



CLEARING PERMIT

Granted under section 51E of the Environmental Protection Act 1986

Purpose Permit number:	CPS 7916/1
Permit Holder:	Commissioner of Main Roads Western Australia
Duration of Permit:	From 26 May 2018 to 26 May 2028

The Permit Holder is authorised to clear native vegetation subject to the following conditions of this Permit.

PART I – CLEARING AUTHORISED

1. Purpose for which clearing may be done

Clearing for the purpose of road widening and material extraction.

2. Land on which clearing is to be done

Lot 8 on Deposited Plan 220398, Murchison
Lot 18 on Deposited Plan 220344, South Murchison
Lot 21 on Deposited Plan 28259, Murchison
Lot 23 on Deposited Plan 220763, South Murchison
Lot 128 on Deposited Plan 221137, Murchison
Lot 11810 on Deposited Plan 220399, Woolgorong
Lot 11804 on Deposited Plan 238483, Nunierra
Lot 11802 on Deposited Plan 26343, Nunierra
Lot 11808 on Deposited Plan 220345, Woolgorong and Nerramyne
Lot 7 on Deposited Plan 92275, South Murchison
Lot 12559 on Deposited Plan 221137, Nunierra, Nerramyne, Woolgorong and Murchison
Lot 318 on Deposited Plan 221137, Murchison
Lot 11800 on Deposited Plan 238586, Woolgorong and Nerramyne
Lot 230 on Deposited Plan 29294, Murchison
Lot 24 on Deposited Plan 29294, Murchison
Lot 11809 on Deposited Plan 29294, Murchison
Lot 301 on Deposited Plan 64845, Nunierra
Lot 209 on Deposited Plan 220398, Murchison
Lot 306 on Deposited Plan 49913, Nerramyne
Road Reserve (PIN 11663861), Nunierra
Road Reserve (PIN 11663862), Nunierra
Road Reserve (PIN 11665424), South Murchison
Road Reserve (PIN 11665425), South Murchison
Road Reserve (PIN 11667428), Woolgorong
Road Reserve (PIN 11668442), Woolgorong
Road Reserve (PIN 11668444), Woolgorong
Road Reserve (PIN 11668445), Woolgorong
Road Reserve (PIN 11668446), Woolgorong
Road Reserve (PIN 11668447), Woolgorong
Road Reserve (PIN 11668850), Murchison
Road Reserve (PIN 11668851), Murchison
Road Reserve (PIN 11668852), Woolgorong

Road Reserve (PIN 11668859), South Murchison
Road Reserve (PIN 11668861), South Murchison
Road Reserve (PIN 11670998), Murchison
Road Reserve (PIN 11706884), Woolgorong
Road Reserve (PIN 11706885), Nerramyne
Road Reserve (PIN 11708250), South Murchison
Road Reserve (PIN 11708251), South Murchison
Road Reserve (PIN 11708252), South Murchison
Road Reserve (PIN 11796002), Nunierra

3. Area of clearing

The Permit Holder must not clear more than 2000 hectares of native vegetation within the combined areas shaded yellow on attached Plan 7916/1 (a), Plan 7916/1 (b), Plan 7916/1 (c), Plan 7916/1 (d), Plan 7916/1 (e), Plan 7916/1 (f), Plan 7916/1 (g), Plan 7916/1 (h) and Plan 7916/1 (i).

4. Period in which clearing is authorised

The Permit Holder shall not clear any native vegetation after 26 May 2023.

5. Application

This Permit allows the Permit Holder to authorise persons, including employees, contractors and agents of the Permit Holder, to clear native vegetation for the purposes of this Permit subject to compliance with the conditions of this Permit and approval from the Permit Holder.

6. Type of clearing authorised

This Permit authorises the Permit Holder to clear native vegetation for the activities described in condition 1 of this Permit to the extent that the Permit Holder has the power to carry out works involving clearing for those activities under the *Main Roads Act 1930* or any other written law.

PART II – MANAGEMENT CONDITIONS

7. Avoid, minimise and reduce the impacts and extent of clearing

In determining the amount of native vegetation to be cleared authorised under this Permit, the Permit Holder must have regard to the following principles, set out in order of preference:

- (a) avoid the clearing of native vegetation;
- (b) minimise the amount of native vegetation to be cleared; and
- (c) reduce the impact of clearing on any environmental value.

8. Direction of clearing

The Permit Holder shall conduct clearing in a progressive manner from one direction to the other (e.g. west to east) to allow fauna to move into adjacent native vegetation ahead of the clearing activity.

9. Weed control

When undertaking any clearing or other activity authorised under this Permit, the Permit Holder must take the following steps to minimise the risk of the introduction and spread of *weeds*:

- (a) clean earth-moving machinery of soil and vegetation prior to entering and leaving the area to be cleared;
- (b) ensure that no *weed*-affected soil, *mulch*, *fill* or other material is brought into the area to be cleared; and
- (c) restrict the movement of machines and other vehicles to the limits of the areas to be cleared.

10. Retain vegetative material and topsoil, revegetation and rehabilitation

The Permit Holder shall:

- (a) retain the vegetative material and topsoil removed by clearing authorised under this Permit and stockpile the vegetative material and topsoil in an area that has already been cleared.
- (b) within 3 months following completion of the extractive activity, *revegetate* and *rehabilitate* the area(s) that are no longer required for the purpose for which they were cleared under this Permit by:
 - (i) re-shaping the surface of the land so that it is consistent with the surrounding 5 metres of uncleared land; and
 - (ii) ripping the ground on the contour to remove soil compaction; and
 - (iii) laying the vegetative material and topsoil retained under condition 10(a) on the cleared area(s).
- (c) within 24 months of laying the vegetative material and topsoil on the cleared area in accordance with condition 10(b) of this Permit:
 - (i) engage an *environmental specialist* to determine the species composition, structure and density of the area *revegetated* and *rehabilitated*; and
 - (ii) where, in the opinion of an *environmental specialist*, the composition structure and density determined under condition 10(c)(i) of this Permit will not result in a similar species composition, structure and density to that of pre-clearing vegetation types in that area, *revegetate* the area by deliberately *planting* and/or *direct seeding* native vegetation that will result in a similar species composition, structure and density of native vegetation to pre-clearing vegetation types in that area and ensuring only *local provenance* seeds and propagating material are used.
- (d) Where additional *planting* or *direct seeding* of native vegetation is undertaken in accordance with condition 10(c)(ii) of this permit, the Permit Holder shall repeat condition 10(c)(i) and 10(c)(ii) within 24 months of undertaking the additional *planting* or *direct seeding* of native vegetation.
- (e) Where a determination by an *environmental specialist* that the composition, structure and density within areas *revegetated* and *rehabilitated* will result in a similar species composition, structure and density to that of pre-clearing vegetation types in that area, as determined in condition 10(c)(i) and (ii) of this permit, that determination shall be submitted for the CEO's consideration. If the CEO does not agree with the determination made under condition 10(c)(ii), the CEO may require the Permit Holder to undertake additional *planting* and *direct seeding* in accordance with the requirements under condition 10(c)(ii).

11. Fauna management

- (a) Immediately prior to undertaking any clearing authorised under this Permit, the Permit Holder shall engage a *fauna specialist* to undertake clearance surveys of any areas to be cleared within the areas cross-hatched yellow on attached Plan 7916/1 (a), Plan 7916/1 (b), Plan 7916/1 (c), Plan 7916/1 (d), Plan 7916/1 (e), Plan 7916/1 (f), Plan 7916/1 (g), Plan 7916/1 (h) and Plan 7916/1 (i), for the gilled slender blue tongue (*Cyclodomorphus branchialis*) and good-legged lerista (*Lerista eupoda*).
- (b) Immediately prior to undertaking any clearing authorised under this Permit, the Permit Holder shall engage a *fauna specialist* to relocate any fauna found under condition 11(a) of this permit, in accordance with a fauna licence pursuant to Regulation 15 of the *Wildlife Conservation Regulations 1970*.
- (c) Where fauna are identified and relocated under condition 11(a) and 11(b) of this Permit, the Permit Holder shall include the following in a report submitted to the Department of Water and Environmental Regulation:
 - (i) the scientific name and gender of each fauna captured under condition 11(a) and 11(b);
 - (ii) the location of any fauna species, as listed in condition 11(a) and 11(b), captured using a Global Positioning System (GPS) unit set to Geocentric Datum Australia 1994 (GDA94), expressing the geographical coordinates in Eastings and Northings or decimal degrees;
 - (iii) the scientific name and gender of each fauna relocated under condition 11(b);
 - (iv) the location of any fauna species, as listed in condition 11(b), relocated using a Global Positioning System (GPS) unit set to Geocentric Datum Australia 1994 (GDA94), expressing the geographical coordinates in Eastings and Northings or decimal degrees;

12. Malleefowl habitat management

- (a) Immediately prior to undertaking any clearing authorised under this Permit, the Permit Holder shall engage a *fauna specialist* to conduct a *fauna survey* of any areas to be cleared within the areas cross-hatched yellow on attached Plan 7916/1 (a), Plan 7916/1 (b), Plan 7916/1 (c), Plan 7916/1 (d), Plan 7916/1 (e), Plan 7916/1 (f), Plan 7916/1 (g), Plan 7916/1 (h) and Plan 7916/1 (i), to identify *Leipoa ocellata* (malleefowl) mounds.
- (b) Where active malleefowl mounds are identified in relation to condition 12(a), the permit holder shall ensure that no clearing occurs within 50 metres of the identified active malleefowl mounds.
- (c) Where active malleefowl mounds are identified under condition 12(b), the Permit Holder shall document the location of any active malleefowl mounds identified and submit to the Department of Water and Environmental Regulation.

13. Western spiny tailed skink habitat management

The Permit Holder shall ensure that no clearing occurs within the Granite Outcrop habitat type (Vegetation and Substrate Associations (VSA 7)) as identified with the documents titled, 'Square Kilometre Array (SKA) Main Roads Upgrade Fauna Assessment, 5 February 2016', and 'Square Kilometre Array Road Upgrade Project Fauna Assessment, 30 January 2017' (see Appendix A).

14. Northern shield-backed trapdoor spider habitat management

The Permit Holder shall avoid impacts to northern shield-backed trapdoor spider (*Idiosoma* sp. 'MYG018') burrows identified at the four coordinate locations shown in the below table:

Location Number	Easting	Northing
1	371692	6893113
2	371607	6893418
3	369220	6903148
4	376435	6941350

15. Flora management

Prior to undertaking any clearing, for any areas that were not subject to surveying under the documents titled, 'Murchison SKA Road Upgrade, Flora and Vegetation Assessment, April 2016', and 'Murchison SKA Road Upgrade, Flora and Vegetation Assessment, February 2017' (see Appendix A).

- (a) The Permit Holder shall engage a *botanist* to undertake a flora survey in accordance with the Environmental Protection Authorities 'Technical Guidance, Flora and Vegetation Surveys for Environmental Impact Assessment, 2016', to identify occurrences of the following priority flora and rare flora:
 - (i) *Eremophila viscida* (rare)
 - (ii) *Eucalyptus beardiana* (rare)
 - (iii) *Calandrinia butcherensis* (Priority 1)
 - (iv) *Chamelaucium* sp. Yalgoo (Y. Chadwick 1816) (Priority 1)
 - (v) *Indigofera eriophylla* (Priority 1)
 - (vi) *Acacia ampliata* (Priority 1)
 - (vii) *Bergia auriculata* (Priority 2)
 - (viii) *Eremophila mirabilis* (Priority 2)
 - (ix) *Angianthus microcephalus* (Priority 2)
 - (x) *Hibiscus krichauffianus* (Priority 3)
 - (xi) *Lepidium scandens* (Priority 3)
 - (xii) *Lepidium xylodes* (Priority 3)
 - (xiii) *Psammomoya ephedroides* (Priority 3)
- (b) Where priority flora or rare flora are identified in relation to condition 15(a) of this Permit, or have previously been recorded within the surveys undertaken for the documents titled 'Murchison SKA Road Upgrade, Flora and Vegetation Assessment, April 2016', and 'Murchison SKA Road Upgrade, Flora and Vegetation Assessment, February 2017', the Permit Holder shall ensure that:
 - (i) no clearing occurs within 50 metres of rare flora and Priority 1 and 2 flora listed under condition 15(a); and
 - (ii) no clearing occurs within 20 metres of the Priority 3 flora listed under condition 15(a).

- (c) Where priority or rare flora species are identified under condition 15(a), the Permit Holder shall document the location and species name of any priority flora or rare flora identified and submit to the Department of Water and Environmental Regulation.

16. Records must be kept

The Permit Holder must maintain the following records for activities done pursuant to this Permit:

- (a) In relation to the clearing of native vegetation authorised under this Permit:
- (i) the location where the clearing occurred, recorded using a Global Positioning System (GPS) unit set to Geocentric Datum Australia 1994 (GDA94), expressing the geographical coordinates in Eastings and Northings;
 - (ii) the date that the area was cleared;
 - (iii) the size of the area cleared (in hectares);
 - (iv) actions taken to avoid, minimise and reduce the impacts and extent of clearing in accordance with condition 7 of this Permit; and
 - (v) actions taken to minimise the risk of the introduction and spread of *weeds* in accordance with condition 9 of this Permit.
- (b) In relation to the *revegetation* and *rehabilitation* of areas pursuant to condition 10 of this Permit:
- (i) the location of any areas *revegetated* and *rehabilitated*, recorded using a Global Positioning System (GPS) unit set to Geocentric Datum Australia 1994 (GDA94), expressing the geographical coordinates in Eastings and Northings or decimal degrees;
 - (ii) a description of the *revegetation* and *rehabilitation* activities undertaken;
 - (iii) the size of the area *revegetated* and *rehabilitated* (in hectares);
 - (iv) the species composition, structure and density of *revegetation* and *rehabilitation*, and
 - (v) a copy of the environmental specialist's report.

17. Reporting

- (a) The Permit Holder must provide to the *CEO* on or before 30 June of each year, a written report:
- (i) of records required under condition 16 of this Permit; and
 - (ii) concerning activities done by the Permit Holder under this Permit between 1 January to 31 December of the preceding calendar year.
- (b) If no clearing authorised under this Permit has been undertaken, a written report confirming that no clearing under this Permit has been undertaken, must be provided to the *CEO* on or before 30 June of each year.
- (c) Prior to 26 February 2028, the Permit Holder must provide to the *CEO* a written report of records required under condition 16 of this Permit where these records have not already been provided under condition 17(a) of this Permit.

Definitions

The following meanings are given to terms used in this Permit:

botanist: means a person who holds a tertiary qualification in environmental science or equivalent, and has a minimum of 2 years work experience in identification and surveys of flora native to the bioregion being inspected or surveyed, or who is approved by the *CEO* as a suitable botanist for the bioregion;

CEO means the Chief Executive Officer of the Department responsible for the administration of the clearing provisions under the *Environmental Protection Act 1986*;

direct seeding means a method of re-establishing vegetation through the establishment of a seed bed and the introduction of seeds of the desired plant species;

environmental specialist: means a person who holds a tertiary qualification in environmental science or equivalent, and has experience relevant to the type of environmental advice that an environmental specialist is required to provide under this Permit, or who is approved by the *CEO* as a suitable environmental specialist;

evidence means site photos of the vegetation types considered to be representative of the Eucalypt Woodlands of the Western Australian Wheatbelt threatened ecological community and a corresponding map showing the location and direction of each photo taken;

fauna specialist: means a person who holds a tertiary qualification specializing in environmental science or equivalent, and has a minimum of 2 years work experience in fauna identification and surveys of fauna native to the region being inspected or surveyed, or who is approved by the CEO as a suitable fauna specialist for the bioregion, and who holds a valid fauna licence issued under the *Wildlife Conservation Act 1950*;

fauna survey: means a field-based investigation, including a review of established literature, of the biodiversity of fauna and/or fauna habitat of the Permit Area. Where conservation significant fauna are identified in the Permit Area, the survey should also include sufficient surrounding areas to place the Permit Area into local context;

fill means material used to increase the ground level, or fill a hollow;

local provenance means native vegetation seeds and propagating material from natural sources within 50 kilometres and the same Interim Biogeographic Regionalisation for Australia (IBRA) subregion of the area cleared.

mulch means the use of organic matter, wood chips or rocks to slow the movement of water across the soil surface and to reduce evaporation;

planting means the re-establishment of vegetation by creating favourable soil conditions and planting seedlings of the desired species;

regenerate/ed/ion means re-establishment of vegetation from in situ seed banks and propagating material (such as lignotubers, bulbs, rhizomes) contained either within the topsoil or seed-bearing *mulch*;

rehabilitate/ed/ion means actively managing an area containing native vegetation in order to improve the ecological function of that area;

revegetate/ed/ion means the re-establishment of a cover of *local provenance* native vegetation in an area using methods such as natural *regeneration*, *direct seeding* and/or *planting*, so that the species composition, structure and density is similar to pre-clearing vegetation types in that area; and

weed/s means any plant -

- (a) that is a declared pest under section 22 of the *Biosecurity and Agriculture Management Act 2007*; or
- (b) published in a Department of Biodiversity, Conservation and Attractions species-led ecological impact and invasiveness ranking summary, regardless of ranking; or
- (c) not indigenous to the area concerned.



