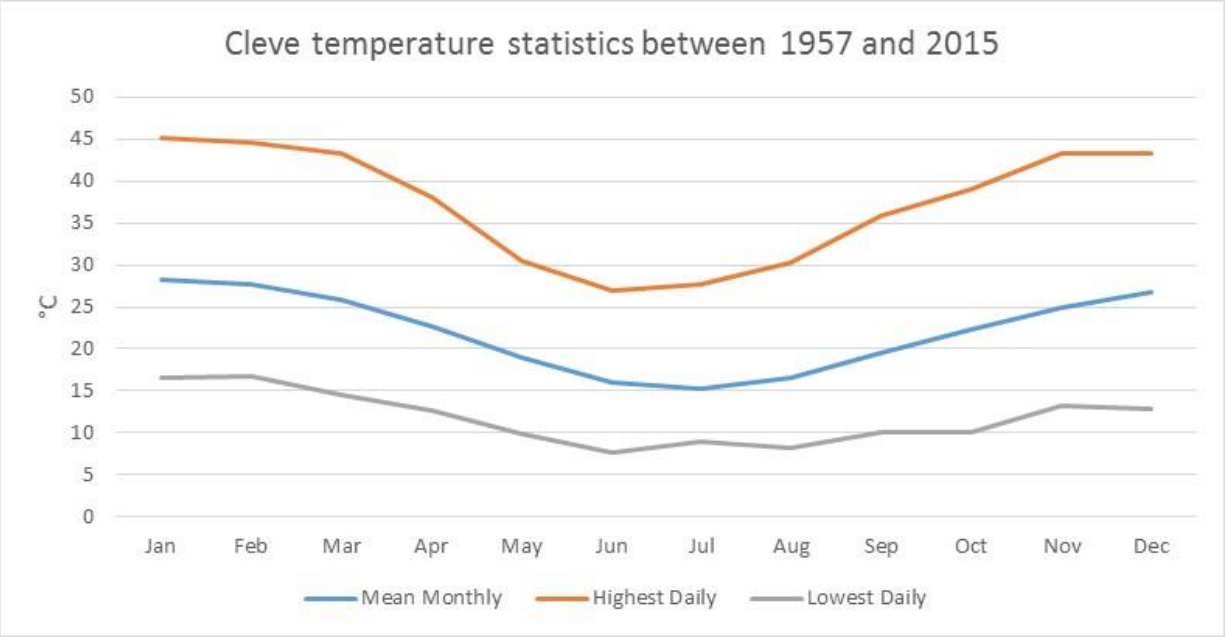

Figure 4: Cleve temperature statistics between 1965 and 2015

2.8 Geohazards

Naturally exposed rocks on steep terrain present a small but probable risk of rock slippage into the valley.

Exposed rock face by jade mining activities also present minor erosion and rock fall hazards. Existing workings comprise of a single bench with a floor at RL 190 to 191 and a small pit 6 m to the north. Length of the bench is 40 m running east west and a width of

30 m with a maximum height of 10 m facing to the east.

Two waste rock dumps are located immediately to the east and at 10-50 m to the north. Stockpiles of waste rock are prone to erosion, however the proposed activity of extracting the waste rock will reduce this hazard.

All proposed rock mining activities will be on the two waste rock dumps.

2.9 Hydrology

The hilly terrain drains into small tributaries of an ephemeral creek, Minbrie Creek. The skeletal soils on the ridges hold minimal water, generating some runoff after a storm event. The deeper soils on the gentler slopes retain sufficient water to supplement seasonal rains to grow grain crops. No natural lakes or sinkholes are found in the vicinity of ML 4132. An old dam is located 1 km to the south west.

2.10 Groundwater

A search of the SARIG database showed that the shallow groundwater under ML4132 is saline at 7,000 to 14,000 ppm (Figure 5) at a depth of 10 to 20 m below surface (Figure 6) and low yielding of between 0.5 – 2.5 L/s, Figure 7 (SARIG, 2015).