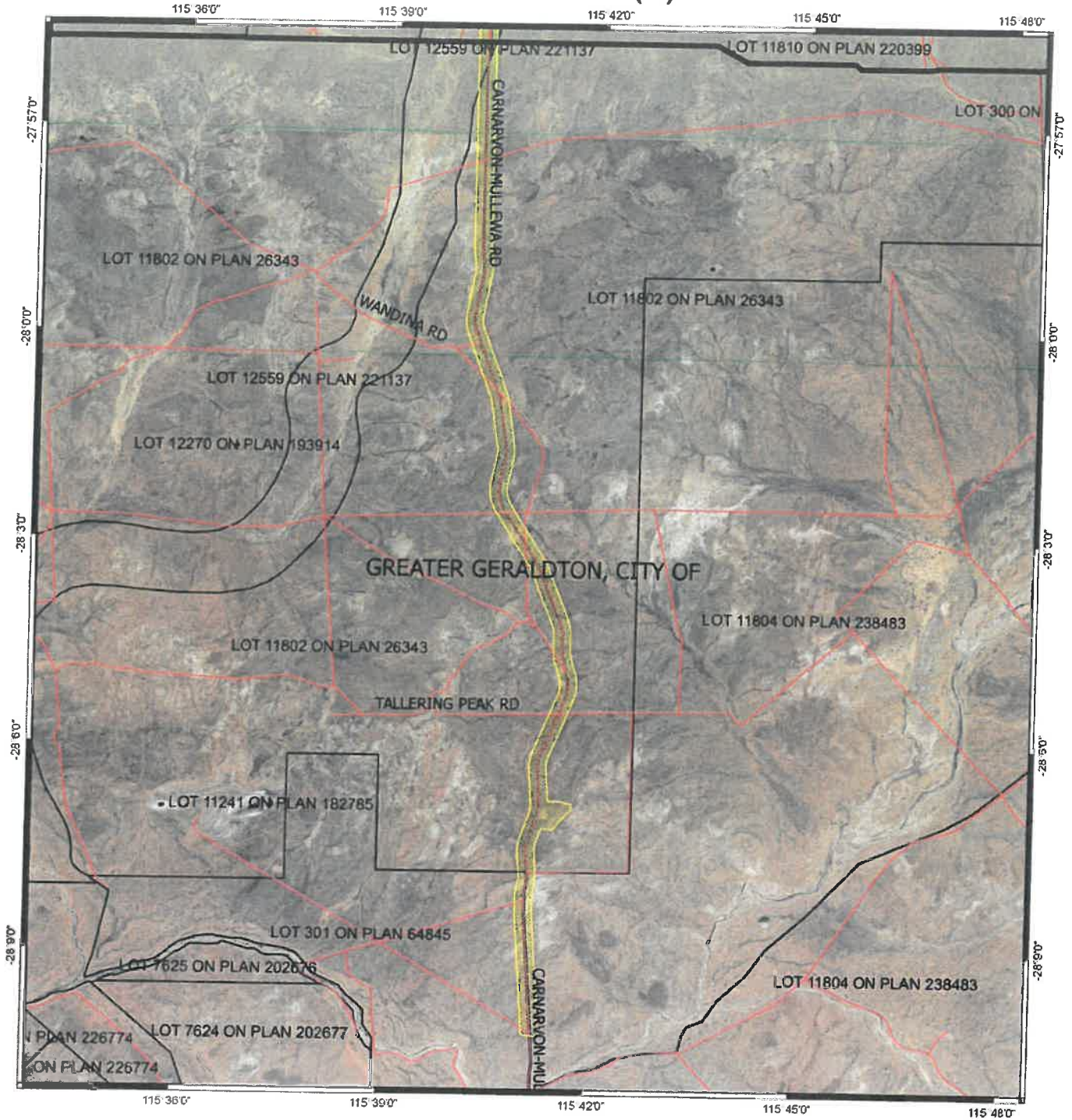
Jane Clarkson
MANAGER
CLEARING REGULATION

Officer delegated under section 20
of the *Environmental Protection Act 1986*

27 April 2018

Appendix A

Plan 7916/1(a)



Legend

-  Roads
-  Cadastre
-  Cadastre
-  Areas approved to clear
-  Local Govt. Authorities (LGA)

7000



7000 m



MGA 64
Geocentric Datum of Australia 1994

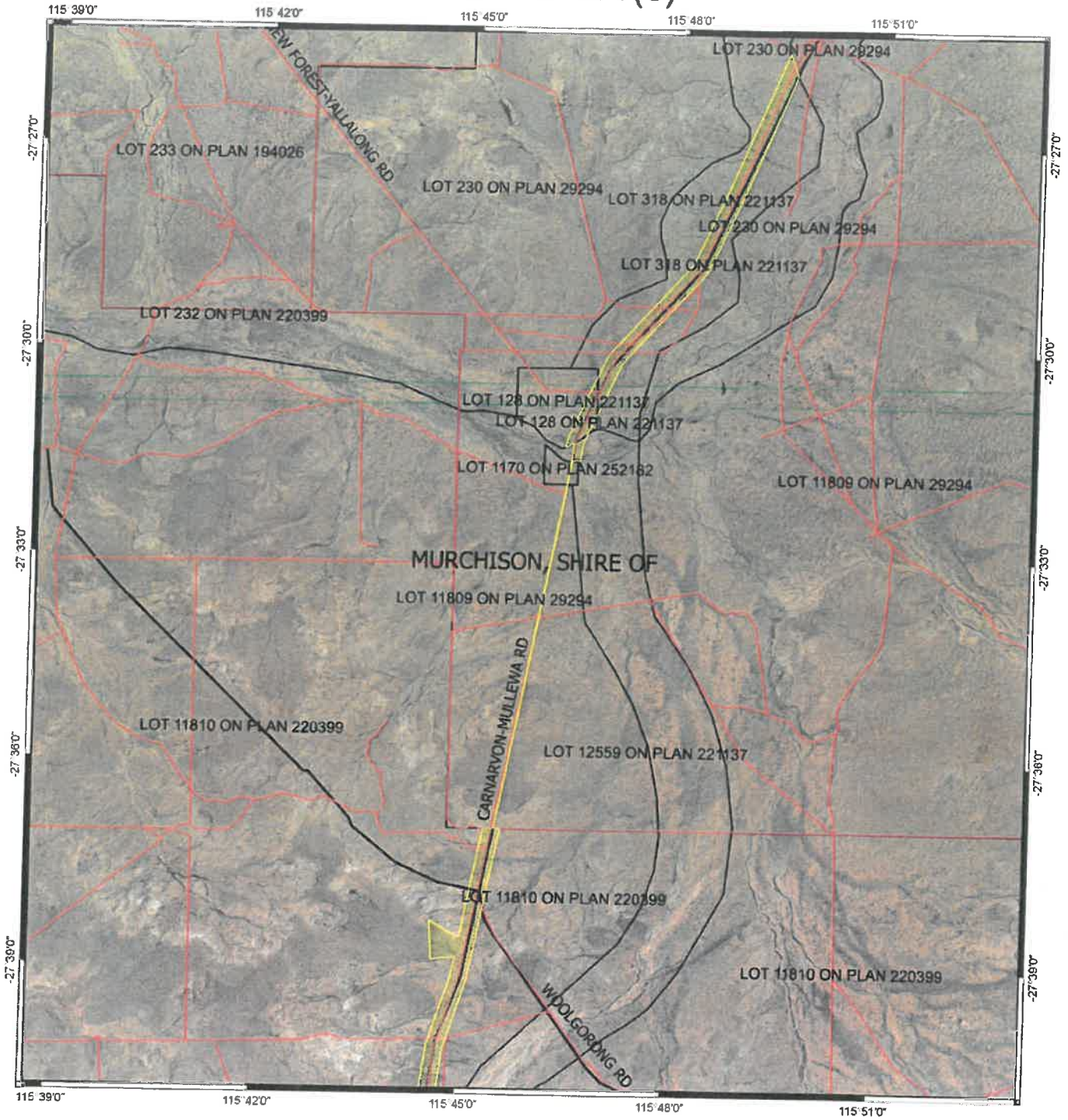
J. Clarkson Date: 27.4.18

J. CLARKSON
Officer with delegated authority under Section 20
of the Environmental Protection Act 1986



GOVERNMENT OF
WESTERN AUSTRALIA

Plan 7916/1(c)



Legend

— Roads

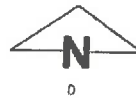
Cadastre

□ Cadastre

▭ Areas approved to clear

□ Local Govt. Authorities (LGA)

7000



7000 m

MGA 84
Geocentric Datum of Australia 1994

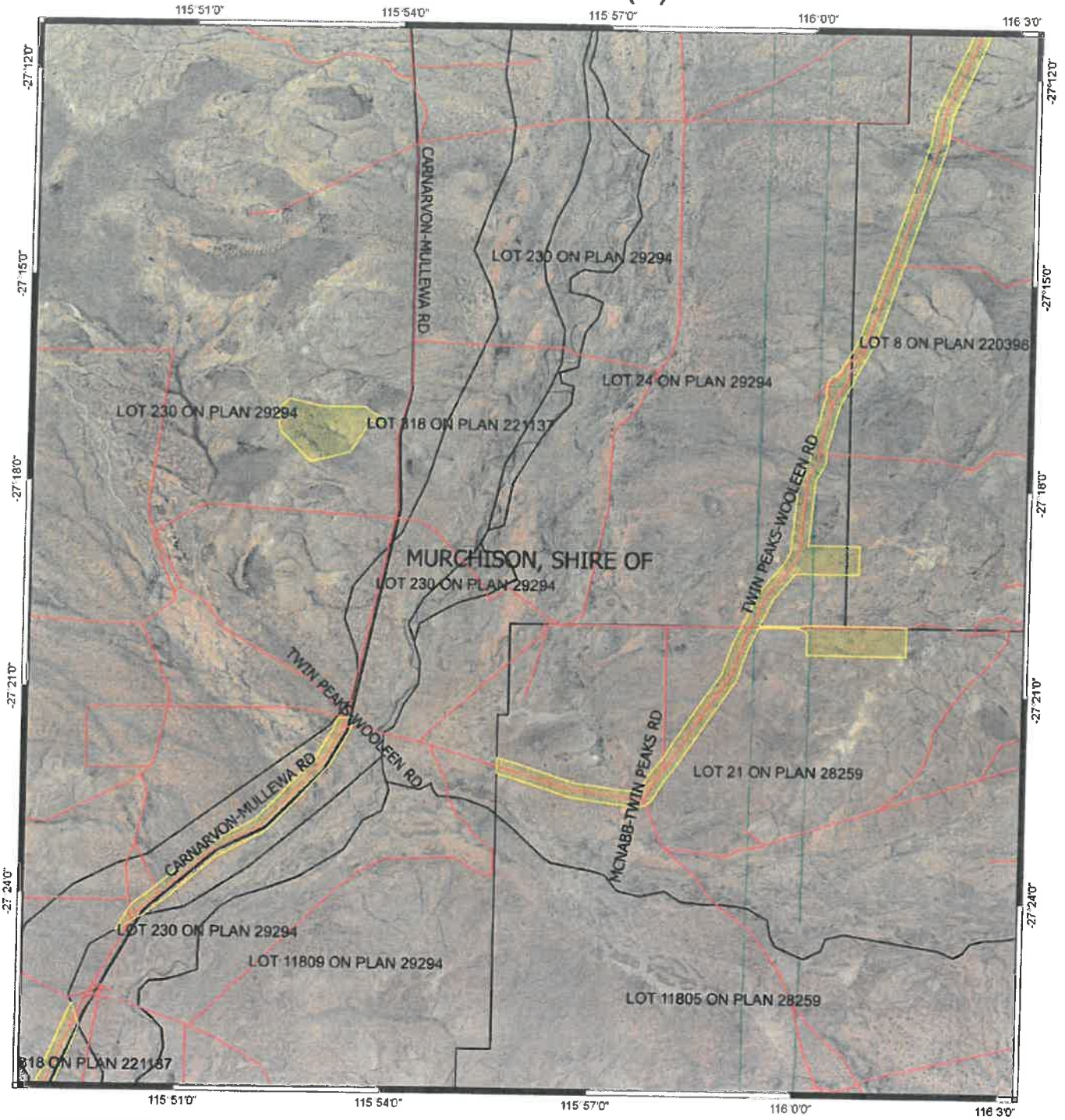
J. Clarkison Date 27.4.18

Official with delegated authority under Section 20
of the Environmental Protection Act 1986



GOVERNMENT OF
WESTERN AUSTRALIA

Plan 7916/1(d)



Legend

-  Roads
-  Cadastre
-  Areas approved to clear
-  Local Govt. Authorities (LGA)

7000



0

7000 m



MGA 84
Geocentric Datum of Australia 1994

J. Clarkson Date: 27.4.18

Officer with delegated authority under Section 20
of the Environmental Protection Act 1986



GOVERNMENT OF
WESTERN AUSTRALIA

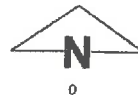
Plan 7916/1(e)



Legend

-  Roads
- Cadastre**
-  Cadastre
-  Areas approved to clear
-  Local Govt. Authorities (LGA)

7000



7000 m



MGA 94
Geocentric Datum of Australia 1994

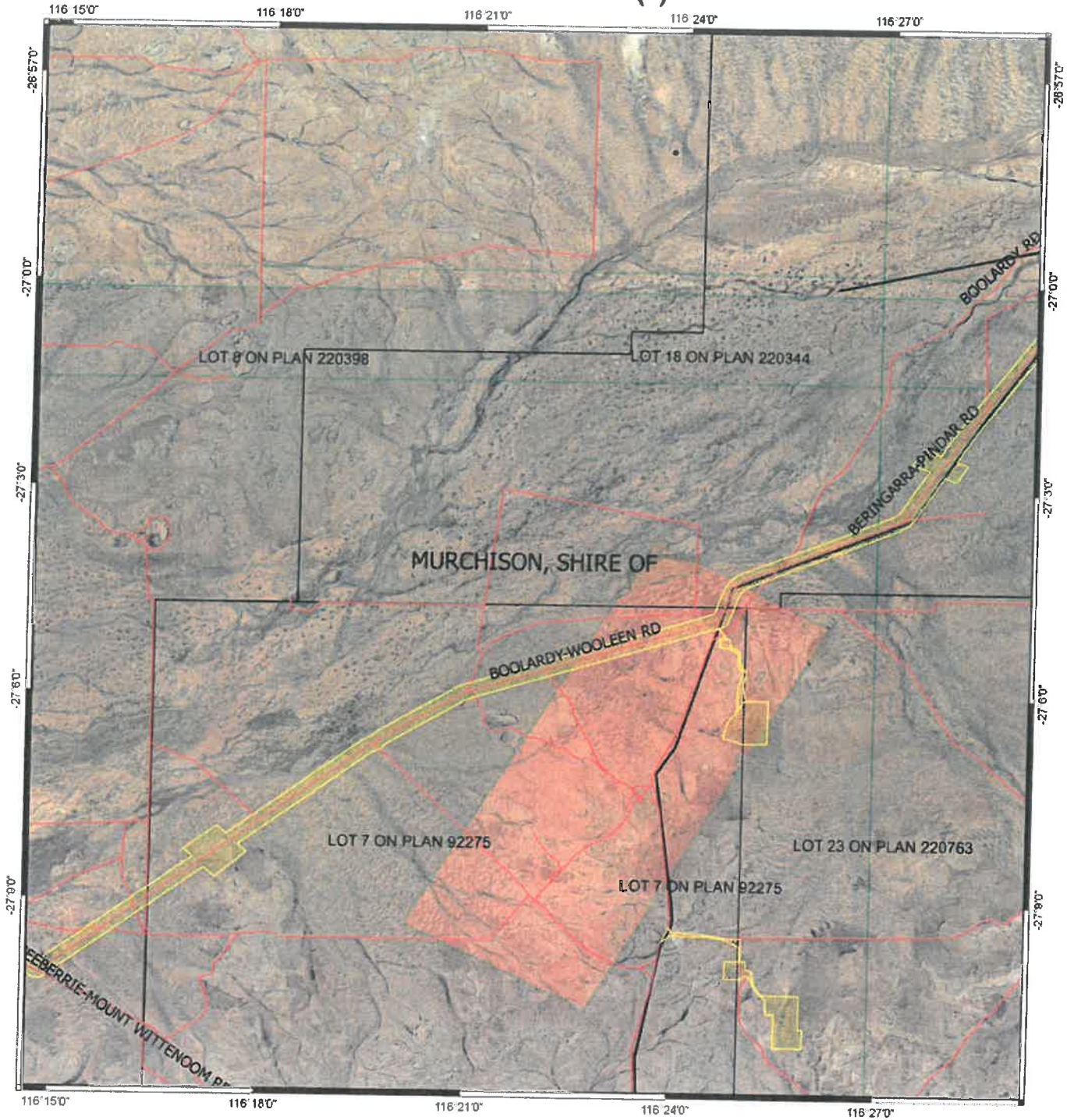
J. Clarkson Date 27.4.18

Officer with delegated authority under Section 20
of the Environmental Protection Act 1986



GOVERNMENT OF
WESTERN AUSTRALIA

Plan 7916/1(f)



-  Roads
-  Cadastre
-  Cadastre
-  Areas approved to clear
-  Local Govt. Authorities (LGA)

7000 0 7000 m



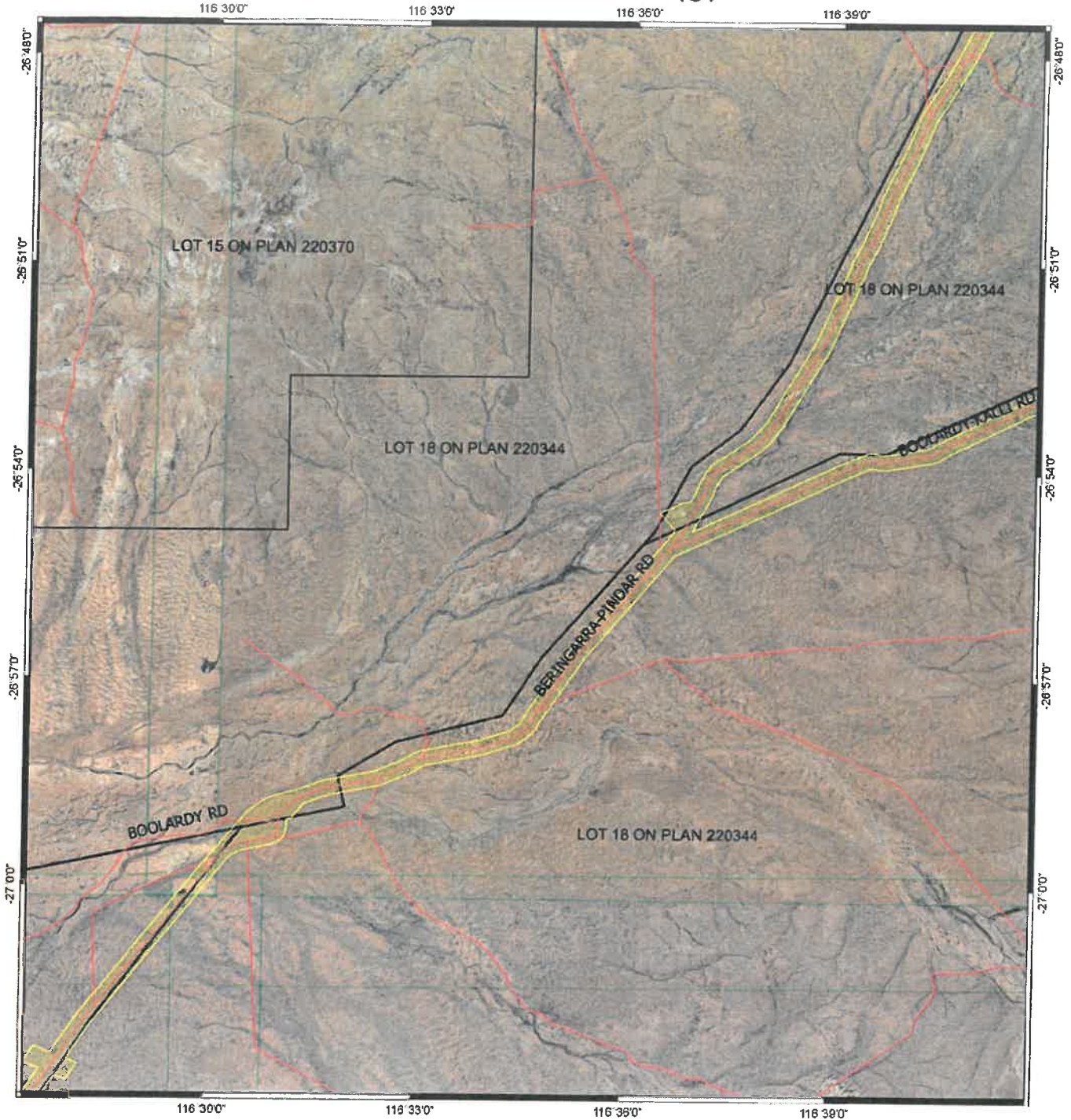
MGA 94
Geocentric Datum of Australia 1994

J. Clarkson Date: 27.4.18
J. Clarkson
Officer with delegated authority under Section 20
of the Environmental Protection Act 1986



GOVERNMENT OF
WESTERN AUSTRALIA

Plan 7916/1(g)



Legend

-  Roads
- Cadastre**
-  Cadastre
-  Areas approved to clear
-  Local Govt. Authorities (LGA)

7000 0 7000 m



MGA 84
Geocentric Datum of Australia 1994

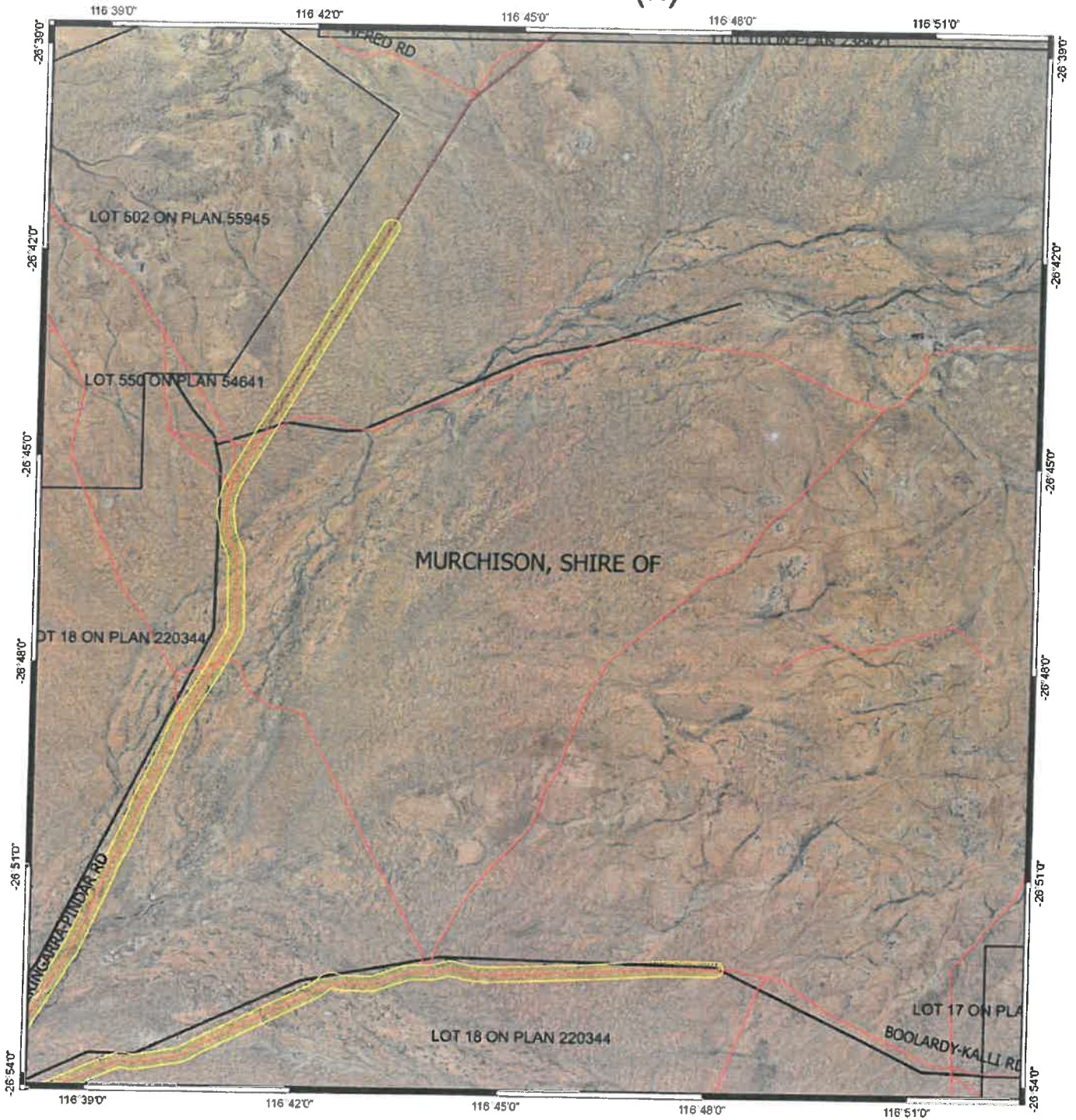
N. J. Clark Date 27.4.18

Officer with delegated authority under Section 20
of the Environmental Protection Act 1986



GOVERNMENT OF
WESTERN AUSTRALIA

Plan 7916/1(h)



Legend

-  Roads
- Cadastre**
-  Cadastre
-  Areas approved to clear
-  Local Govt. Authorities (LGA)

7000 0 7000 m

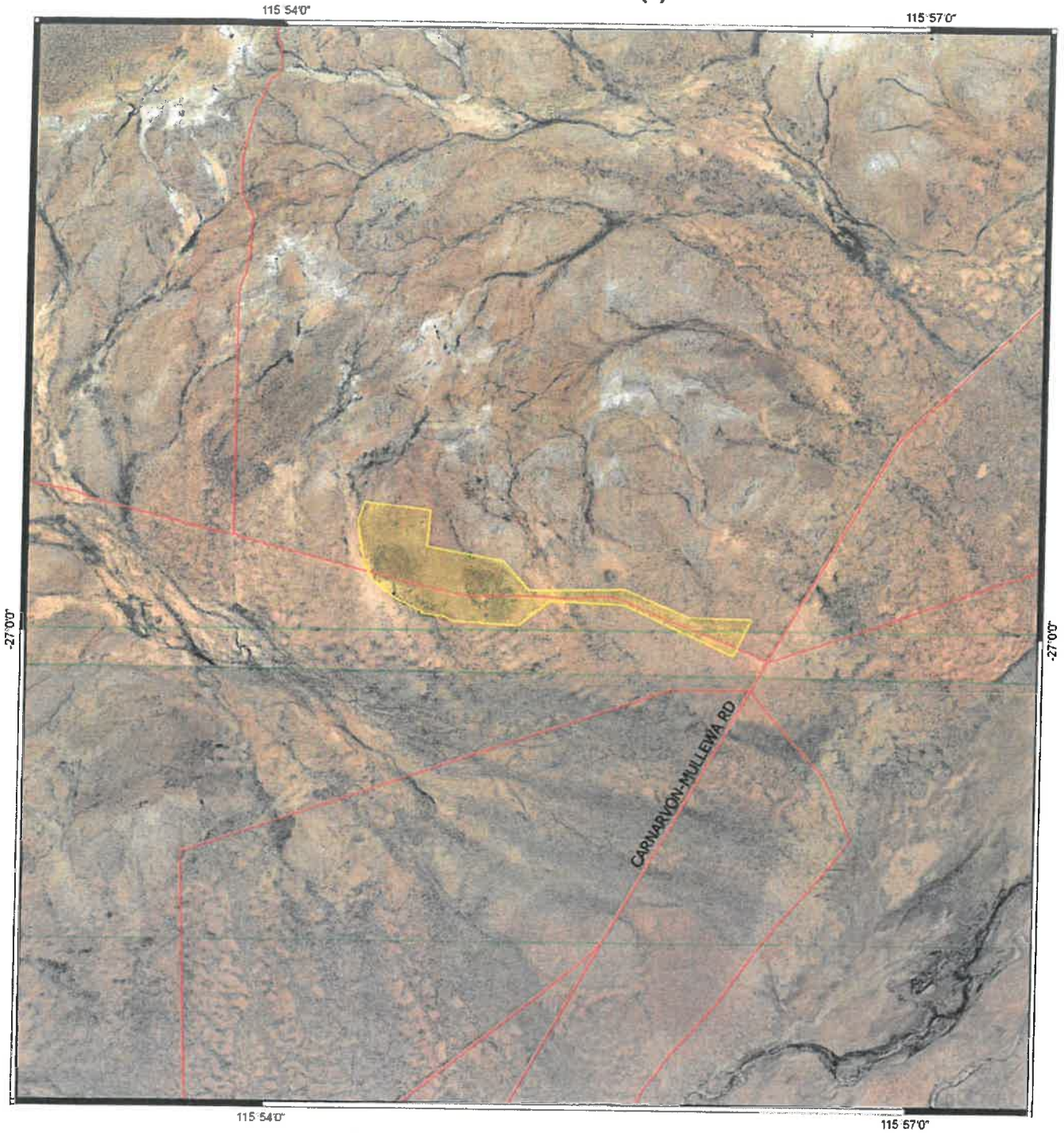


MGA 94
Geocentric Datum of Australia 1994

[Signature] Date 27.4.18
 Officer with delegated authority under Section 20
 of the Environmental Protection Act 1986



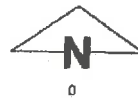
Plan 7916/1(i)



Legend

-  Areas approved to clear
-  Roads
-  LGA
- WANow_Imagery

2000



2000 m

MGA 94
Geocentric Datum of Australia 1994

J. Clarkson Date 27.4.18

Officer with delegated authority under Section 20
of the Environmental Protection Act 1986



GOVERNMENT OF
WESTERN AUSTRALIA



1. Application details

1.1. Permit application details

Permit application No.: 7916/1
Permit type: Purpose Permit

1.2. Applicant details

Applicant's name: Main Roads Western Australia
Application received date: 11 December 2017

1.3. Property details

Property: Numerous properties
Local Government Authority: Shire of Murchison and City of Greater Geraldton
Localities: Murchison, South Murchison, Woolgorong, Nerramayne and Nunierra

1.4. Application

Clearing Area (ha)	No. Trees	Method of Clearing	Purpose category:
2000		Mechanical Removal	Road construction/upgrades and extractive industry.

1.5. Decision on application

Decision on Permit Application: Grant

Decision Date: 27 April 2018

Reasons for Decision:

The clearing permit application has been assessed against the clearing principles, planning instruments and other matters in accordance with section 51O of the *Environmental Protection Act 1986* (EP Act). It has been concluded that the proposed clearing is at variance to principles (a), (b) and (f), may be at variance to principles (c), (h) and (i) and is not likely to be at variance to the remaining principles.

Based on the assessment of the application area, the Delegated Officer determined that:

- the application area comprises a high level of biological diversity;
- the application area contains significant habitat for the western spiny-tailed skink (*Egernia stokesii badia*) and suitable habitat for malleefowl (*Leipoa ocellata*), northern shield-backed trapdoor spider (*Idiosoma* sp. 'MYG018'), gilled slender blue-tongue (*Cyclodomorphus branchialis*), and good-legged lerista (*Lerista eupoda*);
- the application area may include two rare flora species;
- the proposed clearing may impact on the conservation status of up to 11 priority flora species; and
- the proposed clearing may result in the spread of weeds into the ex-Woolgorong conservation reserve and Urawa Nature Reserve.

The Delegated Officer noted that the proposed impacts will occur over a distance of approximately 237 kilometres.

After consideration of the above, the Delegated Officer determined that the following requirements as specified within clearing permit conditions, would help to address the abovementioned impacts:

- pre-clearance surveys to identify gilled slender blue-tongue and good-legged lerista within the application area, and the relocation of any individuals of these species recorded during pre-clearance surveys in accordance with a fauna licence issued pursuant to Regulation 15 of the *Wildlife Conservation Regulations 1970*;
- pre-clearance surveys to identify active malleefowl mounds within the application area, with no clearing to occur within 50 metres of any active malleefowl mounds identified;
- one directional clearing, in a slow progressive manner, to allow conservation significant fauna to move into adjacent habitat ahead of clearing;
- avoidance of the granite outcropping habitat type (SVA 7) identified within the Fauna Assessments, to minimise impacts to the western spiny-tailed skink;
- avoidance of 15 northern shield-backed trapdoor spider burrows located within the application area;

- pre-clearance flora surveys for two rare flora species and 11 priority flora species, with a 50 metre buffer required around any of the rare flora or Priority 1 and 2 flora identified within the Flora Assessments or follow up pre-clearance surveys, and a 20 metre buffer required around any of the specified Priority 3 flora identified within the Flora Assessments or follow up pre-clearance surveys;
- revegetation and rehabilitation of any temporary cleared areas to minimise the extent of long term impacts resulting from the proposed clearing; and
- weed hygiene measures to mitigate the risk of degradation of adjoining native vegetation, including vegetation within the ex-Woolgong reserve and Urawa Nature Reserve.

The Delegated Officer also took into consideration that road upgrades are required to provide safe access for road trains to the Square Kilometre Array, a State Development project.

In determining to grant a clearing permit subject to conditions, the Delegated Officer found that the proposed clearing is unlikely to lead to an unacceptable risk to the environment.

2. Site Information

Clearing Description

The application is to upgrade a series of local roads in the City of Greater Geraldton and Shire of Murchison to allow road trains access to the future Square Kilometre Array (SKA), State Development project. As part of the project 18 borrow pits have been identified to provide material for the proposed road works. The works will include the following at various locations along the local roads (Main Roads Western Australia (MRWA), 2017):

- Road and intersection realignments;
- Road widening;
- River crossing floodway construction;
- Culvert and cattle grid repairs and replacements; and
- Gravel re-sheeting.

It is noted that the application area comprises 10,959 hectares, with the proposed clearing to comprise no more than 2000 hectares within this larger footprint area. The applicant has advised that the proposed clearing for road upgrades comprises approximately 110.82 hectares and the proposed clearing for borrow pits comprises approximately 1,889.18 hectares.

Vegetation Description

The applicant commissioned two flora and vegetation assessments which encompass various portions of the application area, being:

- A flora and vegetation assessment (Flora Assessment 1) undertaken by 360 Environmental (2016) that largely incorporated the northern and southern portion of the application area. This Assessment identified 33 vegetation units within the surveyed portion of the application area; and
- A flora and vegetation assessment (Flora Assessment 2) undertaken by 360 Environmental (2017) that largely incorporated the central portion and small north eastern most portion of the application area. This Assessment identified 29 vegetation units within the surveyed portion of the application area.

A list of the abovementioned identified vegetation types is provided within Appendix A of this decision report, which includes the approximate extent (hectares) of vegetation types recorded within the application area.

Vegetation Condition

The Flora Assessments identified the vegetation under application as being in the following condition (360 Environmental, 2016; 360 Environmental, 2017):

- Completely degraded (approximately 4.6 per cent of the surveyed portion of the application area);
- Degraded (approximately 1.4 per cent of the surveyed portion of the application area);
- Good (approximately 11.3 per cent of the surveyed portion of the application area);
- Very good (approximately 78.37 per cent of the surveyed portion of the application area); and
- Excellent (approximately 4.33 per cent of the surveyed portion of the application area).

Soil type

There are 15 Landform Systems mapped within the application area. A list of these landform types is included within Appendix A.

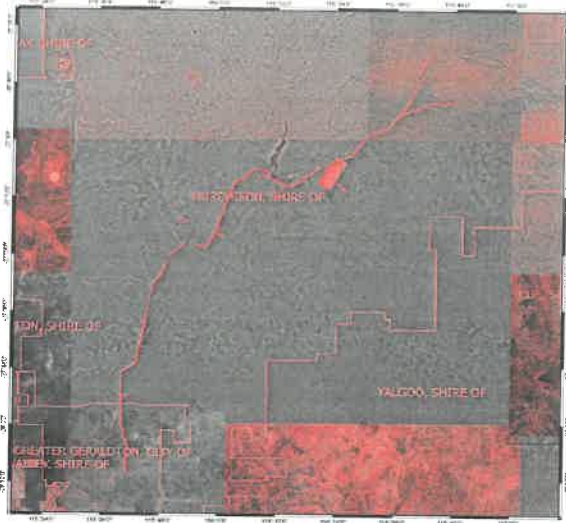


Fig 1: Application area

3. Minimisation and mitigation measures

The applicant has advised that the following general mitigation measures will be undertaken to avoid and minimise impacts associated with the proposed clearing (MRWA, 2017):

- The clearing of native vegetation within the application area will be minimised where possible, and existing cleared areas will be utilised where possible;
- All vegetation proposed to be cleared will be demarcated on site prior to the commencement of project activities. Specific exclusion areas that are to be retained will be marked accordingly;
- Native vegetation will be conserved as far as practicable, and will not be disturbed for such temporary works as side tracks, access tracks, temporary storage areas, campsites, spoil areas or site offices;
- The portion of the road project envelope that intersects Urawa Nature Reserve will be confined to the previously disturbed road corridor maintenance zone. As such this reserve will not be impacted; and
- All areas associated with clearing for borrow pits will be rehabilitated once material has been exhausted. Revegetation will be undertaken in accordance with Main Roads' 'Guideline Revegetation Planning and Techniques, 2015'.

The applicant has also provided a commitment to other specific management measures for conservation significant flora and fauna species, which are referred to within the relevant clearing principles.

4. Assessment of application against clearing principles, planning instruments and other relevant matters

(a) Native vegetation should not be cleared if it comprises a high level of biological diversity.

Proposed clearing is at variance to this Principle

As discussed under section 2, the applicant commissioned two flora and vegetation assessments (Flora Assessment 1, undertaken in 2015 and Flora Assessment 2, undertaken in 2016, herein collectively referred to as the Flora Assessments) which encompass various portions of the application area.

A total of 58 vegetation types were recorded within the Flora Assessments, as shown within Appendix A. The most commonly recorded vegetation types included the following (360 Environmental, 2016; 360 Environmental, 2017):

- Vegetation type 18, which comprises *Acacia ramulosa* var. *linophylla*, *Acacia acuminata* and *Acacia tetragonophylla* tall shrubland over *Aristida contorta*, *Austrostipa nitida* and *Monachather paradoxus* open grassland over mixed annual herbs (comprises approximately 4.5 per cent of the surveyed application area);
- Vegetation type 28f, which comprises *Acacia pteraneura* low woodland over *Acacia craspedocarpa*, *Acacia tetragonophylla*, *Eremophila platycalyx* subsp. *platycalyx* tall open shrubland to tall shrubland over *Abutilon cryptopetalum* scattered low shrubs and mixed open herbland (comprises approximately 4.2 per cent of the surveyed application area);
- Vegetation type 28H, which comprises *Acacia pteraneura* low open woodland to low woodland over *Acacia grasbyi*, *Acacia tetragonophylla* scattered tall shrubs over *Senna* spp., *Eremophila forrestii* subsp. *forrestii* scattered shrubs (comprises approximately 12.7 per cent of the surveyed application area);
- Vegetation type 36, which comprises *Acacia pteraneura* low open woodland over *Thryptomene decussata*, *Acacia coolgardiensis* and *Grevillea stenobotrya* tall open shrubland over *Aristida contorta* very open grassland (comprises approximately 15.7 per cent of the surveyed application area); and
- Vegetation type 37, which comprises *Acacia pteraneura*, *Acacia cuthbertsonii* subsp. *cuthbertsonii* and *Acacia tetragonophylla* tall shrubland over *Eremophila galeata* sparse shrubs over *Ptilotus obovatus* and mixed *Senna* spp. low sparse shrubs over *Aristida contorta* open tussock grassland (comprises approximately 4.9 per cent of the surveyed application area).