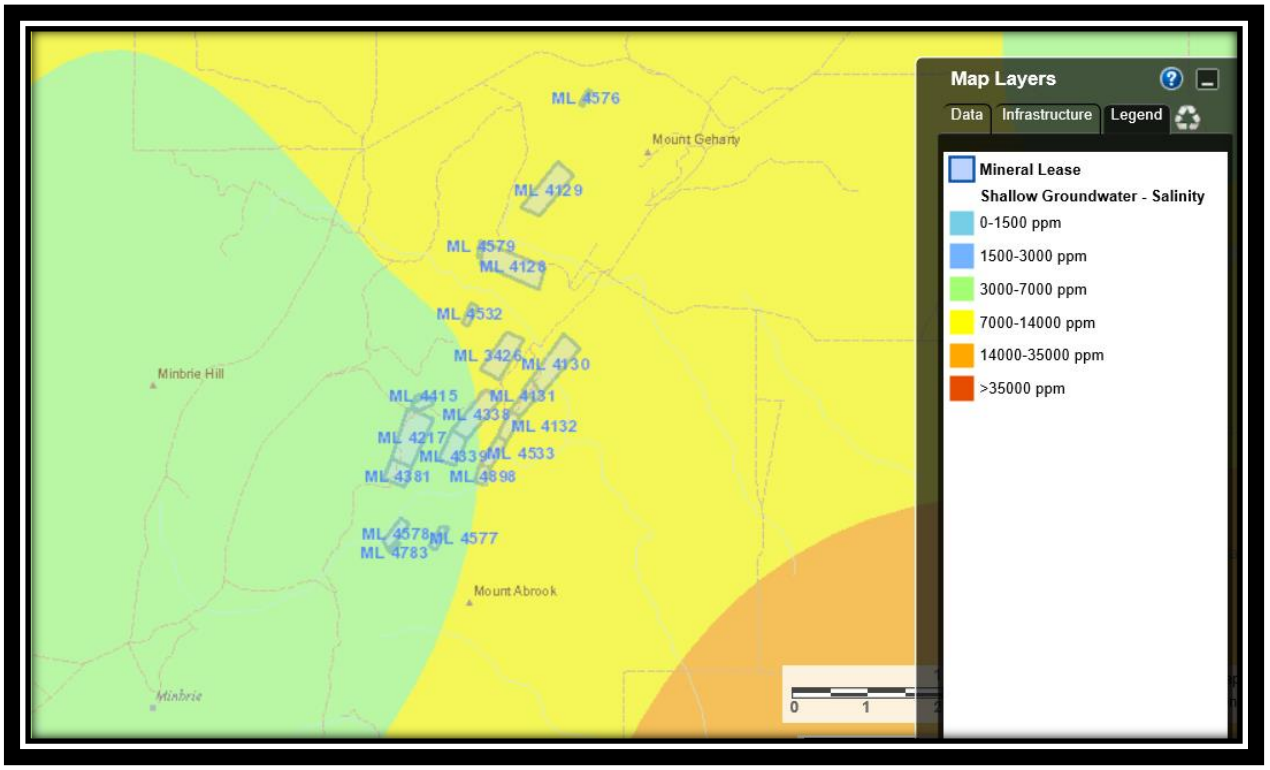

Figure 5: ML4132 Shallow groundwater salinity

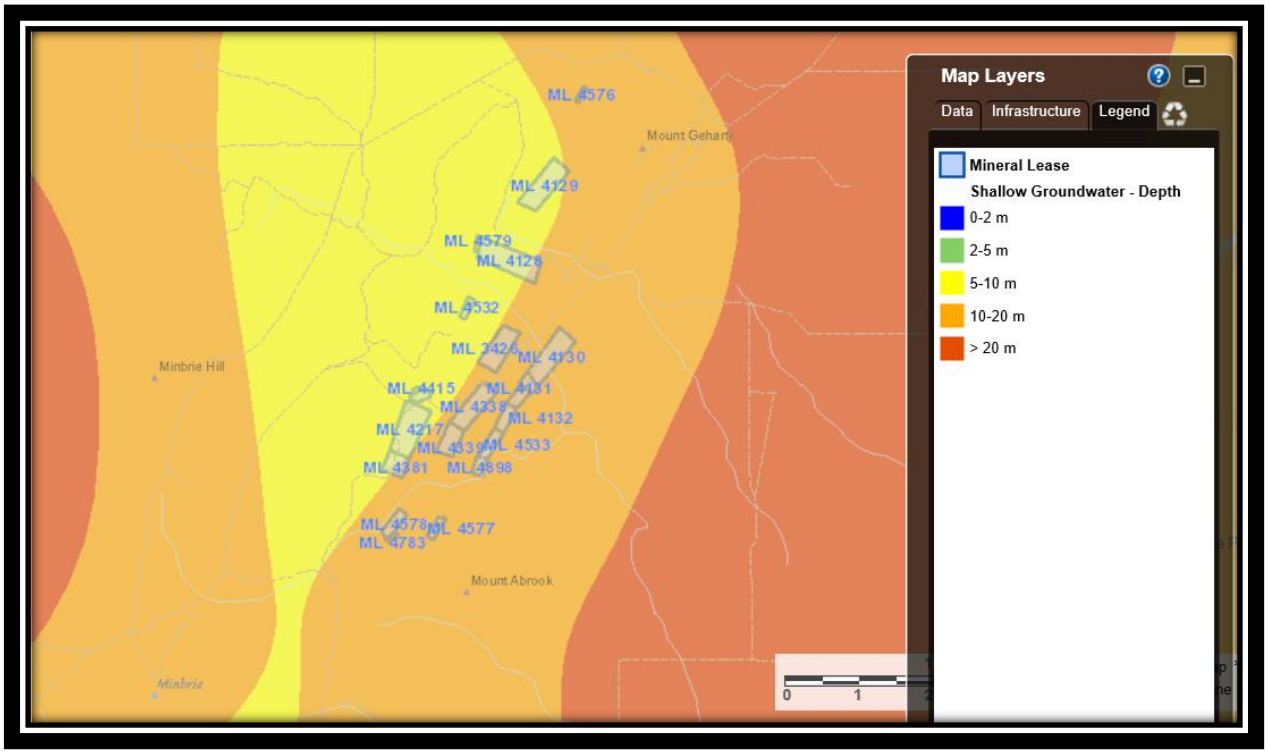

Figure 6: ML4132 Shallow groundwater depth

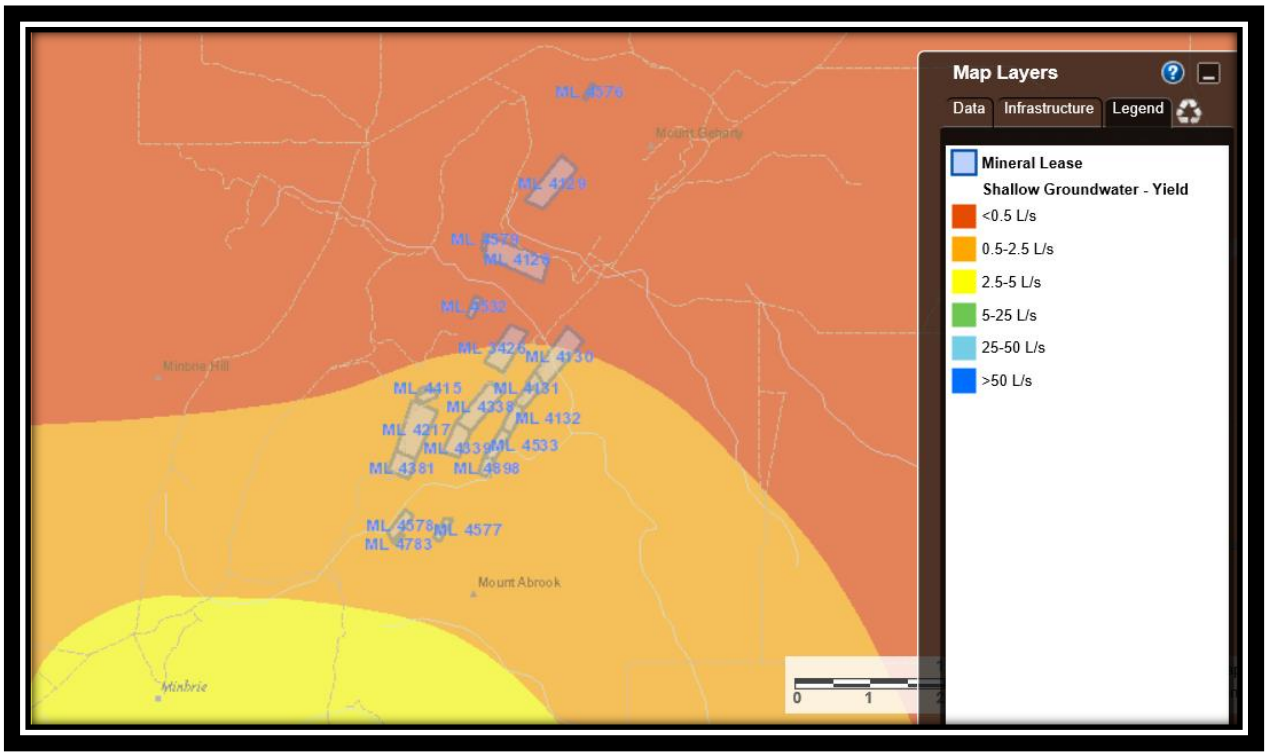

Figure 7: ML4132 Shallow groundwater yield

2.11 Vegetation, weeds, plants and pathogens

Vegetation comprises of scattered mallee around the quarry. No specific flora survey has been undertaken for this work. Species reported in the vicinity include Eucalyptus socialis,

E. Gracilis, E. incrassata and Melaleuca uncinata. Casuarina stricta and Callitris may also be found in the area.

While native herbs and grasses are found in the vicinity of the mine, grazing and introduced species over the last 150 years or more have significantly altered the vegetation. The densest vegetation on the ML is south of the existing pit.

A search of the Atlas of Living Australia (ALA, 2015) found 86 plant species recorded within 2 kilometres of ML4132 as shown in Table 1. Not all species are present on ML4132 but the table provides a list of potential species that could be found.

Table 1: Flora identified within 2 kilometres of ML 4132 since 1923.

Scientific Name Plant Kingdom	Vernacular Name - 1	Vernacular Name - 2
Acacia continua Benth.		Thorn Wattle
Acacia enterocarpa R.V.Smith		Jumping Jack Wattle
Acacia euthycarpa J.M.Black		
Acacia notabilis	Notable Wattle	Flinders Wattle
Acacia spinescens Benth.		Hard-leaf Wattle
Acrotriche patula	Prickly Ground-berry	
Acrotriche patula R.Br.		
Actinobole uliginosum	Flannel Cudweed	Camel Dung
Allocasuarina verticillata	Drooping Sheoak	Drooping Sheoak
Alyxia buxifolia	Sea Box	Sea Box
Anagallis arvensis	Pimpernel	Scarlet Pimpernel
Astroloma humifusum	Cranberry Heath	Cranberry Heath
Austrostipa elegantissima	Feather Spear-grass	Elegant Spear-grass
Austrostipa nitida	Balcarra Spear-grass	Balcarra Grass
Austrostipa nodosa	Tall Spear-grass	Knotty Speargrass
Beyeria lechenaultii	Pale Turpentine Bush	Pale Turpentine Bush
Bromus rubens	Red Brome	Foxtail Brome
Calandrinia eremaea	Dryland Purslane	Small Purslane
Callitris gracilis	Southern Cypress Pine	Slender Cypress-pine
Callitris verrucosa (A.Cunn. ex Endl.) F.Muell.		Camphor Wood
Calotis erinacea Steetz		Tangled Burr-daisy
Calotis hispidula	Hairy Burr-daisy	Bindy eye
Carrichtera annua	Ward's Weed	Ward's Weed
Chrysocephalum apiculatum (Labill.) Steetz		Common Everlasting
Comesperma scoparium J.Drumm.		Broom Milkwort
Comesperma volubile	Love Creeper	Blue Love Creeper
Crassula colorata var. acuminata	Dense Crassula	
Crassula sieberiana ssp. tetramera (NC)	Australian Stonecrop	
Daucus glochidiatus	Native Carrot	Australian Carrot
Dicrastylis verticillata J.M.Black		Sand-sage
Dodonaea baueri	Crinkled Hop-bush	
Eremophila fallax		
Eremophila glabra ssp. glabra	Tar Bush	Common Emu Bush