With regard to the total number of flora species identified, the Flora Assessments identified the following:

- Flora Assessment 1 identified a total of 422 flora species from 186 genera and 62 families (including 22 weed species) (360 Environmental, 2016); and

- Flora Assessment 2 identified a total of 454 flora species from 166 genera and 51 families (including 21 weed species) (360 Environmental, 2017).

None of the weed species identified are listed as Weeds of National Significance or Declared under the *Biosecurity and Agriculture Management Act 2007*.

The condition of the vegetation within the application area varies throughout, ranging from excellent to completely degraded condition (Keighery, 1994), with the majority of the vegetation in a very good (Keighery, 1994) condition (approximately 78.37 per cent of the vegetation under application) (360 Environmental, 2016; 360 Environmental, 2017).

A total of 22 priority flora species were recorded within areas surveyed under the Flora Assessments, of which 19 species were recorded within the application area (identified in Table 1 below). A further nine priority flora species were identified as potentially occurring within the survey area, based on the presence of suitable habitat for these species (360 Environmental, 2016; 360 Environmental, 2017).

Table 1. Priority Flora Species recorded, or considered likely to occur within the application area.

Species	Status	Identified in Application Area
<i>Indigofera eriophylla</i>	Priority 1	Yes (one record)
<i>Chamaelium</i> sp. Yalgoo (Y. Chadwick 1816)	Priority 1	Yes (one record)
<i>Calandrinia butcherensis</i>	Priority 1	Yes (five records)
<i>Acacia ampliata</i>	Priority 1	No (considered likely to occur)
<i>Bergia auriculata</i>	Priority 2	No (considered likely to occur)
<i>Angianthus microcephalus</i>	Priority 2	No (considered likely to occur)
<i>Eremophila mirabilis</i>	Priority 2	No (considered likely to occur)
<i>Hibiscus krichauffianus</i>	Priority 3	Yes (three records)
<i>Lepidium scandens</i>	Priority 3	No (two records identified within the survey area outside of the application area)
<i>Lepidium xyloides</i>	Priority 3	Yes (one record)
<i>Psammomoya ephedroides</i>	Priority 3	Yes (three records)
<i>Dicrastylis linearifolia</i>	Priority 3	No (considered likely to occur)
<i>Micromyrtus placoides</i>	Priority 3	No (considered likely to occur)
<i>Eremophila physocalyx</i>	Priority 3	Yes (three records)
<i>Gunniopsis divisa</i>	Priority 3	No (considered likely to occur)
<i>Prostanthera petrophila</i>	Priority 3	No (considered likely to occur)
<i>Calocephalus aervoides</i>	Priority 3	No (two records identified within the survey area outside of the application)
<i>Eremophila muelleriana</i>	Priority 3	Yes (two records)
<i>Eremophila simulans</i> subsp. <i>Megacalyx</i>	Priority 3	Yes (25 records)
<i>Frankenia confusa</i>	Priority 4	No (four records identified within the survey area outside of the application)
<i>Goodenia berringbinensis</i>	Priority 4	Yes (five records)
<i>Goodenia neogoodenia</i>	Priority 4	Yes (two records)
<i>Gunniopsis propinqua</i>	Priority 3	Yes (one record)
<i>Hemigenia tysonii</i>	Priority 3	Yes (five records)
<i>Petrophile pauciflora</i>	Priority 3	Yes (five records)
<i>Ptilotus lazaridis</i>	Priority 3	Yes (one record)
<i>Ptilotus beardii</i>	Priority 3	Yes (one record)
<i>Sauropus</i> sp. Woolgorong (M. Officer s.n. 10/8/94)	Priority 3	Yes (12 records)
<i>Verticordia jamiesonii</i>	Priority 3	Yes (two records)

Priority 1 and 2 flora species are known from one or a few locations (generally five or less) and appear to be under threat from known threatening processes, with these species in need of further survey. Noting the status of these species, it is considered that the proposed clearing may impact on the conservation status of the four Priority 1 and three Priority 2 flora species identified as either occurring, or likely to occur, within the application area. The applicant has committed to providing a 50 metre buffer to the known P1 and P2 recorded locations to ensure they are not impacted by the proposed clearing (MRWA, 2017).

While Priority 3 species generally don't appear to be under imminent threat, several of the Priority 3 species identified above are known from very few records. These species include *Hibiscus krichauffianus* (known from three records), *Lepidium scandens* (known from five records), *Lepidium xyloides* (known from five records) and *Psammomoya ephedroides* (known from seven records). Noting the limited number of records for these species, it is considered that the proposed clearing may impact on the conservation of these species (DBCA, 2018a).

With regard to the Priority 1 and Priority 2 flora species referred to above, the applicant will be required to maintain a 50 metre buffer around the recorded locations of these species. With regard to the Priority 3 species referred to above, the applicant will be required to maintain a 20 metre buffer around the recorded locations of these species.

Should the applicant require clearing outside of those areas surveyed under the Flora Assessments, the applicant will be required to undertake a targeted flora survey for these species, whereby the abovementioned buffers would need to be maintained around any individuals identified within follow up surveys.

DBCA provided comment on the impacts to conservation significant flora and advised that (DBCA, 2018a):

- targeted surveys should be undertaken to determine the actual impacts to conservation significant flora proposed for this project;
- populations of conservation significant flora, in particular those known from five or fewer locations (*Hibiscus krichauffianus*, *Indigofera eriophylla*, *Lepidium xylodes*) should be avoided as impacts may be significant to the conservation of the species; and
- it is recommended that the clearing area be minimised as much as possible to that which is necessary for road construction.

The remaining Priority 3 and 4 flora species outlined within Table 1 are considered to have moderate distributions and numerous (greater than 10) records, therefore the proposed clearing is not likely to impact on the conservation status of those species.

As discussed under Principle (c), the application area has the potential to contain two rare flora species, based on the suitability of habitat for these species within the application area (360 Environmental, 2016; 360 Environmental, 2017). Whilst the Flora Assessments did not identify these species, the application area includes portions that were not subject to surveys (largely buffer areas associated with the proposed road upgrades), therefore these species may occur within those areas. Should the applicant wish to clear outside of the surveyed areas, targeted flora surveys will be required to determine whether these species occur. If these species are identified, the applicant will be required to maintain a 50 metre buffer around any identified occurrences.

The centre portion of the application area intersects one Priority Ecological Community (PEC) which is known as the 'New Forest (including Twin Peaks and Barloweerie Range) vegetation complexes (banded ironstone formation)' (Priority 1). The Flora Assessments noted that this PEC is restricted to banded ironstone formations and that no banded ironstone formations necessary to support this community were identified within the survey areas (360 Environmental, 2016; 360 Environmental, 2017). Noting this, the proposed clearing is unlikely to impact on this PEC.

As discussed under Principle (d), none of the vegetation types recorded within the application area are considered to be representative of any threatened ecological communities (TEC's) (360 Environmental, 2016; 360 Environmental, 2017), and noting the distance to the closest mapped TEC (approximately 40 kilometres south), the proposed clearing is not likely to impact on any TEC's.

As discussed under Principle (b), two fauna assessments were commissioned by the applicant, which incorporated various portions of the application area. The assessments recorded (individuals or evidence of) seven conservation significant fauna species within the application area, and several others are considered likely to utilise the application area, based on the suitability of habitat for these species. Of these, it is considered that the application area provides significant habitat for the western spiny-tailed skink (*Egernia stokesii badia*) and may provide significant habitat for the following species; malleefowl (*Leipoa ocellata*), gilled slender blue tongue (*Cyclodomorphus branchialis*), good-legged lerista (*Lerista eupoda*) and shield-backed trapdoor spider (*Idiosoma nigrum*).

Noting that the application area includes vegetation that is largely in a very good (Keighery, 1994) condition, 19 priority flora species, suitable habitat for conservation significant fauna species, and may include two species of rare flora, the application area is considered to provide a high level of biological diversity, and is therefore at variance to this Principle.

The applicant will be required to undertake a number of management measures (see Section 1.5) to address the impacts of clearing on the biological diversity within the application area.

(b) Native vegetation should not be cleared if it comprises the whole or a part of, or is necessary for the maintenance of, a significant habitat for fauna indigenous to Western Australia.

Proposed clearing is at variance to this Principle

The applicant commissioned two fauna assessments (Fauna Assessment 1 and Fauna Assessment 2, referred to collectively as the Fauna Assessments) which incorporated various portions of the application area (M.J. & A.R Bamford Consulting Ecologists (Bamford Consulting Ecologists), 2016; Bamford Consulting Ecologists, 2017):

- Fauna Assessment 1 incorporated the northern and southern portions of the application area. The survey undertaken for this assessment identified 120 vertebrate fauna species; and
- Fauna Assessment 2 incorporated the central portion and small north eastern most portion of the clearing footprint. The survey undertaken for this assessment identified 88 vertebrate fauna species.

The Fauna Assessments identified 10 fauna habitat types referred to as Vegetation and Substrate Associations (VSA's) within the application area (see Appendix A for a list of these).

DBCA provided comment on the Fauna Assessments and advised that "the survey methodology was adequate for identifying impacts to conservation significant fauna" (DBCA, 2018b).

Of the vertebrate fauna species identified, the Fauna Assessments recorded a total of seven conservation significant fauna species within the application area, which are identified within Table 2 below.

Table 2. Conservation significant fauna recorded during the Fauna Assessments (Bamford Consulting Ecologists, 2016; Bamford Consulting Ecologists, 2017).

Species	Conservation Status	Evidence (more than one denotes records at more than one location).
Malleefowl (<i>Leipoa ocellata</i>)	Classified as vulnerable under the <i>Environment Protection and Biodiversity Conservation Act 1999</i> (EPBC Act) and 'Fauna that is rare or is likely to become extinct as vulnerable fauna' under the Wildlife Conservation (Specially Protected Fauna) Notice 2017 (WC Fauna Notice).	<ol style="list-style-type: none"> 1. Old, inactive mound 2. Malleefowl tracks 3. Old, inactive mound These observations were recorded within the application area.
Western spiny-tailed skink (<i>Egernia stokesii badia</i>)	Classified as vulnerable under the EPBC Act and 'Fauna that is rare or is likely to become extinct as vulnerable fauna' under the WC Fauna Notice.	<ol style="list-style-type: none"> 1. Scat latrine 2. Scat latrine 3. Scat latrine 4. Scat latrine One Scat latrine was recorded within the application area, the other three were recorded at distances of approximately 420 metres, 700 and 885 metres from the application area respectively.
Peregrine falcon (<i>Falco peregrinus</i>)	Classified as 'Other specially protected fauna' under the WC Fauna Notice.	<ol style="list-style-type: none"> 1. Pair observed Pair recorded within the application area.
Eastern great egret (<i>Ardea modesta</i>)	Protected under international agreement.	<ol style="list-style-type: none"> 1. One individual observed Observation was recorded within the application area
Common greenshank (<i>Tringa nebularia</i>)	Protected under international agreement.	<ol style="list-style-type: none"> 1. One individual observed (recorded within the application area) 2. One individual observed (recorded approximately 680 metres from the application area)
Rainbow bee-eater (<i>Merops ornatus</i>)	Protected under international agreement.	<ol style="list-style-type: none"> 1. Two observed 2. Two observed Both observations were recorded within the application area.
Recorded as the shield-backed trapdoor spider (<i>Idiosoma nigrum</i>), now considered to be the northern shield-backed trapdoor spider (<i>Idiosoma</i> sp. 'MYG018')	The northern shield-backed trapdoor spider is classified as Priority 3 by DBCA.	<ol style="list-style-type: none"> 1. Four burrows 2. Three burrows 3. One burrow 4. Seven burrows These burrows were all recorded within the application area.
Western pebble-mound mouse (<i>Pseudomys chapmani</i>)	Priority 4 listed by DBCA.	<ol style="list-style-type: none"> 1. Ancient, inactive mound 2. Ancient, inactive mound 3. Ancient, inactive mound These inactive mounds were recorded approximately nine kilometres from the application area.

The rainbow bee-eater, peregrine falcon, eastern great egret and common greenshank are all highly mobile avian species with large home ranges. Noting this, and the extent of native vegetation remaining within the local area (approximately 93.6 per cent), whereby it is considered that suitable habitat for these species is present, the application area is unlikely to provide significant habitat for these species.

The western pebble-mound mouse formerly occurred across the Murchison and Gascoyne regions, however Fauna Assessment 1 notes that this species now appears to be restricted to the Pilbara, with only old abandoned mounds recorded to the south (where the application area occurs) (Bamford Consulting Ecologists, 2016). Several ancient, inactive western pebble-mound mouse mounds were recorded within the survey area on low stony hills, approximately nine kilometres from the application area (Bamford Consulting Ecologists, 2016). The age of the mounds suggest that this species no longer occurs within the local area (Bamford Consulting Ecologists, 2016), and it is considered that this species is now locally extinct. Therefore, the proposed clearing is not likely to impact on this species.

Malleefowl occur in shrublands and low woodlands that are dominated by mallee vegetation and require a sandy substrate and abundance of leaf litter to build mounds for roosting purposes (DotE, 2015). A decline in malleefowl numbers has resulted from a number of threats to this species, including loss of vegetation due to clearing for agricultural purposes, fox predation and the degradation of habitat by fire (DotE, 2015). Two inactive malleefowl mounds were identified within the application area, with the Fauna Assessments noting that these mounds were too old to have any conservation value (Bamford Consulting Ecologists, 2016; Bamford Consulting Ecologists, 2017). However, the presence of abandoned mounds within the application area indicates the presence of suitable habitat for this species, and there is the potential that malleefowl have constructed mounds within the application area since the surveys were undertaken. Should active mounds occur within the application area, it may be significant for the maintenance of this species.

DBCA provided comment on potential impacts to malleefowl and advised that "pre-clearance surveys for malleefowl mounds should be conducted as close as possible prior to clearing commencement, at least within 2 weeks prior. If an active mound is found it should be excluded from the clearing area and an avoidance buffer zone applied (at least 50 metre radius around a mound)" (DBCA, 2018b). The applicant advised that any mounds identified during project activities would be checked by an environmentalist specialist, whereby any active mounds would be avoided (MRWA, 2017).

In the Murchison region, the western spiny-tailed skink is restricted to rocky areas, generally comprising extensive granite outcrops with a diverse shrub layer, which are isolated and sparsely scattered across the region (Bamford Consulting Ecologists, 2016). Evidence of this species (comprising several scat latrines) was recorded amongst granite boulders on a large granite hill adjacent to the Boolardy – Wooleen Road. This vegetation type was recorded as VSA 7, described as granite outcrops, granite domes and hills supporting scattered *Acacia* shrublands and areas of *Callitris* woodland and fringing dense shrublands. VSA 7 is considered to provide significant habitat for this species. Approximately 9.5 hectares of the application area was identified as VSA 7. DBCA provided comment on the impacts to this species and advised that "the granite outcrops are considered to provide significant habitat for identified threatened fauna species. The fauna species of greatest concern within and near to the proposed clearing area is the western spiny-tailed skink (*Egernia stokesii badia*) as it is restricted to the granite outcrops and cannot disperse from disturbance" (DBCA, 2018b).

The shield-backed trapdoor spider inhabits dense *Acacia* shrublands with a gravelly loam substrate in the Murchison Bioregion. This Fauna Assessments note that this species was recorded along Carnarvon Mullewa Road on gravelly slopes of lateritic hills supporting *Acacia* shrublands, and on a sandplain intergrading with a lateritic slope (Bamford Consulting Ecologists, 2016; Bamford Consulting Ecologists, 2017). In total 15 burrows were identified, whereby seven of these were recorded within the proposed borrow pits and eight were recorded within the proposed road upgrades area. Fauna Assessment 1 noted that the extent of available habitat within the fauna survey area is patchy but extends over approximately 80 kilometres and at most would be approximately 800 hectares of native vegetation (Bamford Consulting Ecologists, 2016). This represents less than approximately 0.05 per cent of suitable habitat within 15 kilometres of the application area (Bamford Consulting Ecologists, 2016).

DBCA advised that there has been a recent taxonomic revision of the shield-backed trapdoor spider. DBCA further advised that "the *Idiosoma* species recorded within the Fauna Assessments is now considered to be the northern shield-backed trapdoor spider (*Idiosoma* sp. 'MYG018'). This new species is endemic to the far northern Wheatbelt, Yalgoo and Murchison bioregions and extends from Blue Hill Range, Kadji Kadji Nature Reserve and Karara in the south, north to at least Jack Hills, Albion Downs, and Yakabindie. The species was assessed by the TSSC [threatened species scientific community] as not meeting eligibility for listing as threatened, but was identified as a priority species (Priority 3) that occurs at widespread locations, but is poorly-known, with threatening processes known to exist and is in need of further survey" (DBCA, 2018b).

The Fauna Assessments identified an additional four conservation significant fauna species, deemed to be residents within the application area, despite these species not being recorded. These species include; gilled slender blue-tongue (*Cyclodomorphus branchialis*), good-legged lerista (*Lerista eupoda*), golden carp gudgeon (*Hypseleotris aurea*) and long-tailed dunnart (*Sminthopsis longicaudata*).

The gilled slender blue-tongue (classified as 'Fauna that is rare or is likely to become extinct as vulnerable fauna' under the WC Fauna Notice) inhabits semi-arid shrublands on heavy red soils with a small number of records scattered through the region (Bamford Consulting Ecologists, 2016; Bamford Consulting Ecologists, 2017). South of the survey area, it has been recorded on the slopes of ironstone hills. The Fauna Assessments note that suitable habitat for this species occurs within the application area (Bamford Consulting Ecologists, 2016; Bamford Consulting Ecologists, 2017). While this species was not identified at the time of survey, given the availability of suitable habitat, this species may be present within the application area at the time of clearing, and if present would be susceptible to mortality. Noting the limited number of records of this species, it is considered that fauna deaths as a result of clearing may be significant to this species at a local and regional scale.

The good-legged lerista (listed as Priority 1 by DBCA) has a restricted range, occurring only in the vicinity of Meekatharra, Cue and Weld Range (Bamford Consulting Ecologists, 2016; Bamford Consulting Ecologists, 2017). This species occurs within a range of environments, from the crests of banded ironstone hills, gravelly footslopes supporting *Acacia* shrublands to drainage lines and Eucalypt woodland in sandy areas (Bamford Consulting Ecologists, 2016; Bamford Consulting Ecologists, 2017). Given that suitable habitat for this species exists within the application area, it may be present within the application area at the time of clearing, and if present would be susceptible to mortality due to mechanical clearing. Given the restricted range of this species, it is considered that fauna deaths as a result of clearing may be significant to this species at a local and regional scale.