Scientific Name	Vernacular Name - 1	Vernacular Name - 2
Eremophila scoparia (R.Br.) F.Muell.		Broom Bush
Eucalyptus incrassata Labill.		Angular Yellow Mallee
Eucalyptus porosa	Mallee Box	Black Mallee
Eucalyptus socialis (NC)	Beaked Red Mallee	Christmas Mallee
Exocarpos aphyllus	Leafless Cherry	Current Bush
Geijera linearifolia	Sheep Bush	Oilbush
Glycine rubiginosa	Twining Glycine	
Gonocarpus elatus (A.Cunn. ex Fenzl) Orchard		"Hill raspwort"
Goodenia pusilliflora	Small-flower Goodenia	Small-flower Goodenia
Goodenia robusta (Benth.) K.Krause		Woolly Goodenia
Grammosolen dixonii (F.Muell. & Tate) Haegi		
Grevillea huegelii Meisn.		Comb Grevillea
Grevillea pterosperma F. Muell.		Desert Grevillea
Hakea francisiana F.Muell.		Grass Leaf Hakea
Lasiopetalum behrii F.Muell.		Pink Velvet Bush
Logania nuda F.Muell.		Bare Logania
Lomandra effusa	Scented Mat-rush	Cocky's Bootlace
Medicago minima var. minima	Little Medic	Burr Medic
Minuria leptophylla DC.		Minnie Daisy
Olearia pimeleoides	Pimelea Daisy-bush	Burrabunga
Olearia ramulosa (Labill.) Benth.		Oily Bush
Opercularia scabrida Schltdl.		Rough Stinkweed
Opercularia turpis F.Muell. ex Miq.		Grey Stinkweed
Oxalis perennans (NC)	Native Sorrel	
Parentucellia latifolia	Red Bartsia	Common Barsia
Pentameris airoides ssp. airoides	False Hair-grass	
Phebalium bullatum J.M.Black		Desert Phebalium
Pimelea micrantha F.Muell. ex Meisn.		Silky Rice-flower
Pimelea microcephala ssp. microcephala	Shrubby Riceflower	Mallee River-flower
Podolepis capillaris (Steetz) Diels		Invisible Plant
Podolepis tepperi	Delicate Copper-wire Daisy	Delicate Podolepis
Prasophyllum elatum R.Br.		Piano Orchid
Pterostylis biseta (NC)	Two-bristle Greenhood	Rusty Hood
Pterostylis excelsa (NC)	Dryland Greenhood	Greenhoods
Ptilotus spathulatus	Pussy-tails	Cat's Paw
Rytidosperma caespitosum	Common Wallaby-grass	Ringed Wallaby Grass
Scaevola humilis	Inland Fanflower	Sandplain Fan-flower
Schoenus subaphyllus Kuk.		Desert Bog-rush
Senna artemisioides ssp. filifolia	Fine-leaf Desert Senna	
Silene nocturna	Mediterranean Catchfly	Mediterranean Catchfly
Solanum petrophilum F.Muell.		Prickly Nightshade
Spergularia diandra (NC)	Lesser Sand-spurrey	Lesser (or Small) Sand-spurrey
Thysanotus baueri	Mallee Fringe-lily	Fringed Violet
Triodia irritans	Spinifex	Porcupine Grass

Scientific Name	Vernacular Name - 1	Vernacular Name - 2
Velleia arguta R.Br.		Grassland Velleia
Vittadinia dissecta var. hirta	Dissected New Holland Daisy	
Wahlenbergia gracilenta	Annual Bluebell	Annual Bluebell
Wahlenbergia stricta ssp. stricta	Tall Bluebell	
Westringia rigida R.Br.		Stiff Western Rosemary
Lichen sp.		
Maireana enchylaenoides	Wingless Fissure-plant	Wingless Bluebush
Moss sp.		
Rhagodia parabolica	Mealy Saltbush	Fragrant Saltbush

2.12 Fauna

The area is used for grazing predominantly by sheep or cattle. Apart from birds, reptiles and livestock very few animals common to the area.

A review of the ALA database identified 49 animal sightings, within 2 kilometres of ML4132 since 1923, Table 2. These include 41 bird species, 7 reptiles and a mammal (a fox). It is likely that marsupials, feral animals and more reptiles may be found travelling through the area, on occasion.

Table 2: Fauna recorded within 2 kilometres of ML4132 since 1923

Scientific Name Animal Kingdom	Vernacular Name	Vernacular Name - matched
Acanthagenys rufogularis	Spiny-cheeked Honeyeater	Spiny-cheeked Honeyeater
Acanthiza apicalis		Inland Thornbill
Acanthiza chrysorrhoa	Yellow-rumped Thornbill	Yellow-rumped Thornbill
Acanthiza iredalei	Slender-billed Thornbill	Slender-billed Thornbill
Acanthiza uropygialis	Chestnut-rumped Thornbill	Chestnut-rumped Thornbill
Anas gracilis	Grey Teal	Grey Teal
Anilios bituberculatus		Blind Snakes
Anthochaera carunculata	Red Wattlebird	Red Wattlebird
Anthus novaeseelandiae	Australasian Pipit	Australasian Pipit
Aquila audax	Wedge-tailed Eagle	Wedge-tailed Eagle
Artamus cyanopterus	Dusky Woodswallow	Dusky Woodswallow
Barnardius zonarius	Australian Ringneck	Australian Ringneck
Circus assimilis	Spotted Harrier	Spotted Harrier
Colluricincla harmonica	Grey Shrike-thrush	Grey Shrike-thrush
Corvus coronoides	Australian Raven	Australian Raven
Cracticus tibicen	Australian Magpie	Australian Magpie
Cracticus torquatus	Grey Butcherbird	Grey Butcherbird
Ctenophorus cristatus		Bicycle Lizard
Ctenotus schomburgkii		Barred Wedgesnout Ctenotus
Diplodactylus furcosus		Ranges Stone Gecko
Dromaius novaehollandiae	Emu	Emu
Elanus axillaris	Black-shouldered Kite	Black-shouldered Kite

Scientific Name	Vernacular Name	Vernacular Name - matched
Eolophus roseicapillus	Galah	Galah
Epthianura albifrons	White-fronted Chat	White-fronted Chat
Epthianura tricolor	Crimson Chat	Crimson Chat
Falco berigora	Brown Falcon	Brown Falcon
Falco cenchroides	Nankeen Kestrel	Nankeen Kestrel
Gehyra lazelli		Southern Rock Dtella
Hirundo neoxena	Welcome Swallow	Welcome Swallow
Lichenostomus leucotis	White-eared Honeyeater	White-eared Honeyeater
Lichenostomus ornatus	Yellow-plumed Honeyeater	Yellow-plumed Honeyeater
Lichenostomus virescens	Singing Honeyeater	Singing Honeyeater
Manorina flavigula	Yellow-throated Miner	Yellow-throated Miner
Microeca fascinans	Jacky Winter	Jacky Winter
Ocyphaps lophotes	Crested Pigeon	Crested Pigeon
Pachycephala rufiventris	Rufous Whistler	Rufous Whistler
Pardalotus striatus	Striated Pardalote	Striated Pardalote
Passer domesticus	House Sparrow	House Sparrow
Phaps chalcoptera	Common Bronzewing	Common Bronzewing
Pomatostomus superciliosus	White-browed Babbler	White-browed Babbler
Rhipidura leucophrys	Willie Wagtail	Willie Wagtail
Sericornis frontalis	White-browed Scrubwren	White-browed Scrubwren
Smicrornis brevirostris	Weebill	Weebill
Sturnus vulgaris	Common Starling	Common Starling
Tiliqua rugosa	Sleepy Lizard	Bobtail
Tiliqua scincoides	Eastern Bluetongue	Eastern Blue-tongue
Vanellus tricolor	Banded Lapwing	Banded Lapwing
Vulpes	Fox (Red Fox)	Fox
Zosterops lateralis	Silvereye	Silvereye

2.13 Topsoil and subsoil

Topsoil is generally skeletal on the hill tops increasing in thickness but still considered as shallow in the foot slopes. Soils on ML4132 and surrounds are classified as calcareous earths.

Calcareous earths have gradational texture profiles that are calcareous throughout. They are widespread in the pastoral districts of South Australia and the drier margins of the agricultural districts. They have indistinct horizons and are typified by the brownish sandy and loamy soils of the 'mallee' lands. Calcium carbonate (lime) may range up to 10% in surface soils and 60% in subsoils. Some lime is hardened to calcrete (sheet limestone) or may be stony. Natural fertility is low to moderate, but the soils are easy to cultivate and their productivity for cereals in the agricultural regions has been greatly enhanced through the application of fertilisers and the use of medic pasture leys. Surface soils are neutral to alkaline, and subsoils are strongly alkaline (Atlas South Australia, 2015).

2.14 Heritage (Aboriginal, European, Geological)

No reference to heritage of any type was recorded in the original Development and

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Rehabilitation Program (Olliver, 1990).

2.15 Proximity to conservation areas

The Department of Environment, Water and Natural Resources (DEWNR), is the custodian of Native Vegetation Heritage Agreements in areas shown in Figure 8. These Heritage Agreements are privately owned and held for conservation purposes. Public access is not permitted without the consent of the land owner. The boundaries can be cross-referenced to the Reserves database for plant species found within the Heritage Agreement block or blocks by using the unique heritage agreement number (SARIG, 2015).

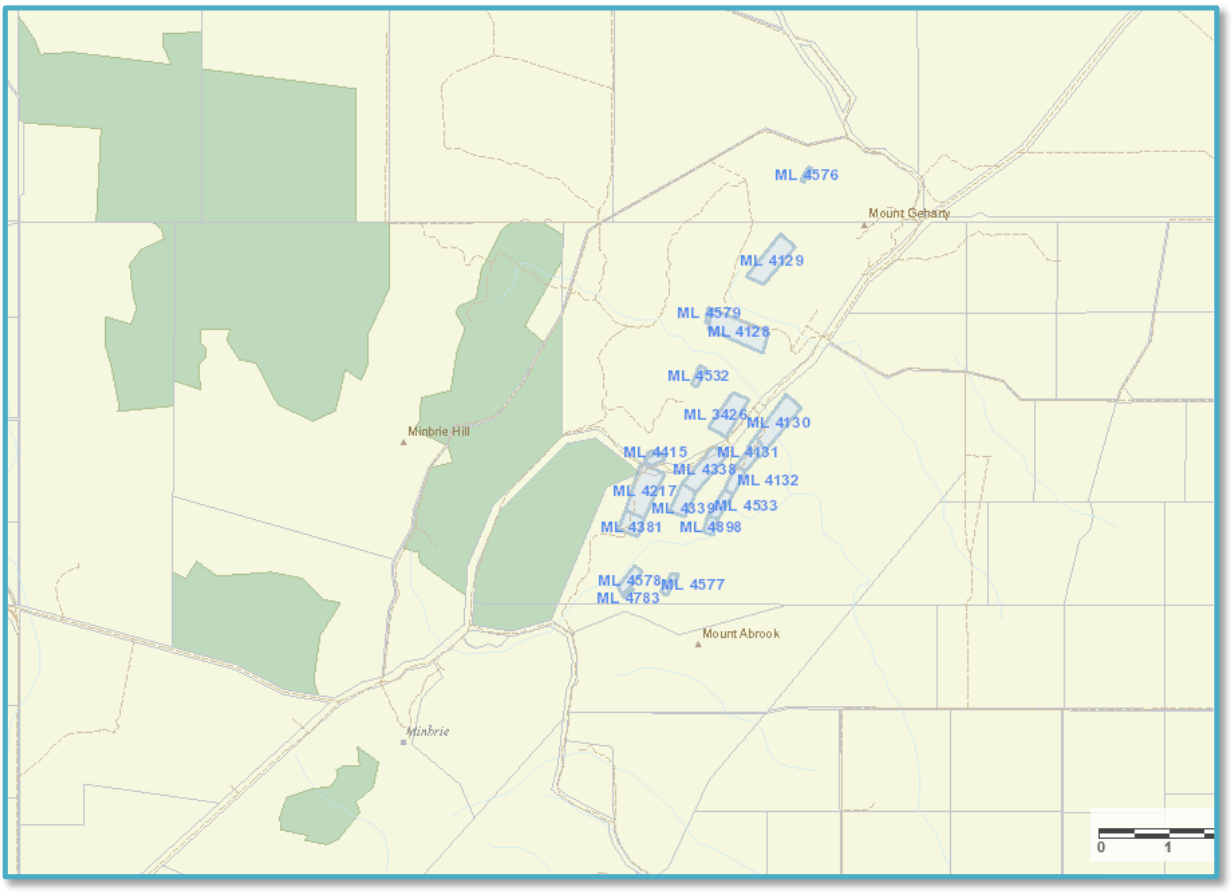

Figure 8: Native Vegetation Heritage Agreements

2.16 Pre-existing site contamination and previous disturbance

ML4132 has been mined for jade, intermittently since 1993. Waste rock stockpiles are located on the lease, but no hydrocarbon or chemical contamination has been reported.

Workings include a single bench quarry with a floor at RL190-191 and a small pit 6 m to the north and two small waste rock dumps. The quarry is 40 m long, 30 m wide and a maximum height of 10 m on the west face. One small dump is located immediately to the east of the quarry and a second 10 to 50 m to the north.

3. Description of the Proposed Mining Operations

The proposed waste rock mining activities will be located over ML4132 an active Jade mine. The mine is one of several open cut jade mine exploiting sporadic outcroppings.

3.1 General description and maps/plans of operations

The site is located on a relatively steep east facing slope on a tributary gully draining to the south, south west to Minbrie Creek, Figure 2.

3.2 Reserves, products and market

3.2.1 Geological environment

Nephrite jade is hosted by dolomitic marble, massive diopside and banded calc-silicate of the Hutchison Group metasediments of early Proterozoic age (1,800 to 2,000 ma). Distinctive intrusive chloritized feldspar rock has cause alteration of marble to tremolite, chlorite, talc and epidote, (Barnes, 1987). Nephrite jade has developed within three stratigraphic units:

- Banded calc silicate at base of Warrow Quartzite.
- Katanga Dolomite
- Dolomitic facies of Middleback Jaspilite.

Nephrite jade is formed as pods, lenses, tabular bodies and occasionally curved shapes.

3.2.2 Reserves and resources

ML4132 contains 4 outcrops of jade, outcrop 68, 69, 70 and 71. Based on the model presented by Barnes et al (Barnes, 1987) the *in situ* inferred reserves are estimated at 2,640 Tonnes. , yield of usable jade is around 17%. Some 461 tonnes of jade were produced between 1968 and 1989.

Colour of the gemstone is dominantly green with dark tones, producing a dark green to black appearance (Olliver, 1990). The highest quality finest grained jade with distinctive dendritic pattern ion the white rind is marketed as Premium Black.

3.2.3 Production rate and products

Jade is mined in campaigns and does not influence this proposed activity. This PEPR refers to the extraction of waste rock already generated by historic mining activities stockpiled in the two dumps describe previously.

3.3 Exploration Activities

Not relevant to this activity

3.4 Mining plan

3.4.1 Type or types of mining operation to be carried out

Jade is mined by open-cut method, the waste rock stockpiles will be mined by the proposed activity. The mining of the waste rock dumps will use top excavation retreat mining methods in two metre layer. The waste rock will be screened to extract the larger rock fractions which will be transported to Luck Bay for Federal and State government sponsored port construction activities.

3.4.2 Sequence of mining and rehabilitation operations

Waste rock mining from existing waste rock stockpiles on ML4132, will be extracted using the methods described below. ML4132 covers an area of 3.95 ha approved to mine jade outcrops 68-72. Figure 9 shows the mine plan including boundaries of ML4132, existing pit (white outline), waste rock dumps (yellow outline) to be mined, drainage line and direction of flow (blue).