The golden carp gudgeon (listed as Priority 2 by DBCA) occurs in pools along the Murchison River, with records both upstream and downstream of the Murchison River crossings associated with the application area (Bamford Consulting Ecologists, 2016; Bamford Consulting Ecologists, 2017). The Fauna Assessments noted that this species is able to tolerate high salinity levels and is likely to occur in the vicinity of the project area in permanent pools (Bamford Consulting Ecologists, 2016; Bamford Consulting Ecologists, 2017). While the application area traverses several non-perennial watercourses and occurs nearby several permanent pools, the Fauna Assessments did not identify any areas of standing water within the application area at the time of survey. Noting this, and the relatively small linear areas proposed for clearing where the application area crosses the Murchison River, (whereby these areas may not need upgrading as part of the project), the application area is unlikely to provide significant habitat for this species. Therefore, the proposed clearing is unlikely to impact on this species via direct mortalities or secondary impacts such as sedimentation of watercourses.

The long-tailed dunnart inhabits rocky areas, such as banded ironstone hills and ridges, and the Fauna Assessments noted that suitable habitat for this species occurs within the survey area, particularly within the undulating hills in the vicinity of Talling Peak (Bamford Consulting Ecologists, 2016; Bamford Consulting Ecologists, 2017). While this species may occur within the application area, noting the extent of suitable habitat available within the extensively vegetated landscape, the vegetation under application is unlikely to provide significant habitat for this species. It is considered that the requirement to undertake directional clearing (i.e. from south to north), in a slow progressive manner, will allow this species to disperse ahead of clearing and thus impacts to this species are unlikely to be significant.

Noting that the application area provides significant habitat for the western spiny-tailed skink and suitable habitat for the good-legged Lerista, gilled slender blue-tongue, northern shield-backed trapdoor spider and malleefowl, the proposed clearing is at variance to this Principle.

To minimise impacts to the abovementioned conservation significant fauna species, the applicant will be required to undertake the following fauna management measures:

- conduct pre-clearance surveys to identify the good-legged lerista and gilled slender blue tongue and relocate any individuals identified to reduce the potential for fatalities;
- avoid any occurrences of the VSA 7 (granite outcropping) habitat type, to minimise impacts to significant habitat for the western spiny-tailed skink;
- conduct pre-clearance surveys to identify active malleefowl mounds prior to any clearing, with no clearing to occur within 50 metres of any active malleefowl mounds identified;
- avoid the 15 northern shield-backed trapdoor spider burrows recorded within the proposed road upgrades area, to minimise the extent of impact to this species; and
- undertake directional clearing to allow the abovementioned fauna to move into adjacent habitat ahead of clearing.

It is considered that with the fauna management measures outlined above, the proposed clearing is not likely to have a significant impact on fauna indigenous to Western Australia.

(c) Native vegetation should not be cleared if it includes, or is necessary for the continued existence of, rare flora.

Proposed clearing may be at variance to this Principle

Two species of rare flora have been recorded within the local area, these being *Eremophila viscida* and *Eucalyptus beardiana*.

Eremophila viscida is a shrub that grows to between 1.2 and four metres high within granitic soils, sandy loam, stony gullies and sandplains (Western Australian Herbarium, 1998-). The closest record of this species is approximately 28 kilometres south of the application area.

Eucalyptus beardiana is a mallee that grows to between three and five metres high, within red or yellow sand and on sand dunes and ridges (Western Australian Herbarium, 1998-). The closest record of this species is approximately 45 kilometres south west of the application area.

These species were not recorded within the flora surveys, however the Flora Assessments noted that suitable habitat for both species is present within the application area (360 Environmental, 2016; 360 Environmental, 2017), and thus both species could potentially occur within the application area.

While clearing within the surveyed area is unlikely to impact on these species, noting that the full extent of the application area was not surveyed (largely buffer areas associated with the road upgrades), the proposed clearing may impact on these species if present within the larger application area.

Given the above, the proposed clearing may be at variance to this Principle.

Should the applicant intend to undertake any clearing outside of the surveyed areas, a flora survey targeted at the abovementioned species would be required. Should these species be identified, the applicant would be required to maintain a 50 metre buffer to these occurrences.

(d) Native vegetation should not be cleared if it comprises the whole or a part of, or is necessary for the maintenance of a threatened ecological community.

Proposed clearing is not likely to be at variance to this Principle

According to available datasets, one TEC has been mapped within the local area, known as the Eucalypt Woodlands of the Western Australian Wheatbelt. This TEC is classified as critically endangered under the *Environment Protection and Biodiversity Conservation Act 1999*. The closest mapped occurrence of this TEC is approximately 40 kilometres south of the application area.

The Assessments noted that none of the vegetation units recorded are considered representative of this TEC, or any other known TEC's (360 Environmental, 2016; 360 Environmental, 2017). Noting this, and that the application area occurs 40 kilometres north of the most northern recorded occurrence of this TEC, the proposed clearing is unlikely to impact on this TEC.

Given the above, the proposed clearing is not likely to be at variance to this Principle.

(e) Native vegetation should not be cleared if it is significant as a remnant of native vegetation in an area that has been extensively cleared.

Proposed clearing is not likely to be at variance to this Principle

The National Objectives and Targets for Biodiversity Conservation 2001-2005 include a target to have clearing controls in place that prevent clearance of ecological communities with an extent below 30 per cent of that present pre-1750 (i.e. pre-European settlement) (Commonwealth of Australia, 2001). This is the threshold level, below which species loss appears to accelerate exponentially.

As indicated in Table 3, the mapped Beard vegetation associations (BVA's) within the application area all retain greater than 30 per cent of their pre-European vegetation extents (Government of Western Australia, 2018).

The local area retains approximately 93.67 per cent native vegetation cover (approximately 3,597,882 hectares) and the application area represents approximately 0.055 per cent of the remaining native vegetation within the local area.

As outlined in the assessment under principles (a), (b), and (c) the application area may contain rare flora, contains priority flora, significant habitat for conservation significant fauna and a high level of biological diversity. Noting this, the application area is considered to be significant remnant. However, given the extent of native vegetation remaining within the local area, Shire, IBRA Bioregion and mapped BVA's, the application area is not considered to be within an extensively cleared landscape.

Given the above, the proposed clearing is not likely to be variance to this principle.

Table 3 – Vegetation remaining statistics (Government of Western Australia, 2018).

	Pre-European extent (ha)	Current extent (ha)	Current extent (%)	% Current extent in all DBCA managed lands
IBRA bioregion*:				
Murchison	28,120,587	28,044,823	99.7	7.8
Yalgoo	5,057,325	4,923,840	97.4	32
Local Government Authority*:				
Shire of Murchison	4,487,317	4,486,372	99.9	7.7
City of Greater Geraldton	988,399	428,555	43.4	11.2
Beard vegetation association in Jarrah Forest bioregion*:				
18	19,890,666	19,843,411	99.7	6.6
29	7,903,991	7,900,200	99.9	6.3
39	6,613,418	6,602,535	99.8	12
40	369,056	351,140	95.15	6.4
160	1,111,549	1,111,535	99.9	11.9
183	369,231	369,231	100	29.8
184	75,140	75,140	100	2.5
202	448,529	448,343	99.9	22.9
204	199,475	198,735	99.6	6.8
326	1,034,327	1,034,300	100	32.8
404	206,553	198,505	96	21.7
1125	65,214	65,214	100	-
2081	1,328,650	1,317,897	99	15

(f) Native vegetation should not be cleared if it is growing in, or in association with, an environment associated with a watercourse or wetland.

Proposed clearing is at variance to this Principle

According to available datasets, the application area does not intersect any mapped wetlands. The closest wetland to the application area is Lake Annean, which at its closest point occurs approximately 670 metres from the application area. Noting the distance to Lake Annean, the proposed clearing is unlikely to impact on this wetland.

According to available datasets, the application area intersects numerous mapped non-perennial watercourses (including the Murchison River and Roderick Rivers) and several non-perennial lakes. The Flora Assessments identified vegetation types that are commonly associated with riparian environments and several of the VSA's identified within the application area are considered to be, or contain elements of riparian habitats, including VSA's 1, 2 and 3 (see Appendix A). Therefore, the proposed clearing will impact on vegetation that is growing in, or in association with, an environment associated with a watercourse.

Impacts to riparian habitat resulting from clearing linear areas to upgrade local roads will be limited to relatively narrow watercourse crossings, and as such, the proposed clearing of these areas is unlikely to result in significant impacts to the overall environmental values of those watercourses.

The applicant has advised that the proposed clearing will include some culvert extensions and floodway improvements, however noted that this will not change the associated watercourses or prohibit flow through these areas (MRWA, 2017).

None of the larger borrow pits are located within major or perennial watercourses and it is unlikely that the proposed clearing within these areas will significantly impact on riparian habitat within the local area.

Given the above, the proposed clearing is at variance to this Principle, however no significant watercourse or wetland related impacts are expected.

(g) Native vegetation should not be cleared if the clearing of the vegetation is likely to cause appreciable land degradation.

Proposed clearing is not likely to be at variance to this Principle

According to available datasets, the application area includes 15 mapped Landform Systems (see Appendix A). These Landform Systems vary markedly and include but are not limited to sandplains, floodplains, lateritic soils and granite outcrops.

As discussed under Section 2.1.1., the proposed clearing associated with the road upgrades is linear, and is to occur over a distance of approximately 237 kilometres. Noting the linearity of this portion, the risk of significant erosion as a result of the proposed clearing is substantially reduced. Therefore it is unlikely that any appreciable land degradation would occur, particularly noting that the surrounding areas are extensively vegetated. The applicant has also advised that the road design will maintain existing surface water flows and incorporate soil erosion control measures and that disturbed areas will be stabilised soon after construction activities are completed (MRWA, 2017).

The remainder of the proposed clearing is associated with material extraction from borrow pits, which considering the extent of clearing proposed within these areas, is considered to pose a greater risk of potential erosion and subsequent land degradation. However, it is noted that none of the borrow pits are located within any mapped major or perennial watercourses, which reduces the potential for water erosion or flooding to cause appreciable land degradation. Furthermore, the applicant has committed to rehabilitating all areas associated with clearing for borrow pits, post extraction. This will assist to minimise any long term impacts associated with wind or water erosion. Consistent with the applicant's commitment, the applicant will be required to revegetate temporary cleared areas post extraction.

Noting that the borrow pits will be rehabilitated post extraction, and that they largely occur as isolated pockets within an extensively vegetated landscape, the proposed clearing is not likely to cause appreciable land degradation.

Given the above, the proposed clearing is not likely to be at variance to this Principle.

(h) Native vegetation should not be cleared if the clearing of the vegetation is likely to have an impact on the environmental values of any adjacent or nearby conservation area.

Proposed clearing may be at variance to this Principle

The application area intersects one recognised conservation area, known as ex Woolgorong, which is a former pastoral station now managed by the Department of Biodiversity, Conservation and Attractions. This conservation area comprises approximately 123,800 hectares.

The applicant has advised that ex Woolgorong intersects a portion of the Carnarvon Mullewa road proposed for upgrade, at a point where resheeting works may be required which will be confined to the road formation, and some grid replacements which will be confined within the existing maintenance zone (MRWA, 2017). Furthermore, three proposed borrow pits located along Carnarvon Mullewa road at SLK 275.1, SLK 253.39 and SLK 244.21 all occur within the ex-Woolgorong reserve and involve the total removal of approximately 255 hectares of native vegetation within the reserve.

Noting that the clearing of these areas comprises approximately 255 hectares, within a much larger area of 123,800 hectares (which equates to a proposed impact of 0.2 per cent to the conservation area), that all three pits are located adjacent to the existing road, and that the applicant will be required to revegetate and rehabilitate the borrow pits, the proposed clearing is unlikely to significantly impact on the environmental values of this conservation area.

The proposed clearing may result in the incidental spread of weeds into the conservation area. Weed management practices will mitigate this risk.

Given the above, the proposed clearing may be at variance to this Principle.

(i) Native vegetation should not be cleared if the clearing of the vegetation is likely to cause deterioration in the quality of surface or underground water.

Proposed clearing may be at variance to this Principle

As discussed under principle (f), the application area intersects numerous mapped minor non-perennial watercourses and several non-perennial lakes. Noting this, the proposed clearing may result in the minor, short term sedimentation of these watercourses, particularly immediately post clearing and during periods of heavy rainfall, prior to the construction of road drainage infrastructure or the establishment of borrow pits.

To minimise the impact of the proposed clearing on watercourses, the applicant has advised that existing natural drainage paths and channels along the road or the vicinity of the project area will not be blocked or restricted during project construction. The applicant also advised that the road design will maintain existing surface water flows and incorporate soil erosion control measures, where required. The applicant will also be required to rehabilitate the temporarily cleared borrow sites, which will assist in minimising long term water quality impacts as a result of run-off within these sites.

Noting these measures, the non-perennial nature of the watercourses mapped within the application area, and the extent of the proposed clearing within an extensively vegetated landscape over a distance of 237 kilometres, it is expected that the impacts of sedimentation as a result of the proposed clearing will be short term and localised, and the proposed clearing is unlikely to significantly deteriorate the quality of surface water.

The majority of the application area has been mapped at a salinity level of between 3000 and 7000 milligrams per litre total dissolved solids. While such salinity levels are considered to be relatively high, noting that the local area (10 kilometre radius) is estimated to retain 93.6 per cent (3,597,882 hectares) native vegetation cover, the proposed clearing is considered unlikely to result in a perceptible rise in the water table and thus significant changes to groundwater or surface water quality via salinity are unlikely.

Given the above, the proposed clearing may be at variance to this principle, however, noting the applicants management measures outlined above, impacts to surface water quality as a result of the proposed clearing are not expected to be significant.

(j) Native vegetation should not be cleared if clearing the vegetation is likely to cause, or exacerbate, the incidence or intensity of flooding.

Proposed clearing is not likely to be at variance to this Principle

The application area occurs within two catchments; Greenough River and Murchison River, which comprise areas of 11,685,300 and 1,432,600 hectares respectively. Noting that the local area (10 kilometre radius) is estimated to retain approximately 93.6 per cent (3,597,882 hectares) of its native vegetation, and that the temporarily cleared areas associated with the borrow pits will be revegetated and rehabilitated post extraction, it is considered that the proposed clearing is unlikely to be in a location or of a localised scale that would result in an increase in the incidence or intensity of flooding.

Given the above, the proposed clearing is not likely to be at variance to this principle.

Planning instruments and other relevant matters.

The Square Kilometre Array (SKA) is a global radio telescope project, located on Boolardy Station in the Murchison region of Western Australia. As part of the project's development, the applicant is co-ordinating a road upgrade for access to the SKA site. The applicant (MRWA, 2017) has advised that "the aim of this project is to upgrade a series of local roads in the City of Greater Geraldton and Shire of Murchison to allow road trains access to the future Square Kilometre Array (SKA) project. To complete this 18 material [borrow] pits have been identified to provide material...The works to the roads will include the following treatments at various locations along the local roads:

- Road and intersection realignments
- Road widening
- River crossing floodway construction
- Culvert and cattle grid repairs and replacements
- Gravel re-sheeting

The clearing permit application was advertised on the DWER website on 26 February 2018 with a 21 day submission period. One submission was received in relation to this application. The submission (2018) objected to the proposed clearing based on the following:

- the recommendations in the fauna survey dated February 16 have not been addressed;
- there is no information on the areas to be cleared, only a large-scale map with no detail;
- the lack of any supporting evidence provides us (and DWER) no basis to come to an informed view about the acceptability or necessity for the proposed clearing;
- the proposal does not specify how wide the road is to be or how wide the strip of vegetation to be cleared;
- there is no information about what will happen if any priority plants are found;
- there is no information about what will occur if priority fauna such as a malleefowl nest is found;
- the flora survey was minimal and did not cover the full area proposed to be cleared;
- there are a limited number of public documents with flora and fauna surveys in the area to make comparisons;

- there is no information on changes to the hydrology with no information on culverts, bridges or built up road areas;
- the clearing is likely to be at variance with numerous Clearing Principles. If the application is assessed to be at variance with one or more of the Clearing Principles, it should be refused;
- in particular, clearing should not be approved if any threatened or priority flora or fauna species are impacted, which is extremely likely; and
- the flora report is very general and appears not to assess the road alignment in areas where a current road does not exist.

The Submission (2018) noted that should a Clearing Permit be granted, the following is recommended:

- the proponent provides evidence of actions considered and taken to avoid and minimise clearing of vegetation;
- strictly limit the clearing width to the absolute minimum required;
- the proponent to prepare plans with sufficient details, and to provide appropriate supervision, to prevent over-clearing of any areas approved to be cleared;
- the proponent to undertake planting of vegetation in degraded or open areas to compensate on a 4 for 1 basis for any vegetation removed;
- the DWER to undertake early and regular inspection, policing and enforcement of Clearing Permit conditions, including of excessive or un-necessary clearing, especially of any incidental damage/clearing of understorey; and
- a closeout/completion report with photos of before and after to be completed by the proponent and submitted to the DWER with evidence, and made publicly available to stakeholders.

The matters raised in the submission have been addressed within this Decision Report.

The watercourses in the southern section of the SKA road are within a proclaimed surface water area (Greenough River and Tributaries) under the *Rights in Water and Irrigation 1914 Act* and therefore, the applicant will require a permit to disturb the bed and banks of watercourses from DWER.

With regard to minimising impacts of the end land use to watercourses within the vicinity of the project the applicant has advised that (MRWA, 2017):

- Drainage from construction and material extraction activities is to be contained or treated within the project area and shall not be discharged to a watercourse without treatment;
- Existing natural drainage paths and channels along the road or the vicinity of the project area will not be unnecessarily blocked or restricted during project construction;
- Vehicle and equipment wash down areas will be located away from environmentally sensitive areas and watercourses; and
- No on-site storage of fuel, oils and other contaminant materials will be permitted within 100 metres of a watercourse or wetland.

According to available databases, the application area is classified as low to extremely low probability of acid sulphate soils. The applicant has advised that as no dewatering or excavation below the water table is planned, no further investigations are required (MRWA, 2017). The applicant has advised that no dewatering or drainage modifications are required, hence no change to groundwater levels or quality is expected (MRWA, 2017).

The applicant undertook Aboriginal Heritage Risk Assessments for the proposed works, which identified nine known registered heritage sites and three other heritage sites within the vicinity of the project area, with an overall risk rating of low to high across the sites. With regard to the road upgrade areas, the applicant has advised that heritage surveys will be carried out for any areas where road works are required outside the existing formation in undisturbed areas (MRWA, 2017). The applicant advised that any heritage sites that are found will be avoided if possible and approval will be sought from the Department of Aboriginal Affairs for unavoidable impacts (MRWA, 2017). With regard to the borrow pit areas, the applicant has advised that all material pits will be surveyed, whereby any heritage sites identified will be excluded from the project area and will not be impacted by the project works (MRWA, 2017).