Figure 9: Mine Plan showing ML4132 boundary, existing pit, waste dumps to be mined and natural drainage

3.4.3 Mining methods

Jade is mined as described in (Olliver, 1990). In summary overburden in the hanging wall is blasted and removed with a front end loader to an adjacent dump.

Exposed jade is selectively removed from the quarry face with a hydraulic jack-pick and sorted on the quarry floor. Selected jade is loaded by a front end loader onto a dump truck and transported to the stockpile compound located around 33 km on the outskirts of Cowell for further processing.

The proposed extraction of waste rock will not require any additional blasting activities or working at the rock face.

The waste rock dumps will be mined using top excavation retreat mining in two metre layers. The waste rock will be screened, loaded and trucked to Lucky Bay. Rejects will be returned to the waste rock stockpile.

The waste rock dumps will not be mine below ground level and therefore there is not risk of intercepting groundwater.

A crew of 4 persons will be employed one for bulking up, one for the truck and two for grading activities. Work will be between 7 am and 6 pm for a 2 week campaign. Rejects will be returned to the dumps.

Rehabilitation of the rejects will be the same as outlined in (Olliver, 1990). Waste material will comprise of inert materials mostly siltstone, quartzite, granitic types and scarns. In summary:

- All waste rock stockpiles will be located away from water courses to prevent any disruption to water flow.
- The slopes will be pushed back to blend into the surrounding topography.
- Any recoverable topsoil has been removed separately from other materials and will be used to cover the waste rock.
- Vegetation will be allowed to grow back through the topsoil seed bank and natural dispersion.
- Weeds will be controlled until a pre mining or better condition is achieved.

3.5 Mining operations

3.5.1 Modes and hours of operation

The hours of operation and other operational logistics are summarised in Table 3.

Table 3: Operational logistics

Minimum hours the site is to be worked per year:	40 hours
Minimum time for each campaign:	One off
Maximum and minimum time between campaigns:	One off
Define the beginning and end of each campaign:	Screening stockpiled waste rock, end when last load is delivered to Lucky Bay, estimated 2 weeks later
Hours of mining operations during campaigns:	11 hours
Days of mining operations during campaign:	Monday to Friday
Determining factors for initiating and ceasing mining campaigns:	Lucky Bay port expansion project commencing and completion of waste rock delivery.
Maximum and minimum tonnage of each campaign:	3,000 to 4,000 tonnes
Maximum and minimum tonnage of production per year:	3,000 to 4,000 tonnes

3.5.2 Workforce

No change from original DAP (Olliver, 1990), that is a maximum of 4 permanent staff will be used for mining of Jade, no jade will be mined at ML4132 while screening waste rock. For the proposed mining of the rock dumps 4 contract staff will be required.

3.5.3 Use of explosives

No blasting will be required for mining the waste rock dumps.

3.5.4 Type of equipment

Equipment to be used consists of:

- 2x 300 excavators
- Portable fixed screen
- 2x Volvo 6 wheel drive trucks, 30T capacity
- 60T Mitsubishi Excavator

3.5.5 Stockpiles

Stockpiles to be mined are the two located on ML4132. The product will be rock screened, rejects consisting of inert materials, mostly siltstone, quartzite, granitic types and scarns, will be returned to the waste rock dumps.

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3.5.6 Transport of rocks from Site

From site the truck will travel via a private access track to Speed Track Road, to Deviation Road, to Tonkin Road, to Deviation Road, to Likin Highway to Cowell/Lucky Bay, Figure 10.

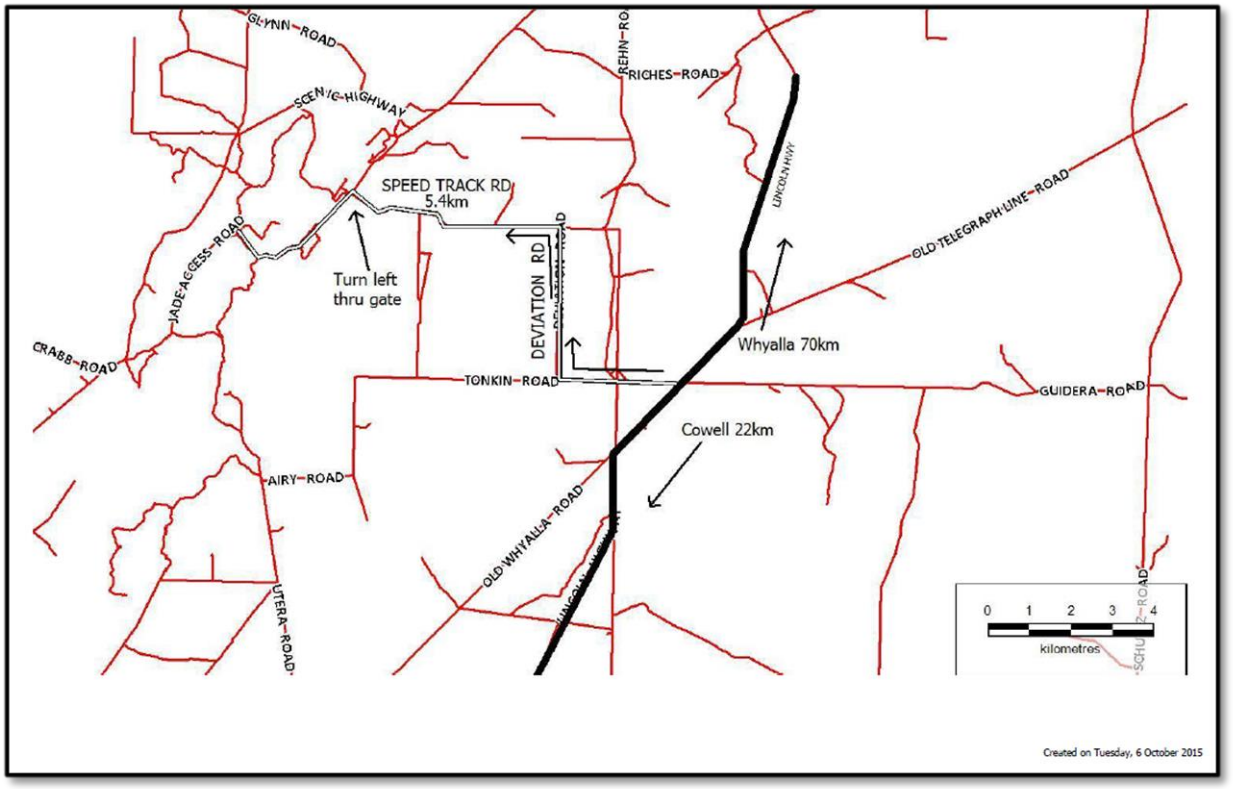

Figure 10: Transport route to Cowell/Lucky Bay from site

3.6 Mine Completion

3.6.1 Description of mine site at competition

At completion the jade mine will be left as approved in 1993 and outlined by Olliver (Olliver, 1990). The intended outcome is for the site to be left in a state that is environmentally and visually compatible with the surrounding area.

Similarly for the proposed waste rock mining; on completion of rock mining the site will be left in a condition that is not harmful to the environment or interfere with ongoing land use; that is ongoing jade mining and agricultural pursuits.

3.7 Crushing, processing and product transport

3.7.1 Screening Plant

The waste rock will be screened using a skeleton bucket and a portable grid, Figure 11. The rock will be loaded to a truck and sent to Lucky Bay where work is underway to expand the Ferry terminal.

Figure 11: Equipment used to grade waste rock

3.7.4 Hours of Operations

See Table 3.

3.7.5 Type of mobile equipment

See Section 3.5.4

3.7.6 Rehabilitation strategies and timing

The removal of the existing waste dumps is a progressive rehabilitation strategy. Any further jade mining after extracting the waste rock will continue with progressive rehabilitation as outlined in (Olliver, 1990) and summarised below:

Shallow open cuts will be made safe by battering down the pit walls to an angle consistent with surrounding topography leaving the site as a shallow depression, similar to that shown in Figure 12. For the deeper cuts a 1.5 – 2 metre high safety bund will be placed at least 2 m back from the face and surrounding the pit to prevent access to man or livestock. Fretting will be removed from the pit/ramp walls and pit wall will be left in a safe condition.

Figure 12: Shallow pit and waste rock stockpiles at completion

The batters of waste rock stockpiles will be pushed back to an angle approximating the surrounding land surface. If required, the slopes will be contoured to prevent accelerated erosion. Currently the materials in the waste stockpiles are very permeable to water and virtually no runoff is generated.

The dumps will all be located away from any watercourse and constructed no higher than 3 m from the surrounding terrain. The land will be returned to jade mining, grazing and open woodland as found pre mining activities.

All mine plant and equipment will be removed from site by the mining contractor upon completion of rock mining operations.

3.8 Wastes

3. 8.1 Overburden

Overburden will be placed on the waste rock dumps and treated in the same manner as waste rock described in previous section.

3.8.2 Processing wastes

No further processing of wastes will be undertaken on site

3.8.3 Industrial and commercial wastes

If maintenance of vehicles and machinery occurs on site the contractor will take all industrial waste off site and disposed of at an EPA licensed waste facility.

All domestic and putrescible waste will be taken off site at the end of each shift and disposed of at an EPA licensed waste facility.

3.8.4 Rehabilitation and closure strategies

Refer to sequence of mining and rehabilitation Section 3.7.6

3.9 Supporting surface infrastructure

3.9.1 Access

Access to the site is from the Lincoln Highway and via existing public road with two possible tracks:

- Turn off main access track 1.8 km south, south west from the nearest public road and proceed 0.5 km to the south east.
- Alternate track is from outcrop 55 going south, south west for 0.6 km.

3.9.2 Accommodation and offices

There will be no accommodation or offices on site.

3.10.3 Public roads, services and utilities used by the operation

Public Roads and the Port Lincoln Highway will be used to truck rock to Luck Bay. No other public utilities will be used.

3.10. 4 Visual screening

There will be no requirement for visual screening

3.10.5 Fuel and chemical

Fuel will be stored and bunded in accordance EPA legislation.

3.10.6 Site Security

The site is fenced and a gate is used to restrict access.

3.10.7 Silt control and drainage

There are ephemeral present near the location of the Mining Leases as shown on the

topographic map, Figure 2. All waste rock stockpiles will be located away from water courses. No significant erosion has been observed on site this is attributable to the coarse materials, and high permeability significantly limiting runoff.

4 RESULTS OF CONSULTATION

Individual or Group	Date	Concern/Issue Raised	Response
Schiller	November 2015	Notified of intended activity. No concerns raised.	N/A
Loechel	November 2015	Notified of intended activity. No concerns raised.	N/A

5. Management of Environmental Impacts

An issues register has been developed to record and address any community concerns and to track and manage environmental impacts, Table 4. Community consultation is ongoing at the site and currently no outstanding issues have been identified. The register will remain an active component of the environmental management plan.

Table 4: Issues register

Aspect	Issue / concern / nature of consultation	Affected Party	Response
Blasting vibration	N/A	N/A	N/A
Closure	No issues raised	N/A	N/A
Dust	No issues raised by community Potential respiratory concerns with employees	N/A employees	N/A Have a water truck on hand to supress dust. Provide dust masks and safety glasses as measure of last resort.
Geohazards	No issues raised Rock falls, slips and trips.	N/A Employees, public and livestock.	N/A Ensure pit walls and stockpiles are left in a stable condition at all times.
Heritage	No issues raised	N/A	N/A
Noise	No issues raised Potential hearing impairment to employees	N/A employees	N/A No concerns were raised in the past, all vehicles and equipment to operate within the

Aspect	Issue / concern / nature of consultation	Affected Party	Response
			prescribed range of 80 db. Ear plugs or mufflers will be provided as a last resort.
Public Safety	No issues raised	N/A	N/A
Soil	No issues identified	N/A	N/A
Surface water and groundwater	No issues raised	N/A	N/A
Traffic	No issues raised There will be minimal additional traffic to public roads and Port Lincoln Highway	N/A	N/A
Visual amenity	No issues raised	N/A	N/A
Waste Disposal	No issues raised	N/A	N/A
Weeds and pests	No issues raised	N/A	N/A

5. 1 Heritage

5.1.1 Describe the context and views of affected parties

No aboriginal, geological or European heritage sites have been identified on ML4132.

5.1.2 Applicable legislation and standards

- Native Title Act 1994
- Aboriginal Heritage Act 1998

5.1.3 Potential impact/events

No items or sites have been identified that could potentially have heritage significance.

5.1.4 Control and management strategies

All operators will know their obligations under the relevant legislation. Staff will be trained in their obligation under the relevant legislation. During the activity of mining staff will be vigilant of any potential heritage areas and take preventative action should such material be encountered.

5.1.5 Evaluation of residual risks

Level of risk, LOW

5.1.6 Justification for acceptance of residual risk

N/A

5.1.7 Proposed outcome(s)

No disturbance to Aboriginal or European artefacts, sites, objects or remains unless prior approval under relevant legislation is obtained.

5.1.8 Outcome measurement criteria

Records taken within one calendar month after the discovery of any possible sites, objects or remains will demonstrate that work ceased on discovery and appropriate authorities advised. Work recommenced only after authorisation.

5.2 Public Safety

5.2.1 Describe the context and views of affected parties

ML4132 is located in a remote area, however, there is potential for mine employees, local land owners and possibly members of public to trespass on land. The landowners and mine operators are aware of the hazards and take appropriate evasive action. General public may not be aware of mining activities, however, fencing gates and safety bunds provide an additional barrier.

5.2.2 Applicable legislation and standards

- Australian Government Work Health and Safety Act 2011

5.2.3 Potential impact/events

Injuries or death to people due to rock falls, slips and trips over quarry face or loose and exposed rocks.

5.2.4 Control and management strategies

Fences and gates have been built limit access to the site. All gates will be locked to prevent unauthorised persons from entering

5.2.5 Evaluation of residual risks

Level of risk LOW

5.2.6 Justification for acceptance of residual risk

N/A

5.2.7 Proposed outcome

In constructing and operating the Lease, ensure that unauthorised entry to the site does not result in public injuries and or deaths that could have been reasonably prevented

5.2.8 Outcome Measurement Criteria

All incidents resulting from unauthorised access to the mine site are recorded and independently investigated within one calendar month to show that the incident could not have been reasonably prevented by the lessee.

5.3 Waste

5.3.1 Describe the context and views of affected parties

During the two week campaign servicing of vehicles and equipment will generate waste in the form of scrap timber, metal, plastic and rubber, and used hydrocarbons from vehicle and equipment maintenance. General domestic rubbish will also be generated by employees, in their day-to-day activities.

5.3.2 Applicable legislation and standards

- South Australian Environment Protection Authority Act 1993

5.3.3 Potential impact/events

Industrial waste and rubbish can contaminate water ways and present a visual impact.

5.3.4 Control and management strategies

All rubbish and industrial waste will be placed in appropriate containers and taken offsite for reuse, recycling or disposal in an appropriate manner that complies with the relevant legislation.

5.3.5 Evaluation of residual risks

Level of risk, LOW

5.3.6 Justification for acceptance of residual risk

N/A

5.3.7 Proposed outcome

All commercial waste is removed and disposed in accordance with relevant legislation.

5.3.8 Outcome measurement criteria

Records of waste disposal demonstrate that all putrescible or industrial waste (including contaminated soil) within the lease was disposed of offsite when required in accordance with legislative requirements (Environment Protection Act 1993).

5.4 Stormwater

5.4.1 Describe the context and views of affected parties

Heavy rain events can generate more water than can percolate into the ground. This results in runoff that can carry sediment and potential pollutants to the receiving streams. The access tracks and exposed surface areas are a potential sources of sediment. ML4132 is located near ephemeral creeks.

Stormwater runoff from exposed areas will mostly drain towards the pit. It is expected that even under intense storm events runoff will infiltrate rapidly and excess will be intercepted by dense vegetation between the workings and the natural drainage line, see Figure 9.