The Wajarri Yamatji native title claim group (WAD6033/1998) and the Yamatji Marlpa Aboriginal Corporation (whom act on behalf of the claimants) were notified of the proposed clearing on 23 February 2018. The Yamatji Marlpa Aboriginal Corporation provided comment on 15 March 2018, advising that (Yamatji Marlpa Aboriginal Corporation, 2018):

- On behalf of the claim group, we write to advise you and Main Roads that there may be Aboriginal sites located within the permit area. We note the *Aboriginal Heritage Act 1972 (WA)* (AHA) protects all Aboriginal sites whether they are registered or not.
- An Aboriginal site may:
 - exist in any area of Western Australia;
 - not have been recorded in the Register of Aboriginal Sites or elsewhere; and
 - not have been identified in previous heritage surveys or reports on that area;
 but nonetheless remain fully protected and consequently, the absence of Aboriginal sites listed on the Register within the permit area is not determinative of the absence of Aboriginal sites.
- It is therefore essential that Main Roads understands its legal obligations under the AHA and that heritage surveys are undertaken prior to any ground disturbing activities being conducted.
- We also remind Main Roads that any objects associated with traditional Aboriginal culture or use, whether associated with an Aboriginal site or not, must also be protected from damage during ground disturbing activities.

The applicant has advised that appropriate processes under the *Native Title Act 1993* and the *Land Administration Act 1997* will be followed for all Native Title Future Act matters (MRWA, 2017).

With regard to impacts associated with the end land, DBCA advised that "44 per cent of the mapped vegetation along the clearing footprint is Mulga woodland...[which] is highly dependent on sheet flow and therefore is sensitive to alterations to

sheet flow... Linear infrastructure such as roads have the potential to alter natural sheet flow characteristics and therefore cause the degradation of the Mulga woodland where the sheet flow has been significantly altered... Therefore it is recommended that in designing the planned roads sufficient culverts are used to minimise altering the sheet flow in Mulga woodlands" (DBCA, 2017a).

The applicant has advised that the road design will maintain existing surface water flows and that the proposed clearing will include some culvert extensions and floodway improvements (MRWA, 2017)

5. References

- 360 Environmental (2016) Flora and Vegetation Assessment. Murchison SKA Road Upgrade. Additional Information for Clearing Permit Application CPS 7916/1. DWER Ref A1595613.
- 360 Environmental (2017) Flora and Vegetation Assessment. Murchison SKA Road Upgrade. Additional Information for Clearing Permit Application CPS 7916/1. DWER Ref A1595578.
- Commonwealth of Australia (2001) National Objectives and Targets for Biodiversity Conservation 2001-2005, Canberra.
- Department of Biodiversity, Conservation and Attractions (DBCA) (2018a) Flora advice for Clearing Permit Application CPS 7916/1 received 29 March 2018 (DER Ref A1662020).
- Department of Biodiversity, Conservation and Attractions (DBCA) (2018b) Fauna advice for Clearing Permit Application CPS 7916/1 received 5 April 2018 (DER Ref A1662015).
- Department of the Environment (DotE) (2015) '*Leipoa ocellata*' in Species Profile and Threats Database, Department of the Environment, Canberra.
- Government of Western Australia. (2018). 2017 Statewide Vegetation Statistics incorporating the CAR Reserve Analysis (Full Report). Current as of December 2017. WA Department of Biodiversity, Conservation and Attractions.
- Keighery, B.J. (1994) Bushland Plant Survey: A Guide to Plant Community Survey for the Community. Wildflower Society of WA (Inc). Nedlands, Western Australia.
- Main Roads Western Australia (MRWA) (2017) Preliminary Environmental Impact Assessment and Environmental Management Plan. Square Kilometre Array. Additional information for Clearing Permit Application CPS 7916/1. DWER Ref 1578088.
- M.J. & A.R. Bamford Consulting Ecologists (Bamford Consulting Ecologists) (2016) Square Kilometre Array (SKA) Main Roads Upgrade Fauna Assessment, 5 February 2016. Additional Information for Clearing Permit Application CPS 7916/1. DWER Ref A1595578.
- M.J. & A.R. Bamford Consulting Ecologists (Bamford Consulting Ecologists) (2017) Square Kilometre Array Road Upgrade Project Fauna Assessment, 30 January 2017. Additional Information for Clearing Permit Application CPS 7916/1. DWER Ref A1595613.
- Shepherd, D.P., Beeston, G.R., and Hopkins, A.J.M. (2001), Native Vegetation in Western Australia. Technical Report 249. Department of Agriculture Western Australia, South Perth.
- Submission (2018) Direct Interest Submission received on 16 March 2018 in response to Clearing Permit Application CPS 7916/1 (DER Ref 1636641).
- Western Australian Herbarium (1998-) FloraBase - The Western Australian Flora. Department of Parks and Wildlife. <http://florabase.dpaw.wa.gov.au/> (Accessed April 2018).
- Yamatji Marpa Aboriginal Corporation (2018) Direct interest response received on 15 March 2018 for Clearing Permit Application CPS 7916/1. DWER Ref 1635905.

Vegetation types recorded within the application area.

Project	Vegetation Association	Area(ha)
SKA Road	1 <i>Tecticornia doliformis</i> open samphire shrubland	72.36
	10 <i>Eucalyptus victrix</i> open woodland over <i>Acacia sclerosperma</i> subsp. <i>sclerosperma</i> over <i>Eremophila laanii</i> and <i>triplex</i> spp. open shrubland over <i>Eriochloa pseudoacrotricha</i> and <i>Eragrostis dielsii</i> open grassland	12.14
	11 <i>Eucalyptus victrix</i> open woodland <i>Acacia burkittii</i> , <i>Acacia fuscaneura</i> and <i>Acacia tetragonophylla</i> tall shrubland over <i>Cenchrus setiger</i> , <i>Setaria verticillata</i> and <i>Eulalia aurea</i> closed grassland over <i>Trichodesma zeylanicum</i> , <i>Glycine canescens</i> and <i>Solanum nigrum</i> open herbland.	1.96
	12 <i>Eucalyptus victrix</i> open woodland over <i>Melaleuca leiocarpa</i> scrub over <i>Atriplex</i> spp. and <i>Rhagodia drummondii</i> over scattered <i>Tecticornia peltata</i> samphire	13.68
	13 Mixed <i>Acacia</i> spp. tall shrubland over * <i>Cenchrus setiger</i> open grassland over * <i>Acetosa vesicaria</i> , * <i>Lysimachia arvensis</i> and <i>Myriocephalus oldfieldii</i> open herbland	1.22
	14 <i>Acacia tetragonophylla</i> and <i>A. cyperophylla</i> var. <i>cyperophylla</i> tall shrubland over <i>Cyperus concinnus</i> sparse sedges over <i>Goodenia berrinbinensis</i> , <i>Marsilea ? costulifera</i> and <i>Glossostigma drummondii</i> closed herbland	0.74
	15 <i>Atriplex amnicola</i> , <i>A. bunburyana</i> and <i>A. codonocarpa</i> low open shrubland over <i>Eragrostis dielsii</i> sparse grasses	136.35
	16 <i>Acacia synchronicia</i> tall open shrubland over <i>Eremophila laanii</i> , <i>Eremophila longifolia</i> and <i>Scaevola spinescens</i> open shrubland over <i>Setaria dielsii</i> open grassland over <i>Ptilotus divaricatus</i> , <i>Ptilotus macrocephalus</i> and <i>Tetragonia cristata</i> open herbland	128.44
	17 <i>Acacia synchronicia</i> and <i>A. sclerosperma</i> subsp. <i>sclerosperma</i> tall open shrubland over scattered <i>Scaevola spinescens</i> sparse shrubs over <i>Eriochloa pseudoacrotricha</i> sparse grasses over <i>Rhodanthe floribunda</i> , <i>Sisymbrium erylmoides</i> and <i>Salsola australis</i> very open herbland	24.39
	18 <i>Acacia ramulosa</i> var. <i>linophylla</i> and <i>A. acuminata</i> and <i>A. tetragonophylla</i> tall shrubland over <i>Aristida contorta</i> , <i>Austrostipa nitida</i> and <i>Monachather paradoxus</i> open grassland over mixed annual herbs	361.00
	19 <i>Acacia ramulosa</i> var. <i>linophylla</i> , <i>A. burkittii</i> and <i>A. tetragonophylla</i> tall shrubland over <i>Aristida contorta</i> and <i>Austrostipa nitida</i> open grassland over mixed annual herbs	227.39
	2 <i>Frankenia pauciflora</i> and <i>Ptilotus obovatus</i> low shrubland over <i>Maireana carnosae</i> , <i>Sclerolaena densiflora</i> and <i>Lawrenzia densiflora</i> open herbland over <i>Eragrostis dielsii</i> and <i>Aristida contorta</i> open grassland	10.45
	20 <i>Acacia burkittii</i> , <i>A. cuthbertsonii</i> subsp. <i>cuthbertsonii</i> and <i>A. tetragonophylla</i> tall shrubland <i>Maireana carnosae</i> , <i>Sclerolaena eriacantha</i> and <i>Calandrinia ptychosperma</i> herbland over <i>Eragrostis dielsii</i> and open <i>Aristida contorta</i> grassland	173.49
	21 <i>Acacia tysonii</i> tall shrubland over <i>Lawrenzia glomerata</i> sparse herbs	13.28
	22 <i>Acacia synchronicia</i> and <i>Eremophila pterocarpa</i> subsp. <i>pterocarpa</i> tall shrubland over mixed <i>Senna</i> spp. shrubland over <i>Sclerolaena</i> spp. open herbland over <i>Eragrostis dielsii</i> and <i>Aristida contorta</i> open grassland	255.65
	23 <i>Acacia sclerosperma</i> subsp. <i>sclerosperma</i> and <i>A. synchronicia</i> tall open shrubland over mixed <i>Senna</i> spp. sparse shrubs over <i>Salsola australis</i> sparse herbs	268.21
	24 <i>Acacia pteraneura</i> , <i>A. grasbyi</i> and <i>A. ramulosa</i> var. <i>linophylla</i> tall shrubland over mixed <i>Senna</i> spp. sparse shrubs over <i>Ptilotus obovatus</i> sparse low shrubs over <i>Aristida contorta</i> open grassland	150.96
	25 <i>Acacia eremaea</i> and <i>Eremophila oppositifolia</i> subsp. <i>angustifolia</i> tall open shrubland over mixed <i>Chenopodiaceae</i> spp. low shrubs and herbs	114.49
	26 <i>Acacia pteraneura</i> and <i>A. grasbyi</i> low open woodland over <i>Acacia ramulosa</i> var. <i>linophylla</i> tall shrubland over mixed <i>Senna</i> spp. and <i>Ptilotus obovatus</i> sparse shrubs over <i>Ptilotus macrocephalus</i> , <i>Ptilotus polystachyus</i> and <i>Calandrinia creethiae</i> open herbland over <i>Eragrostis pergracilis</i> and <i>Aristida contorta</i> open tussock grassland	193.85
	27 <i>Acacia fuscaneura</i> low woodland over <i>Acacia tetragonophylla</i> tall open shrubland over mixed <i>Eremophila</i> spp. and <i>Senna</i> spp. sparse shrubs	66.21
	28f <i>Acacia pteraneura</i> low woodland over <i>Acacia craspedocarpa</i> , <i>Acacia tetragonophylla</i> , <i>Eremophila platycalyx</i> subsp. <i>platycalyx</i> tall open shrubland to tall shrubland over <i>Abutilon cryptopetalum</i> scattered low shrubs and mixed open herbland	328.71
	28H <i>Acacia pteraneura</i> low open woodland to low woodland over <i>Acacia grasbyi</i> , <i>Acacia tetragonophylla</i> scattered tall shrubs over <i>Senna</i> spp., <i>Eremophila forrestii</i> subsp. <i>forrestii</i> scattered shrubs	937.49
	28W <i>Acacia pteraneura</i> low open woodland over <i>Acacia tetragonophylla</i> , (<i>Acacia ramulosa</i> var. <i>linophylla</i>) scattered tall shrubs over <i>Eremophila forrestii</i> subsp. <i>forrestii</i> scattered shrubs over (<i>Eremophila spuria</i> low open shrubland) with <i>Monachather paradoxus</i> , <i>Eriachne helmsii</i> scattered grasses to very open grassland and <i>Ptilotus polystachyus</i> scattered herbs	106.86
	28WH <i>Acacia pteraneura</i> low open woodland over <i>Acacia tetragonophylla</i> , (<i>Acacia ramulosa</i> var. <i>linophylla</i>) scattered tall shrubs over <i>Eremophila forrestii</i> subsp. <i>forrestii</i> scattered shrubs over (<i>Eremophila spuria</i> low open shrubland) with <i>Monachather paradoxus</i> , <i>Eriachne helmsii</i> scattered grasses to very open grassland and <i>Ptilotus polystachyus</i> scattered herbs	15.51
	29 <i>Hakea preissii</i> and <i>Acacia victoriae</i> tall shrubland over <i>Senna</i> spp. over <i>Sclerolaena densiflora</i> , <i>Salsola australis</i> and <i>Ptilotus polystachyus</i> herbland over <i>Aristida contorta</i> open tussock grassland	12.73
	3 <i>Acacia eremaea</i> and <i>Eremophila pantonii</i> scattered tall shrubs over <i>Atriplex paludosa</i> subsp. <i>baudinii</i> shrubland and <i>Maireana villosa</i> shrubland over <i>Austrostipa elegantissima</i> sparse grasses over <i>Atriplex codonocarpa</i> , <i>Sclerolaena densiflora</i> and <i>Erymophyllum ramosum</i> subsp. <i>ramosum</i> open herbland	9.27
	30 <i>Acacia ramulosa</i> var. <i>linophylla</i> tall shrubland over <i>Eremophila forrestii</i> subsp. <i>forrestii</i> open shrubland over <i>Monachather paradoxus</i> and <i>Aristida contorta</i> open grassland	58.49
	31 <i>Acacia ramulosa</i> var. <i>linophylla</i> and <i>Thryptomene decussata</i> tall shrubland over mixed <i>Eremophila</i> spp. and <i>Grevillea</i> spp. open shrubland over <i>Ptilotus polystachyus</i> very open herbland over <i>Thyridolepis multiculmis</i> sparse grasses	77.94
	32 <i>Acacia sclerosperma</i> subsp. <i>sclerosperma</i> tall open shrubland over <i>Quoya paniculata</i> and <i>Rhagodia eremaea</i> shrubland over <i>Ptilotus polystachyus</i> , <i>Salsola australis</i> and <i>Heliotropium ammophilum</i> open herbland over <i>Aristida holathera</i> var. <i>holathera</i> , <i>Eriachne aristidea</i> and <i>Paractaenum novae-hollandiae</i> subsp. <i>novae-hollandiae</i> open grassland	2.49
	33 <i>Acacia tetragonophylla</i> and <i>Hakea recurva</i> subsp. <i>arida</i> tall sparse shrubs over <i>Eremophila platycalyx</i> subsp. <i>platycalyx</i> shrubs over <i>Ptilotus obovatus</i> low open shrubland over <i>Aristida contorta</i> very open grassland over <i>Calandrinia hortorum</i> , <i>Calandrinia primuliflora</i> and <i>Gunniopsis rodwayi</i> open herbland	16.77
	34 <i>Acacia coolgardensis</i> tall shrubland over <i>Aluta aspera</i> subsp. <i>hesperia</i> , <i>Eremophila forrestii</i> subsp. <i>forrestii</i> and <i>Grevillea obliquistigma</i> subsp. <i>obliquistigma</i> open shrubland over <i>Monachather paradoxus</i> and <i>Thyridolepis multiculmis</i> sparse grasses over <i>Goodenia mimuloides</i> , <i>Goodenia occidentalis</i> and <i>Halaragis odontocarpa</i> open herbland	263.51
	35 <i>Acacia pteraneura</i> low open woodland over <i>A. burkittii</i> tall shrubland over <i>Eremophila platycalyx</i> subsp. <i>platycalyx</i> sparse shrubs over <i>Senna</i> sp. Austin low sparse shrubs over <i>Aristida contorta</i> sparse grasses	15.88