5.4.2 Applicable legislation and standards

- South Australian Environment Protection Authority Act 1993

5.4.3 Potential impact/events

Heavy rains may start erosion and sediment laden runoff into Minbrie Creek.

5.4.4 Control and management strategies

The site has been operational for several decades without any significant erosion or siltation of nearby streams. This is attributed to high levels of infiltration, and coarse grained to rocky competent materials on exposed sites.

5.4.5 Evaluation of residual risks

Level of risk LOW

5.4.6 Justification for acceptance of residual risk

N/A

5.4.7 Proposed outcome

In mining waste rock on ML4132 the contractor will ensure that no contaminated water leaves the Lease area or results in loss of or contamination of soil on or off the Lease.

5.4.8 Measurement Criteria

Visual inspection of Minbrie Creek will not find evidence of excessive siltation or soil contamination.

5.5 Weeds and Pests

5.5.1 Describe the context and views of affected parties

Weeds are wide spread through the Eyrie Hills as a consequence of a long agricultural history and European settlement. It is recognised that there is a risk that mining equipment and vehicles will introduce new species of weeds.

5.5.2 Applicable legislation and standards

- Environment Protection and Biodiversity Conservation Act 1999 (EPBC Act) administered by the Australian Government Department of the Environment
- Quarantine Act 1908
- Biological Control Act 1984
- South Australian Natural Resources Management Act 2004
- South Australian National Parks and Wildlife Act 1972

The South Australian legislation provides for the enforced control or destruction of declared plants in part or all of the State. It also regulates the entry and movement of declared plants within South Australia, and prevents the sale of produce contaminated with seeds of a declared plant anywhere in the State.

5.5.3 Potential impact/events

The introduction of new weeds and pests to the site could impact on land value and the ability to move rock around the state.

5.5.4 Control and management strategies

Where practical only mine equipment and vehicles will be used on site. Contractor vehicles and equipment will be cleaned prior to entering the site.

A site inspect for introduced weeds will be undertaken after the first rain events May. Any weeds or pests will be controlled immediately to prevent the setting of new seeds.

5.5.5 Evaluation of residual risks

Level of risk, LOW

5.5.6 Justification for acceptance of residual risk

Control measures and the short duration of the campaign should be adequate to prevent the introduction of new weeds or pests.

5.5.7 Proposed outcome(s)

The contractor will ensure that no introductions of new species of weeds, plant pathogens or pests (including feral animals), nor sustained increase in abundance of existing weed or pest species in the Lease area compared to adjoining land.

Weeds are defined in this condition as any invasive plant that threatens native vegetation in the local area or any species recognised as invasive in South Australia.

5.5.8 Measurement Criteria

A site inspection two weeks after the first rains in May will be undertaken to verify that no new weeds or pests have entered ML4132 or access tracks.

5.6 Soil

5.6.1 Describe the context and views of affected parties

The proposed rock mining activities on the waste rock dumps of ML4132 will not require any clearance of topsoil. Vehicles and equipment will only travel over pre cleared access tracks and exposed work areas. Some topsoil was placed aside during the original jade mining activities for later reuse in rehabilitation.

There is a risk that stockpiled topsoil may be removed by the contractors if they are not aware of its purpose. There is a risk of potential hydrocarbon spills that may contaminate nearby topsoil from inappropriately maintained vehicles and equipment. There is also a potential for inappropriate access or clearance of undisturbed topsoil by untrained mine or contractor employees.

5.6.2 Applicable legislation and standards

- South Australian Environment Protection Authority Act 1993

5.6.3 Potential impact/events

Loss or hydrocarbon contamination of topsoil.

5.6.4 Control and management strategies

All employees and contractors will be shown the topsoil stockpiles and instructed on the importance of proper vehicle maintenance. In addition a trained responsible person will be assigned to identify and treat any accidental hydrocarbon spills.

5.6.5 Evaluation of residual risks

Level of Risk, LOW

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5.6.6 Justification for acceptance of residual risk

N/A

5.6.7 Proposed outcomes

In mining and extracting waste rock the contractor will ensure that the existing soil quality and quantity is maintained.

5.6. 8 Measurement Criteria

Before and after rock extraction photographic evidence of the soil stockpiles will show that that there is no decrease in the size of topsoil stockpiles compared to baseline photos.

5.7 Native Vegetation

5.7.1 Describe the context and views of affected parties

The open cut on ML4132 is surrounded by open woodland and a mixture of native vegetation and pasture/weed species. These provide habitat for many species of birds and reptiles. If this habitat is damaged the vegetation and animals supported by it will be impact harmed.

5.7.2 Applicable legislation and standards

- Environment Protection and Biodiversity Conservation Act 1999 (EPBC Act) administered by the Australian Government Department of the Environment
- South Australian Natural Resources Management Act 2004
- South Australian National Parks and Wildlife Act 1972

5.7.3 Potential impact/events

Some activities that may harm the native vegetation include:

- Unlawful clearance of vegetation will damage vegetation and ecosystem supported by it.
- Accidental fires may burn the habitat.
- Dust generation may reduce productivity by inhibiting photosynthesis.

5.7.4 Control and management strategies

All contractor and mine employees will be instructed on the importance of avoiding any activities on nearby vegetation. There should be no need for any additional clearance of native vegetation as sufficient access and work area has been previously cleared for the jade mining operations.

Dust generation over the two week campaign would be controlled, by using water to supress dust or temporarily stopping work during windy conditions.

Firefighting equipment will be provided with each vehicle and a water truck will be on hand

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to provide additional firefighting capability.

5.7.5 Evaluation of residual risks

Level of risk, LOW

5.7.6 Justification for acceptance of residual risk

N/A

5.7.7 Proposed outcomes

In constructing and operating the Lease ensure no loss of abundance or diversity of native vegetation on or off the Lease through:

- clearance,
- dust/contaminant deposition,
- fire, or
- other damage

Unless prior approval under the relevant legislation is obtained.

5.7. 8 Measurement Criteria

That clearance will only be undertaken in accordance with the approved native vegetation management plan.

A before and after rock extraction campaign site survey supported by photographic evidence will show that no clearance in excess of the approved native vegetation plan (NVP) has occurred from mining activities.

A native vegetation plan will be developed for the sites should any vegetation clearance be required, and a Significant Environment Benefit (SEB) may be required.

5.8 Mine Completion

5.8.1 Describe the context and views of affected parties

On completion of the rock mining activities the site will be left in a pre-mining or better condition. The rocks will be extracted from ML4132 a mining lease owned and operated by Gemstone Australia and the area is also used for agricultural activates.

5.8.2 Applicable legislation and standards

- South Australian Environment Protection Authority Act 1993

A social licence to operate dictates that post waste rock mining the land will be left in the same or better condition as pre-mining and that previous landuse will continue unhindered.

5.8.3 Potential impact/events

Potential impacts on the completion of rock mining include:

- Modified landforms may obstruct access to jade miners and agricultural activities.
- Rubbish, industrial waste and hydrocarbon polluted soil may be left on site causing social disturbance and environmental harm.
- Erosion may deposit sediment in the ephemeral Minbrie Creek.

5.8.4 Control and management strategies

All waste rock stockpiles will be returned to their original location and will not exceed their original height.

All rubbish, industrial waste and any contaminated soil will be removed and treated or disposed in accordance with EPA guidelines.

All waste rock stockpiles generated by waste rock mining will be left with a batter slope at an angle to control erosion.

5.8.5 Evaluation of residual risks

Level of risk, LOW.

5.8.6 Justification for acceptance of residual risk

N/A

5.8.7 Proposed outcomes

Access and productivity to the jade miners and agricultural activities will not be hindered.

- Integrate and harmonise final landforms and vegetation with the surrounding landscape.
- The risks to the health and safety of the public, native fauna and livestock are as low as reasonably practical.
- The site is physically stable.
- No compromise of the quality and quantity of surface water to existing users and water dependent ecosystems.
- No industrial or commercial waste left onsite.
- Where practical, pre mining land use is re-established.

5.8. 8 Measurement Criteria

Pre and post rock mining photographs will be taken as evidence that the proposed control measures have been implemented and are as effective as planned. That is the site is left in at least as stable a condition as it was pre rock mining, water ways and vegetation remain unharmed by mining activities and that the site is free from rubbish and industrial waste.

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No complaints from the jade mine operators, landowner and legislators will be left unaddressed.

6. Operator Compliance Monitoring Plan

Outcome	Measurement Criteria	Form of measurement	Location	Outcome Achievement	Frequency	Control and Background Data
Heritage						
No traffic accidents involving the public at mine access points that could have been reasonably prevented by the Tenement Holder.	All traffic accidents involving the public at mine access points are recorded in mine log book. All incidents will be investigated by a suitably qualified independent third party within one calendar month (or other time as agreed with DSD Mining Regulation) and the results of the investigation show that the incident could not have been reasonably prevented by the Tenement Holder.	Results of investigations following a traffic accident	At location of accident	Investigation was conducted by a suitably qualified third part within one calendar month and showed the tenement holder could not have reasonably prevented the accident.	As required	Stop work and report to qualified person for clearance prior to further activities
Public Safety (Construction and operation)						
No public injuries and or deaths resulting from unauthorised entry to the site that could have been reasonably prevented.	All public injuries and/or deaths resulting from unauthorised access to the mine site are recorded in mine log book and investigated by a suitably qualified third party within one calendar month (or other time as agreed with DSD Mining Regulation) and the results of the investigation show that the incident could not have been reasonably prevented by the Tenement Holder	Results of investigations following a public injury from unauthorised access to the mine site	At location of incident	Investigation was conducted by a suitably qualified third part within one calendar month and showed the tenement holder could not have reasonably prevented the accident.	As required	Appropriate fencing and gates to limit site access
Public Safety (post mine completion)						

Outcome	Measurement Criteria	Form of measurement	Location	Outcome Achievement	Frequency	Control and Background Data
No public injuries or deaths as a result of the final landform post mine completion.	A final inspection is undertaken after removal of the extractive landform which verifies the land is safe and stable and poses no risk to members of the public.	Final inspection of rehabilitated area	Location of extractives landform	Area where the extractives landform is removed from is safe and stable and poses no risk to members of the public.	Upon completion of the extractives campaign	Appropriate fencing and gates to limit site access Contoured landforms.
Weeds and pests						
No introduction of new species of weeds, or pests (including feral animals), nor increase in abundance of existing weed or pest species in the Tenement.	Records of inspections prior to and following the extractives campaign by the Tenement Holder will demonstrate no introduction of new weeds or pests and no increased abundance of existing weeds and/or pests.	Records of weed and pest inspections	Within lease boundaries	No new species of weeds or pests and no increase in abundance of existing weeds and pests.	prior to and following the extractives campaign	Refer to Section 5.5.4.
Soil						
The existing (pre-mining) soil quality and quantity is maintained.	Records of inspections prior to and following the extractives campaign of soil stockpiles will show all stockpiles to have: Established vegetative cover; No signs of erosion (formation of rills, gullies or other evidence of soil loss).	Records of soil inspections	Soil stockpiles at locations displayed in the mine plan.	Vegetation cover is established over the stockpiles and there are no signs of erosion or evidence of soil loss.	prior to and following the extractives campaign	Prohibit activities off the exposed access tracks and cleared areas.
Waste						

Outcome	Measurement Criteria	Form of measurement	Location	Outcome Achievement	Frequency	Control and Background Data
All commercial or industrial waste is disposed of in accordance with relevant legislation.	Waste disposal receipts demonstrate that all commercial or industrial waste (including contaminated soil) within the tenement was disposed of offsite in accordance with *Environment Protection Act 1993* requirements.	Records of waste disposal receipts	Lease area	Waste receipts demonstrate all commercial or industrial waste was disposed of in accordance with relevant legislation.	As required.	Collect in provided containers and remove post mining for recycling or approved landfills.
Noise						
No public nuisance impacts from noise emanating from mining operations (including transport).	Records from mine logbook will demonstrate that any noise complaints received were resolved with the complainant within 48 hours (or other time as agreed with DSD Mining Regulation). If complaints are not resolved the Tenement Holder will conduct noise monitoring at the sensitive receptor to demonstrate noise emissions comply with the *Environment Protection (Noise) Policy 2007*.	Records of noise complaints and resolution. If no resolution is achieved records of noise monitoring undertaken.	At location of complaint.	All noise complaints resolved within 48 hours. If no resolution is achieved then noise monitoring is undertaken and complaint against the EP (Noise) Policy.	After a noise complaint is received.	Use well serviced and maintained vehicles and equipment with Worksafe approved noise levels.
Air Quality						

Outcome	Measurement Criteria	Form of measurement	Location	Outcome Achievement	Frequency	Control and Background Data
No nuisance impacts to local residents from dust generated by mining operations (including transport).	Records from mine logbook will demonstrate that any dust complaints received were resolved with the complainant within 48 hours (or other time as agreed with DSD Mining Regulation). If complaints are not resolved the operator will undertake dust monitoring in accordance with DSD requirements.	Records of dust complaints and resolution. If not resolution is reached records of dust monitoring	Location of complaint	Resolution of dust complaints within 48 hours or monitoring conducted in accordance with DSD requirements.	As required.	Dust will be supressed with water or stopping work during very dry windy conditions.
Surface Water						
No water contaminated as a result of mining operations leaves the Tenement area.	Photographic records taken at the beginning of each campaign, will show that runoff from areas disturbed by mining cannot physically leave the tenement area.	Photographic records of mining operations	Perimeter of mining operations as defined in mine plan.	Appropriate bunding is in place to prevent water that is contaminated by mining operations (including silt) from leaving the lease.	On completion of rock mining activities	Landforms will be contoured to control erosion. Any accidental hydrocarbon spills will be cleaned and contaminated soils removed
Native Vegetation						

Outcome	Measurement Criteria	Form of measurement	Location	Outcome Achievement	Frequency	Control and Background Data
No loss of abundance or diversity of native vegetation on or off the tenement through; • clearance, • dust/contaminant deposition, • fire, • other damage, Unless prior approval under the relevant legislation is obtained.	Site survey/photographic evidence at the completion of the campaign will show no clearance of native vegetation outside what was approved in ADP1992/013.	Native vegetation survey and photographic evidence.	Location of disturbance identified in the mine plan.	No clearance of native vegetation outside what was approved in ADP1992/013	At the completion of the campaign	No clearance of vegetation required.
Adjacent Land Uses						
No adverse impacts to adjacent land use.	Any complaints of impact to adjacent land use from mining operations will be recorded in the mine logbook at time of complaint and investigated within 48 hours (or other time as agreed with DSD Mining Regulation) to show that the mine operator did not cause the impact through mining operations.	Records of complaints and their resolution	Location of complaint	All complaints investigated within 48 hours to show the impact was not caused by mining operations.	As required	Liaison with jade mine operator and farmer to ensure activities do not inhibit productivity.

7 New Environmental Risks

All new environmental risks associated with the operation are considered in section 5 of the PEPR

8 Operator Capabilities

Operator has 25 years of mining experience on site without any significant incidents. The same operating procedures will be used as that used for jade mining without the hazard of blasting and work at the pit face.

9 Lease Conditions

No lease conditions have been set for rock mining activities on ML4132

10 Maps & Plans

The overarching Jade Mining plans, vertical and cross sections will not change as the proposed mining activities will not impact or significantly change any of these other than to lower the final height of the waste rock dumps.

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Attachment 1 Tenement details

Tenement Label	ML 4132
Tenement Holders	Gemstones Australia Pty Ltd
Tenement Operators	Olliver Geological Services Pty Ltd
Registration Grant Date	10/09/1973
Expiry Date	9/03/2021
Commodities	Jade
Operation Name	Cowell Jade Deposits
Operation Method	Open Cut
Operation Status	Operating
Tenement Status	Active
Legal Area	3.95
Area Unit	Hectares
Renewal Received Date	null
Transfer Received Date	null
Surrender Received Date	null
Surrender Date	null
Court Action Pending	No
Commodity Categories	Gem & Semi-precious Stones
MPL Purpose	-
Location	-