Appendix A

	36 <i>Acacia pteraneura</i> low open woodland over <i>Thryptomene decussata</i> , <i>Acacia coolgardiensis</i> and <i>Grevillea stenobotrya</i> tall open shrubland over <i>Aristida contorta</i> very open grassland	1029.70
	37 <i>Acacia pteraneura</i> , <i>A. cuthbertsonii</i> subsp. <i>cuthbertsonii</i> and <i>A. tetragonophylla</i> tall shrubland over <i>Eremophila galeata</i> sparse shrubs over <i>Ptilotus obovatus</i> and mixed <i>Senna</i> spp. low sparse shrubs over <i>Aristida contorta</i> open tussock grassland	297.03
	38 <i>Acacia coolgardiensis</i> , <i>A. eremaea</i> and <i>A. burkittii</i> tall shrubland over <i>Ptilotus obovatus</i> low sparse shrubs over mixed annual herbs	51.10
	39 <i>Acacia umbraculiformis</i> , <i>A. coolgardiensis</i> and <i>A. burkittii</i> tall shrubland over <i>Senna</i> sp. Austin (A. Strid 20210), <i>Ptilotus obovatus</i> and <i>Sida ectogama</i> open shrubland over <i>Aristida contorta</i> open grassland over <i>Borya sphaerocephala</i> very open herbland	17.50
	4 <i>Atriplex cinerea</i> open shrubland over <i>Goodenia corynocarpa</i> isolated herbs	4.98
	40 <i>Acacia aulacophylla</i> and <i>Thryptomene decussata</i> open shrubland over <i>Micromyrtus sulphurea</i> low open shrubland	33.18
	41 <i>Acacia aulacophylla</i> , <i>A. coolgardiensis</i> and <i>A. umbraculiformis</i> open shrubland over <i>Micromyrtus prochytes</i> and <i>Calytrix uncinata</i> sparse low shrubs over <i>Eriachne pulchella</i> subsp. <i>pulchella</i> sparse grasses	4.07
	42 Mixed shrubs and herbs of <i>Acetosa vesicaria</i> , <i>Corchorus crozophorifolius</i> , <i>Goodenia kingiana</i> and <i>Trichodesma zeylanicum</i>	11.13
	43 <i>Tecticornia indica</i> subsp. <i>leiostachya</i> , <i>Tecticornia indica</i> subsp. <i>bidens</i> , <i>Tecticornia</i> sp. low samphire shrubland	61.01
	44 (<i>Acacia kalgoorliensis</i> , <i>Eremophila pterocarpa</i> subsp. <i>pterocarpa</i> scattered shrubs) over <i>Atriplex vesicaria</i> low shrubland	22.58
	45 <i>Acacia kalgoorliensis</i> , <i>Acacia microcalyx</i> tall shrubland over <i>Eremophila pterocarpa</i> subsp. <i>pterocarpa</i> open shrubland over <i>Atriplex amnicola</i> , <i>Atriplex vesicaria</i> , <i>Maireana pyramidata</i> , <i>Enchylaena tomentosa</i> var. <i>tomentosa</i> low shrubland	15.37
	46 <i>Eriachne flaccida</i> , (<i>Eragrostis leptocarpa</i> , <i>Eragrostis pergracilis</i> , <i>Eragrostis dielsii</i>) grassland with <i>Marsilea exarata</i> very open fernland	3.03
	47 <i>Acacia burkittii</i> , <i>Acacia tetragonophylla</i> , <i>Acacia grasbyi</i> tall open shrubland over <i>Aristida contorta</i> very open grassland	65.28
	48 <i>Eremophila fraseri</i> subsp. <i>fraseri</i> open shrubland over <i>Ptilotus obovatus</i> scattered low shrubs with sparsely scattered to scattered <i>Acacia pteraneura</i> and scattered <i>Acacia grasbyi</i>	32.9
	49 <i>Acacia grasbyi</i> , <i>Acacia tetragonophylla</i> high open shrubland over scattered low shrubs	214.90
	5 <i>Hakea recurva</i> subsp. <i>arida</i> and <i>Acacia tetragonophylla</i> tall open shrubland over <i>Calandrinia pumila</i> and <i>Myriocephalus oldfieldii</i> open herbland	0.73
	51 <i>Acacia ramulosa</i> var. <i>linophylla</i> , <i>Acacia longispinea</i> tall open shrubland to tall shrubland over <i>Eremophila forrestii</i> subsp. <i>forrestii</i> , <i>Eremophila simulans</i> subsp. <i>megalalyx</i> open shrubland over <i>Thyridolepis multiculmis</i> , <i>Monachather paradoxus</i> , <i>Eragrostis lanipes</i> very open grassland	47.87
	53 <i>Eremophila fraseri</i> subsp. <i>fraseri</i> , <i>Senna artemisioides</i> subsp. <i>helmsii</i> open shrublands	118.88
	54 (<i>Acacia tetragonophylla</i> scattered tall shrubs) over <i>Eremophila exilifolia</i> shrubland	20.00
	56 <i>Acacia ramulosa</i> var. <i>linophylla</i> , <i>Thryptomene decussata</i> tall shrubland over <i>Eremophila latrobei</i> subsp. <i>latrobei</i> scattered shrubs over <i>Aluta aspera</i> subsp. <i>Hesperia</i> , <i>Philotheca sericea</i> scattered low shrubs over <i>Monachather paradoxus</i> open grassland. (Associated with some exposed decomposing granites)	1.46
	57 <i>Grevillea nematophylla</i> subsp. <i>supraplana</i> , <i>Acacia pruinocarpa</i> scattered low trees (low open woodland on parts of lower slopes) over <i>Acacia ramulosa</i> var. <i>linophylla</i> tall open shrubland to tall shrubland over <i>Eremophila glutinosa</i> , <i>Eremophila forrestii</i> subsp. <i>forrestii</i> , <i>Trachymene decussata</i> scattered shrubs over <i>Aluta aspera</i> subsp. <i>hesperia</i> scattered low shrubs	40.20
	58 <i>Acacia ramulosa</i> var. <i>linophylla</i> , <i>Thryptomene decussata</i> tall shrubland over <i>Prostanthera campbellii</i> , <i>Eremophila latrobei</i> subsp. <i>latrobei</i> open shrubland. (Recorded on chert rockpiles)	0.27
	6 <i>Melaleuca stereophloia</i> open heath over <i>Alfentanthera nodiflora</i> , <i>Myriocephalus oldfieldii</i> and <i>Centipeda minima</i> subsp. <i>macrocephala</i> open herbland	0.38
	7 <i>Eucalyptus victrix</i> open woodland over <i>Melaleuca stereophloia</i> tall open heath over <i>Leptochloa fusca</i> subsp. <i>muelleri</i> and <i>Setaria dielsii</i> open grassland over <i>Myriocephalus oldfieldii</i> open herbland	0.41
	8 <i>Eucalyptus camaldulensis</i> subsp. <i>obfusa</i> and <i>Casuarina obesa</i> open forest over <i>Acacia sclerosperma</i> subsp. <i>sclerosperma</i> and <i>Rhagodia eremaea</i> open shrubland over <i>Cyperus gymnocaulos</i> sparse sedgeland over <i>Eriochloa pseudoacrotricha</i> sparse grassland <i>Atriplex semilunaris</i> , <i>Salsola australis</i> and <i>Amaranthus clementii</i> open herbland.	9.02
	9 <i>Eucalyptus victrix</i> open woodland over <i>Acacia sclerosperma</i> subsp. <i>sclerosperma</i> over <i>Eriochloa pseudoacrotricha</i> , <i>Cenchrus ciliaris</i> and <i>Dichanthium sericeum</i> subsp. <i>humilis</i> over <i>Pluchea rubelliflora</i> , <i>Streptoglossa cylindriceps</i> and <i>Swainsona pterostylis</i> open herbland.	3.58
	Completely degraded	
	Degraded	328.40
		25.46
Carnarvon Mullewa Road 21.7 SLK	34 <i>Acacia coolgardiensis</i> tall shrubland over <i>Aluta aspera</i> subsp. <i>hesperia</i> , <i>Eremophila forrestii</i> subsp. <i>forrestii</i> and <i>Grevillea obliquistigma</i> subsp. <i>obliquistigma</i> open shrubland over <i>Monachather paradoxus</i> and <i>Thyridolepis multiculmis</i> sparse grasses over <i>Goodenia mimuloides</i> , <i>Goodenia occidentalis</i> and <i>Haloragis odontocarpa</i> open herbland	42.61
	Completely degraded	
		3.64
Carnarvon Mullewa Road 166.81 SLK	28 <i>Acacia pteraneura</i> low woodland over <i>Eremophila galeata</i> , <i>Eremophila forrestii</i> subsp. <i>forrestii</i> and mixed <i>Senna</i> spp. open shrubland over mixed <i>Ptilotus</i> sparse herbs over <i>Eragrostis dielsii</i> , <i>Eragrostis pergracilis</i> and <i>Aristida contorta</i> open grassland	7.50
	36 <i>Acacia pteraneura</i> low open woodland over <i>Thryptomene decussata</i> , <i>Acacia umbraculiformis</i> tall open shrubland	21.66
	37 <i>Acacia pteraneura</i> scattered low trees over <i>A. grasbyi</i> , <i>A. cuthbertsonii</i> subsp. <i>cuthbertsonii</i> , <i>A. tetragonophylla</i> scattered tall shrubs to tall open shrubland <i>Ptilotus obovatus</i> and mixed <i>Senna</i> spp. low sparse shrubs (quartz plains, low rises and hill slopes)	86.6
	Completely degraded	
		2.31
Carnarvon Mullewa Road 201.13 SLK	54 (<i>Acacia tetragonophylla</i> scattered tall shrubs) over <i>Eremophila exilifolia</i> shrubland	1.01
	31 <i>Acacia ramulosa</i> var. <i>linophylla</i> and <i>Thryptomene decussata</i> tall shrubland over mixed <i>Eremophila</i> spp. and <i>Grevillea</i> spp. open shrubland over <i>Ptilotus polystachyus</i> very open herbland over <i>Thyridolepis multiculmis</i> sparse grasses	72.42
	36 <i>Acacia pteraneura</i> low open woodland over <i>Thryptomene decussata</i> , <i>Acacia umbraculiformis</i> tall open shrubland	138.73
	37 <i>Acacia pteraneura</i> scattered low trees over <i>A. grasbyi</i> , <i>A. cuthbertsonii</i> subsp. <i>cuthbertsonii</i> , <i>A. tetragonophylla</i> scattered tall shrubs to tall open shrubland <i>Ptilotus obovatus</i> and mixed <i>Senna</i> spp. low sparse shrubs (quartz plains, low rises and hill slopes)	13.50
	40 <i>Thryptomene decussata</i> , (<i>Acacia aulacophylla</i>) open shrubland over <i>Micromyrtus sulphurea</i> , <i>Aluta aspera</i> subsp. <i>Hesperia</i> , <i>Calytrix divergens</i> , <i>Philotheca brucei</i> subsp. <i>brucei</i> low open shrubland with <i>Neurachne minor</i> , <i>Eriachne mucronata</i> , <i>Styidium longibracteatum</i> scattered grasses and herbs. (On laterite outcropping).	2.57
	Completely degraded	
		18.94
Carnarvon Mullewa Road 244.21 SLK	20 <i>Acacia burkittii</i> , <i>A. cuthbertsonii</i> subsp. <i>cuthbertsonii</i> and <i>A. tetragonophylla</i> tall shrubland <i>Maireana carnosae</i> , <i>Sclerolaena ericantha</i> and <i>Calandrinia ptychosperma</i> herbland over <i>Eragrostis dielsii</i> and open <i>Aristida contorta</i> grassland	7.15
	34 <i>Acacia coolgardiensis</i> tall shrubland over <i>Aluta aspera</i> subsp. <i>hesperia</i> , <i>Eremophila forrestii</i> subsp. <i>forrestii</i> and <i>Grevillea obliquistigma</i> subsp. <i>obliquistigma</i> open shrubland over <i>Monachather paradoxus</i> and <i>Thyridolepis multiculmis</i> sparse	53.41

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	grasses over <i>Goodenia mimuloides</i> , <i>Goodenia occidentalis</i> and <i>Haloragis odontocarpa</i> open hermland	
Camaron Mullewa Road 253.39 SLK	18 <i>Acacia ramulosa</i> var. <i>linophylla</i> and <i>A. acuminata</i> and <i>A. tetragonophylla</i> tall shrubland over <i>Aristida contorta</i> , <i>Austrostipa nitida</i> and <i>Monachather paradoxus</i> open grassland over mixed annual herbs	7.30
	31 <i>Acacia ramulosa</i> var. <i>linophylla</i> and <i>Thryptomene decussata</i> tall shrubland over mixed <i>Eremophila</i> spp. and <i>Grevillea</i> spp. open shrubland over <i>Ptilotus polystachyus</i> very open hermland over <i>Thyridolepis multiculmis</i> sparse grasses	6.42
	34 <i>Acacia coolgardiensis</i> tall shrubland over <i>Aluta aspera</i> subsp. <i>hesperia</i> , <i>Eremophila forrestii</i> subsp. <i>forrestii</i> and <i>Grevillea obliquistigma</i> subsp. <i>obliquistigma</i> open shrubland over <i>Monachather paradoxus</i> and <i>Thyridolepis multiculmis</i> sparse grasses over <i>Goodenia mimuloides</i> , <i>Goodenia occidentalis</i> and <i>Haloragis odontocarpa</i> open hermland	45.21
	39 <i>Acacia umbraculiformis</i> , <i>A. coolgardiensis</i> and <i>A. burkittii</i> tall shrubland over <i>Senna</i> sp. Austin (<i>A. Strid</i> 20210), <i>Ptilotus obovatus</i> and <i>Sida ectogama</i> open shrubland over <i>Aristida contorta</i> open grassland over <i>Borya phaeocephala</i> very open hermland	1.67
	Completely degraded	2.29
Camaron Mullewa Road 275.1 SLK	18 <i>Acacia ramulosa</i> var. <i>linophylla</i> and <i>A. acuminata</i> and <i>A. tetragonophylla</i> tall shrubland over <i>Aristida contorta</i> , <i>Austrostipa nitida</i> and <i>Monachather paradoxus</i> open grassland over mixed annual herbs	1.90
	Completely degraded	0.02
	19 <i>Acacia ramulosa</i> var. <i>linophylla</i> , <i>A. burkittii</i> and <i>A. tetragonophylla</i> tall shrubland over <i>Aristida contorta</i> and <i>Austrostipa nitida</i> open grassland over mixed annual herbs	29.67
	30 <i>Acacia ramulosa</i> var. <i>linophylla</i> , (<i>Acacia murrayana</i>) tall open shrubland over <i>Eremophila simulans</i> subsp. <i>magecalyx</i> , (<i>Eremophila forrestii</i> subsp. <i>forrestii</i>) open shrubland over <i>Monachather paradoxus</i> scattered grasses	73.57
	36 <i>Acacia pteraneura</i> low open woodland over <i>Thryptomene decussata</i> , <i>Acacia umbraculiformis</i> tall open shrubland	0.35
	52 <i>Acacia umbraculiformis</i> , <i>Acacia ramulosa</i> var. <i>linophylla</i> tall shrubland over <i>Ptilotus obovatus</i> , <i>Eremophila lachnocalyx</i> low open shrubland	19.82
	56 <i>Acacia ramulosa</i> var. <i>linophylla</i> , <i>Thryptomene decussata</i> tall shrubland over <i>Eremophila latrobei</i> subsp. <i>latrobei</i> scattered shrubs over <i>Aluta aspera</i> subsp. <i>Hesperia</i> , <i>Philothea sericea</i> scattered low shrubs over <i>Monachather paradoxus</i> open grassland. (Associated with some exposed decomposing granites)	8.01
Twin Peaks Wooleen 12.8 SLK	28h <i>Acacia pteraneura</i> low open woodland to low woodland over <i>Acacia grasbyi</i> , <i>Acacia tetragonophylla</i> scattered tall shrubs over <i>Senna</i> spp., <i>Eremophila forrestii</i> subsp. <i>forrestii</i> scattered shrubs.	1.69
	30 <i>Acacia ramulosa</i> var. <i>linophylla</i> , (<i>Acacia murrayana</i>) tall open shrubland over <i>Eremophila simulans</i> subsp. <i>magecalyx</i> , (<i>Eremophila forrestii</i> subsp. <i>forrestii</i>) open shrubland over <i>Monachather paradoxus</i> scattered grasses	19.79
	31 <i>Acacia ramulosa</i> var. <i>linophylla</i> and <i>Thryptomene decussata</i> tall shrubland over mixed <i>Eremophila</i> spp. and <i>Grevillea</i> spp. open shrubland over <i>Ptilotus polystachyus</i> very open hermland over <i>Thyridolepis multiculmis</i> sparse grasses /57 <i>Grevillea nematophylla</i> subsp. <i>supraplana</i> , <i>Acacia pruinocarpa</i> scattered low trees (low open woodland on parts of lower slopes) over <i>Acacia ramulosa</i> var. <i>linophylla</i> tall open shrubland to tall shrubland over <i>Eremophila glutinosa</i> , <i>Eremophila forrestii</i> subsp. <i>forrestii</i> , <i>Trachymene decussata</i> scattered shrubs over <i>Aluta aspera</i> subsp. <i>hesperia</i> scattered low shrubs	34.6
	41 <i>Acacia aulacophylla</i> , <i>A. coolgardiensis</i> and <i>A. umbraculiformis</i> open shrubland over <i>Micromyrtus prochytes</i> and <i>Calytrix uncinata</i> sparse low shrubs over <i>Eriachne pulchella</i> subsp. <i>pulchella</i> sparse grasses	1.49
	49 <i>Acacia grasbyi</i> , <i>Acacia tetragonophylla</i> high open shrubland over scattered low shrubs	28.86
	57 <i>Grevillea nematophylla</i> subsp. <i>supraplana</i> , <i>Acacia pruinocarpa</i> scattered low trees (low open woodland on parts of lower slopes) over <i>Acacia ramulosa</i> var. <i>linophylla</i> tall open shrubland to tall shrubland over <i>Eremophila glutinosa</i> , <i>Eremophila forrestii</i> subsp. <i>forrestii</i> , <i>Trachymene decussata</i> scattered shrubs over <i>Aluta aspera</i> subsp. <i>hesperia</i> scattered low shrubs	115.51
	28h <i>Acacia pteraneura</i> low open woodland to low woodland over <i>Acacia grasbyi</i> , <i>Acacia tetragonophylla</i> scattered tall shrubs over <i>Senna</i> spp., <i>Eremophila forrestii</i> subsp. <i>forrestii</i> scattered shrubs.	1.72
	31 <i>Acacia ramulosa</i> var. <i>linophylla</i> and <i>Thryptomene decussata</i> tall shrubland over mixed <i>Eremophila</i> spp. and <i>Grevillea</i> spp. open shrubland over <i>Ptilotus polystachyus</i> very open hermland over <i>Thyridolepis multiculmis</i> sparse grasses	6.7
Twin Peaks Wooleen 15.2 SLK	40 <i>Thryptomene decussata</i> , (<i>Acacia aulacophylla</i>) open shrubland over <i>Micromyrtus sulphurea</i> , <i>Aluta aspera</i> subsp. <i>Hesperia</i> , <i>Calytrix divergens</i> , <i>Philothea brucei</i> subsp. <i>brucei</i> low open shrubland with <i>Neurachne minor</i> , <i>Eriachne mucronata</i> , <i>Stylidium longibracteatum</i> scattered grasses and herbs. (On laterite outcropping).	1.10
	48 <i>Eremophila fraseri</i> subsp. <i>fraseri</i> open shrubland over <i>Ptilotus obovatus</i> scattered low shrubs with sparsely scattered to scattered <i>Acacia pteraneura</i> and scattered <i>Acacia grasbyi</i>	0.50
	49 <i>Acacia grasbyi</i> , <i>Acacia tetragonophylla</i> high open shrubland over scattered low shrubs	12.15
	56 <i>Acacia ramulosa</i> var. <i>linophylla</i> , <i>Thryptomene decussata</i> tall shrubland over <i>Eremophila latrobei</i> subsp. <i>latrobei</i> scattered shrubs over <i>Aluta aspera</i> subsp. <i>Hesperia</i> , <i>Philothea sericea</i> scattered low shrubs over <i>Monachather paradoxus</i> open grassland. (Associated with some exposed decomposing granites)	4.3
	57 <i>Grevillea nematophylla</i> subsp. <i>supraplana</i> , <i>Acacia pruinocarpa</i> scattered low trees (low open woodland on parts of lower slopes) over <i>Acacia ramulosa</i> var. <i>linophylla</i> tall open shrubland to tall shrubland over <i>Eremophila glutinosa</i> , <i>Eremophila forrestii</i> subsp. <i>forrestii</i> , <i>Trachymene decussata</i> scattered shrubs over <i>Aluta aspera</i> subsp. <i>hesperia</i> scattered low shrubs	94.10
	Completely degraded	0.58
	28 <i>Acacia pteraneura</i> low woodland over <i>Eremophila galeata</i> , <i>Eremophila forrestii</i> subsp. <i>forrestii</i> and mixed <i>Senna</i> spp. open shrubland over mixed <i>Ptilotus</i> sparse herbs over <i>Eragrostis dielsii</i> , <i>Eragrostis pergracilis</i> and <i>Aristida contorta</i> open grassland	1.27
	Completely Degraded	0.27
	28F <i>Acacia pteraneura</i> low woodland over <i>Acacia craspedocarpa</i> , <i>Acacia tetragonophylla</i> , <i>Eremophila platycalyx</i> subsp. <i>platycalyx</i> tall open shrubland to tall shrubland over <i>Abutilon cryptopetalum</i> scattered low shrubs and mixed open hermland	3.75
	28h <i>Acacia pteraneura</i> low open woodland to low woodland over <i>Acacia grasbyi</i> , <i>Acacia tetragonophylla</i> scattered tall shrubs over <i>Senna</i> spp., <i>Eremophila forrestii</i> subsp. <i>forrestii</i> scattered shrubs.	41.25
Wooleen Mt Wittenoom 4 SLK	28w <i>Acacia pteraneura</i> low open woodland over <i>Acacia tetragonophylla</i> , (<i>Acacia ramulosa</i> var. <i>linophylla</i>) scattered tall shrubs over <i>Eremophila forrestii</i> subsp. <i>forrestii</i> scattered shrubs over (<i>Eremophila spuria</i> low open shrubland) with <i>Monachather paradoxus</i> , <i>Eriachne helmsii</i> scattered grasses to very open grassland and <i>Ptilotus polystachyus</i> scattered herbs	25.58
	30 <i>Acacia ramulosa</i> var. <i>linophylla</i> , (<i>Acacia murrayana</i>) tall open shrubland over <i>Eremophila simulans</i> subsp. <i>magecalyx</i> , (<i>Eremophila forrestii</i> subsp. <i>forrestii</i>) open shrubland over <i>Monachather paradoxus</i> scattered grasses	23.06
	31 <i>Acacia ramulosa</i> var. <i>linophylla</i> and <i>Thryptomene decussata</i> tall shrubland over mixed <i>Eremophila</i> spp. and <i>Grevillea</i> spp. open shrubland over <i>Ptilotus polystachyus</i> very open hermland over <i>Thyridolepis multiculmis</i> sparse grasses.	10.75
	36 <i>Acacia pteraneura</i> low open woodland over <i>Thryptomene decussata</i> , <i>Acacia umbraculiformis</i> tall open shrubland	30.51
	40 <i>Thryptomene decussata</i> , (<i>Acacia aulacophylla</i>) open shrubland over <i>Micromyrtus sulphurea</i> , <i>Aluta aspera</i> subsp. <i>Hesperia</i> , <i>Calytrix divergens</i> , <i>Philothea brucei</i> subsp. <i>brucei</i> low open shrubland with <i>Neurachne minor</i> , <i>Eriachne mucronata</i> , <i>Stylidium longibracteatum</i> scattered grasses and herbs. (On laterite outcropping).	11.78
	42 <i>Acacia pteraneura</i> low woodland over <i>Acacia scleroclada</i> , <i>Hibiscus</i> sp. <i>Gardneri</i> (A.L. Payne PRP 1435) open shrubland over <i>Indigofera monophylla</i> scattered low shrubs over <i>Tetragonia cristata</i> , <i>Trachymene pilbarensis</i> very open hermland and <i>Monachather paradoxus</i> , <i>Aristida contorta</i> grassland. (Recorded on granite outcrop).	0.33
	Degraded	10.37

Appendix A

Woolleen Mt Wittenoorn 11 SLK RHS	28F <i>Acacia pteraneura</i> low woodland over <i>Acacia craspedocarpa</i> , <i>Acacia tetragonophylla</i> , <i>Eremophila platycalyx</i> subsp. <i>platycalyx</i> tall open shrubland to tall shrubland over <i>Abutilon cryptopetalum</i> scattered low shrubs and mixed open herbland	6.62
	30 <i>Acacia ramulosa</i> var. <i>linophylla</i> , (<i>Acacia murrayana</i>) tall open shrubland over <i>Eremophila simulans</i> subsp. <i>magecalyx</i> , (<i>Eremophila forrestii</i> subsp. <i>forrestii</i>) open shrubland over <i>Monachather paradoxus</i> scattered grasses	2.75
	36 <i>Acacia pteraneura</i> low open woodland over <i>Thryptomene decussata</i> , <i>Acacia umbraculiformis</i> tall open shrubland	12.46
	37 <i>Acacia pteraneura</i> scattered low trees over <i>A. grasbyi</i> , <i>A. cuthbertsonii</i> subsp. <i>cuthbertsonii</i> , <i>A. tetragonophylla</i> scattered tall shrubs to tall open shrubland <i>Ptilotus obovatus</i> and mixed <i>Senna</i> spp. low sparse shrubs (quartz plains, low rises and hill slopes)	2.45
	40 <i>Thryptomene decussata</i> , (<i>Acacia aulacophylla</i>) open shrubland over <i>Micromyrtus sulphurea</i> , <i>Aluta aspera</i> subsp. <i>Hesperia</i> , <i>Calytrix divergens</i> , <i>Philotheca brucei</i> subsp. <i>brucei</i> low open shrubland with <i>Neurachne minor</i> , <i>Eriachne mucronata</i> , <i>Stylidium longibracteatum</i> scattered grasses and herbs. (On laterite outcropping).	2.56
48 <i>Eremophila fraseri</i> subsp. <i>fraseri</i> open shrubland over <i>Ptilotus obovatus</i> scattered low shrubs with sparsely scattered to scattered <i>Acacia pteraneura</i> and scattered <i>Acacia grasbyi</i>	53.50	
Woolleen Mt Wittenoorn 11 SLK	26 <i>Acacia pteraneura</i> and <i>A. grasbyi</i> low open woodland over <i>Acacia ramulosa</i> var. <i>linophylla</i> tall shrubland over mixed <i>Senna</i> spp. and <i>Ptilotus obovatus</i> sparse shrubs over <i>Ptilotus macrocephalus</i> , <i>Ptilotus polystachyus</i> and <i>Calandrinia creethiae</i> open herbland over <i>Eragrostis pergracilis</i> and <i>Aristida contorta</i> open tussock grassland	0.48
	28F <i>Acacia pteraneura</i> low woodland over <i>Acacia craspedocarpa</i> , <i>Acacia tetragonophylla</i> , <i>Eremophila platycalyx</i> subsp. <i>platycalyx</i> tall open shrubland to tall shrubland over <i>Abutilon cryptopetalum</i> scattered low shrubs and mixed open herbland	3.74
	28h <i>Acacia pteraneura</i> low open woodland to low woodland over <i>Acacia grasbyi</i> , <i>Acacia tetragonophylla</i> scattered tall shrubs over <i>Senna</i> spp., <i>Eremophila forrestii</i> subsp. <i>forrestii</i> scattered shrubs.	41.76
	30 <i>Acacia ramulosa</i> var. <i>linophylla</i> , (<i>Acacia murrayana</i>) tall open shrubland over <i>Eremophila simulans</i> subsp. <i>magecalyx</i> , (<i>Eremophila forrestii</i> subsp. <i>forrestii</i>) open shrubland over <i>Monachather paradoxus</i> scattered grasses	47.98
	31 <i>Acacia ramulosa</i> var. <i>linophylla</i> and <i>Thryptomene decussata</i> tall shrubland over mixed <i>Eremophila</i> spp. and <i>Grevillea</i> spp. open shrubland over <i>Ptilotus polystachyus</i> very open herbland over <i>Thyridolepis multiculmis</i> sparse grasses.	4.10
	36 <i>Acacia pteraneura</i> low open woodland over <i>Thryptomene decussata</i> , <i>Acacia umbraculiformis</i> tall open shrubland	13.58
	40 <i>Thryptomene decussata</i> , (<i>Acacia aulacophylla</i>) open shrubland over <i>Micromyrtus sulphurea</i> , <i>Aluta aspera</i> subsp. <i>Hesperia</i> , <i>Calytrix divergens</i> , <i>Philotheca brucei</i> subsp. <i>brucei</i> low open shrubland with <i>Neurachne minor</i> , <i>Eriachne mucronata</i> , <i>Stylidium longibracteatum</i> scattered grasses and herbs. (On laterite outcropping).	7.2
	48 <i>Eremophila fraseri</i> subsp. <i>fraseri</i> open shrubland over <i>Ptilotus obovatus</i> scattered low shrubs with sparsely scattered to scattered <i>Acacia pteraneura</i> and scattered <i>Acacia grasbyi</i>	3.47
	53 <i>Eremophila fraseri</i> subsp. <i>fraseri</i> , <i>Senna artemisioides</i> subsp. <i>helmsii</i> open shrublands	12.13
	Bare Rock	2.24
Boolarly Woolleen 13.6 SLK	28 <i>Acacia pteraneura</i> low woodland over <i>Eremophila galeata</i> , <i>Eremophila forrestii</i> subsp. <i>forrestii</i> and mixed <i>Senna</i> spp. open shrubland over mixed <i>Ptilotus</i> sparse herbs over <i>Eragrostis dielsii</i> , <i>Eragrostis pergracilis</i> and <i>Aristida contorta</i> open grassland	87.68
	30 <i>Acacia ramulosa</i> var. <i>linophylla</i> tall shrubland over <i>Eremophila forrestii</i> subsp. <i>forrestii</i> open shrubland over <i>Monachather paradoxus</i> and <i>Aristida contorta</i> open grassland	15.09
	Completely Degraded	3.25
Beringarra Pinder Rd 116.4 SLK	23 <i>Acacia sclerosperma</i> subsp. <i>sclerosperma</i> and <i>A. synchronicia</i> tall open shrubland over mixed <i>Senna</i> spp. sparse shrubs over <i>Salsola australis</i> sparse herbs	35.00
	9 <i>Eucalyptus victrix</i> open woodland over <i>Acacia sclerosperma</i> subsp. <i>sclerosperma</i> over <i>Eriochloa pseudoacrotricha</i> , <i>Cenchrus ciliaris</i> and <i>Dichanthium sericeum</i> subsp. <i>humilis</i> over <i>Pluchea rubelliflora</i> , <i>Streptoglossa cylindriceps</i> and <i>Swainsona pterostylis</i> open herbland.	1.47
	Completely Degraded	3.05
Beringarra Pinder Rd 138.55 SLK	28 <i>Acacia pteraneura</i> low woodland over <i>Eremophila galeata</i> , <i>Eremophila forrestii</i> subsp. <i>forrestii</i> and mixed <i>Senna</i> spp. open shrubland over mixed <i>Ptilotus</i> sparse herbs over <i>Eragrostis dielsii</i> , <i>Eragrostis pergracilis</i> and <i>Aristida contorta</i> open grassland	56.2
Beringarra Pinder Rd 146 SLK	16 <i>Acacia synchronicia</i> tall open shrubland over <i>Eremophila laanii</i> , <i>Eremophila longifolia</i> and <i>Scaevola spinescens</i> open shrubland over <i>Setaria dielsii</i> open grassland over <i>Ptilotus divaricatus</i> , <i>Ptilotus macrocephalus</i> and <i>Tetragonia cristata</i> open herbland	7.89
	25 <i>Acacia eremaea</i> and <i>Eremophila oppositifolia</i> subsp. <i>angustifolia</i> tall open shrubland over mixed <i>Chenopodiaceae</i> spp. low shrubs and herbs	4.58
	30 <i>Acacia ramulosa</i> var. <i>linophylla</i> , (<i>Acacia murrayana</i>) tall open shrubland over <i>Eremophila simulans</i> subsp. <i>magecalyx</i> , (<i>Eremophila forrestii</i> subsp. <i>forrestii</i>) open shrubland over <i>Monachather paradoxus</i> scattered grasses	45.5
	31 <i>Acacia ramulosa</i> var. <i>linophylla</i> and <i>Thryptomene decussata</i> tall shrubland over mixed <i>Eremophila</i> spp. and <i>Grevillea</i> spp. open shrubland over <i>Ptilotus polystachyus</i> very open herbland over <i>Thyridolepis multiculmis</i> sparse grasses.	34.01
	40 <i>Thryptomene decussata</i> , (<i>Acacia aulacophylla</i>) open shrubland over <i>Micromyrtus sulphurea</i> , <i>Aluta aspera</i> subsp. <i>Hesperia</i> , <i>Calytrix divergens</i> , <i>Philotheca brucei</i> subsp. <i>brucei</i> low open shrubland with <i>Neurachne minor</i> , <i>Eriachne mucronata</i> , <i>Stylidium longibracteatum</i> scattered grasses and herbs. (On laterite outcropping).	0.74
	49 <i>Acacia grasbyi</i> , <i>Acacia tetragonophylla</i> high open shrubland over scattered low shrubs	2.27
	50 <i>Acacia pteraneura</i> scattered low trees over scattered shrubs and very open herbland	5.23
	28F <i>Acacia pteraneura</i> low woodland over <i>Acacia craspedocarpa</i> , <i>Acacia tetragonophylla</i> , <i>Eremophila platycalyx</i> subsp. <i>platycalyx</i> tall open shrubland to tall shrubland over <i>Abutilon cryptopetalum</i> scattered low shrubs and mixed open herbland	7.95
25 <i>Acacia eremaea</i> and <i>Eremophila oppositifolia</i> subsp. <i>angustifolia</i> tall open shrubland over mixed <i>Chenopodiaceae</i> spp. low shrubs and herbs	5.48	
55 <i>Maireana convexa</i> , <i>Maireana glomerifolia</i> chenopod low shrubland	3.65	
40 <i>Thryptomene decussata</i> , (<i>Acacia aulacophylla</i>) open shrubland over <i>Micromyrtus sulphurea</i> , <i>Aluta aspera</i> subsp. <i>Hesperia</i> , <i>Calytrix divergens</i> , <i>Philotheca brucei</i> subsp. <i>brucei</i> low open shrubland with <i>Neurachne minor</i> , <i>Eriachne mucronata</i> , <i>Stylidium longibracteatum</i> scattered grasses and herbs. (On laterite outcropping).	7.64	
28h <i>Acacia pteraneura</i> low open woodland to low woodland over <i>Acacia grasbyi</i> , <i>Acacia tetragonophylla</i> scattered tall shrubs over <i>Senna</i> spp., <i>Eremophila forrestii</i> subsp. <i>forrestii</i> scattered shrubs.	7.19	
41 <i>Acacia aulacophylla</i> , <i>A. coolgardiensis</i> and <i>A. umbraculiformis</i> open shrubland over <i>Micromyrtus prochytes</i> and <i>Calytrix uncinata</i> sparse low shrubs over <i>Eriachne pulchella</i> subsp. <i>pulchella</i> sparse grasses	11.34	
30 <i>Acacia ramulosa</i> var. <i>linophylla</i> , (<i>Acacia murrayana</i>) tall open shrubland over <i>Eremophila simulans</i> subsp. <i>magecalyx</i> , (<i>Eremophila forrestii</i> subsp. <i>forrestii</i>) open shrubland over <i>Monachather paradoxus</i> scattered grasses	36.49	
36 <i>Acacia pteraneura</i> low open woodland over <i>Thryptomene decussata</i> , <i>Acacia umbraculiformis</i> tall open shrubland	55.82	
50 <i>Acacia pteraneura</i> scattered low trees over scattered shrubs and very open herbland	3.64	
49 <i>Acacia grasbyi</i> , <i>Acacia tetragonophylla</i> high open shrubland over scattered low shrubs	5.85	
Completely degraded	1.03	

(360 Environmental, 2016; 360 Environmental, 2017)

Landform Systems mapped within the application area:

- **Tindalarra System** - Near level hardpan wash plains, narrow drainage lines and moderately saline drainage floors; supporting tall mixed acacia shrublands with wanderrie grasses, also minor saltbush/bluebush low shrublands.
- **Nerramyne System** - Undulating plains of sandy-surfaced laterite and weathered granite with low remnant plateaux, breakaways and rises supporting acacia shrublands.
- **Kalli System** - Elevated gently undulating red sandplains edged by stripped surfaces on laterite and granite, supporting acacia tall shrublands with wanderrie grass understoreys
- **Waguin System** - Sandplains and stripped granite or laterite surfaces with low fringing breakaways and lower plains; supports bowgada and mulga shrublands with wanderrie grasses and minor halophytic shrublands.
- **Yanganoo System** - Almost flat hardpan wash plains, with or without small wanderrie banks and weak groving; supporting mulga shrublands and wanderrie grasses on banks.
- **Bayou System** - Saline alluvial meander plains and river floodplains with anatomising river channels supporting halophytic shrublands with overstorey shrubs and eucalyptus trees.
- **Narryer System** - Low hills and lateritised breakaways above very gently undulating stony slopes and plains on gneiss and granite with sparse acacia shrublands.
- **Gabanintha System** - Greenstone ridges, hills and footslopes supporting sparse acacia and other mainly non-halophytic shrublands.
- **Jundee Systems** - Hardpan plains with variable gravelly mantles and minor sandy banks supporting weakly groved mulga shrublands.
- **Violet System** - Gently undulating gravelly plains on greenstone, laterite and hardpan, with low stony rises and minor saline plains; supporting groved mulga and bowgada shrublands and occasionally chenopod shrublands.
- **Challenge System** - Gently undulating gritty and sandy surfaced plains, occasional granite hills, tors and low breakaways, supporting acacia shrublands and occasional halophytic shrublands.
- **Wooleen System** - Saline, vegetated lake beds with almost flat, fringing saline alluvial plains and occasional elliptical sandy banks, supporting mostly halophytic shrublands and tussock grasslands.
- **Ero System** - Tributary floodplains with shallow, erodible duplex soils on red-brown hardpan, more or less saline and supporting acacia shrublands with halophytic and non-halophytic undershrubs.
- **Beringarra System** - Riverine plains with floodplains and channels, supporting halophytic shrublands, mixed acacia shrublands and low woodlands with minor perennial grasses.
- **Roderick System** - Broad, saline riverine plains, mainly supporting chenopod shrublands; also numerous grassy drainage foci, claypans and non-saline marginal hardpan plains with acacia shrublands.

Vegetation and Substrate Associations (VSA's) recorded within the application area

VSA 1: Drainage systems supporting *Eucalyptus camaldulensis*, *Acacia* shrublands and tussock grasslands. Major drainage support areas of *Casuarina obesa* and contain pools of water with fringing sedgeland and grasslands.

VSA 2: Floodplain depressions supporting chenopod shrublands (Samphire, Bluebush, Saltbush).

VSA 3: Major riverine plains with active lower floodplains flanking channelled watercourses; supports mixed *Acacia* shrublands, low woodlands with minor perennial grasses and areas halophytic shrublands. The Murchison and Roderick River floodplains.

VSA 4: Hardpan wash plains supporting mulga dominated shrublands and wanderrie grasses on occasional sandy banks. *Acacia* shrublands occur at a variable density (*Acacia aneura*, *Acacia tetragonophylla*, *Acacia grasbyi*, *Acacia ramulosa*), with *Eremophila* shrubs and scattered tussock grasses.

VSA 5: Sandplains supporting *Acacia* shrublands (eg. *Acacia ramulosa*, *Acacia aneura*) with occasional minor areas of granite outcropping.

VSA 6: Stony footslopes and undulating stony plains supporting sparse / open *Acacia* and *Eremophila* shrublands. Occasional low rocky hills support *Acacia* shrubs.

VSA 7: Granite outcrops, granite domes and hills supporting scattered *Acacia* shrublands and areas of *Callitris* woodland and fringing dense shrublands.

VSA 8: Low lateritic stony rises supporting *Acacia* shrublands (dominated by *Acacia aneura* and *Acacia quadramarginea*) with minor areas of outcropping.

VSA 9: Lateritic, gravelly hills and stony rises supporting Mulga shrublands with an *Eremophila* shrub layer. Upper, stony slopes support areas of *Thryptomene decussata*.

VSA 10: Granitic breakaways, varying relief, some minor areas with cliff faces up to three metres, supporting *Acacia aneura* and *Acacia quadramarginea* shrublands.

(Bamford Consulting Ecologists, 2016; Bamford Consulting Ecologists, 2017).