



CATALYST METALS LTD

OLD HIGHWAY PROJECT | NATIVE VEGETATION CLEARING PERMIT APPLICATION: SUPPORTING DOCUMENT

Tenements: M 52/1080, M 52/1081

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TABLE OF CONTENTS

1	INTRODUCTION.....	6
1.1	Document Purpose.....	6
1.2	Background	7
1.3	The Proponent.....	7
2	PLANNED MINING ACTIVITIES	9
2.1	Estimated Vegetation Disturbance Requirements	11
2.2	Indicative Time.....	11
2.3	Method of Vegetation Clearing.....	11
2.4	Operational Controls.....	12
2.5	Rehabilitation and Maintenance.....	12
3	EXISTING ENVIRONMENT BASELINE	13
3.1	Climate	13
3.2	Hydrology	14
3.3	Hydrogeology	14
3.3.1	Excess Water Management.....	17
3.4	Soils and Land Use	17
3.4.1	Soil and Landform	17
3.5	Flora and Vegetation.....	18
3.5.1	Vegetation Types.....	18
3.5.2	Vegetation Conditions	32
3.5.3	Conservation Significant Flora Species	34
3.5.4	Threatened and Priority Ecological Communities	35
3.6	Fauna	37
3.7	Short-Range Endemics.....	37
3.8	Subterranean Fauna.....	38
3.9	Social Settings.....	38
3.9.1	Land Use and Community.....	38
3.9.2	Native Title	39
3.9.3	Aboriginal Heritage.....	39
3.9.4	Non-Aboriginal Heritage	42
4	ASSESSMENT AGAINST THE 10 CLEARING PRINCIPLES.....	42
4.1	Scale of Proposed Land Clearing	42

4.2	Assessment of 10 Clearing Principles.....	44
5	REHABILITATION	49
6	STAKEHOLDER ENGAGEMENT	49
7	CONCLUSION	54
8	REFERENCES	55

LIST OF APPENDICES

APPENDIX 1.	VEGETATION AND FLORA ASSESSMENT (ECOSCAPE 2021)	56
APPENDIX 2.	FAUNA ASSESSMENT (ECOSCAPE 2021)	57

LIST OF TABLES

Table 3-1:	Production and Monitoring Bore details	16
Table 3-2:	Vegetation Types in the Project Area (Ecoscape, 2021)	20
Table 3-3:	Vegetation Conditions (Ecoscape, 2021)	32
Table 4-1:	Assessment Against the 10 Clearing Principles of Native Vegetation: Clearing of the Project	45
Table 6-1:	Key Stakeholder for the Purpose Permit Area	50

LIST OF FIGURES

Figure 1-1:	Project Location	8
Figure 2-1:	Indicative Project Layout Development Envelope Footprint	10
Figure 3-1:	Monthly Weather for Meekatharra Meteorological Station (No. 007045). Source: BOM, 2025	13
Figure 3-2:	Vegetation Types within the Project Area	31
Figure 3-3:	Vegetation Conditions within the Project Area	33
Figure 3-4:	Priority Listed Flora Species and TEC/PEC	36
Figure 3-5:	Heritage surveys and recorded sites	41
Figure 4-1:	Project Layout in Relation to Environmental and Heritage Surveys	43

ABBREVIATIONS AND DEFINITIONS

Abbreviation	Definition
ACHIS	Aboriginal Cultural Heritage Inquiry System
AEP	Annual Exceedance Period
BC	Biodiversity Conservation
BoM	Bureau of Meteorology
CYL	Catalyst
DCGA	Doolgunna Calcrete Groundwater Assemblage
DMPE	Department of Mines, Petroleum and Energy
DPLH	Department of Planning, Lands, and Heritage
EP	<i>Environmental Protection</i>
EPA	Environmental Protection Authority
EPBC	Environment Protection and Biodiversity Conservation
GDP	Ground Disturbance Permit
JJAC	Jidi Jidi Aboriginal Corporation
MCP	Mine Closure Plan
NVCP	Native Vegetation Clearing Permit
NWN	Nharnuwangga Wajarri and Ngarlawangga
P1	Priority 1
PEC	Priority Ecological Communities
ROM	run-of-mine
TDS	Total Dissolved Solids
TEC	Threatened Ecological Communities
TO	Traditional Owner
TSF	tailing storage facility
VU	Vulnerable
WoNS	Weed of National Significance
WRD	waste rock dumps
YNAC	Yugunga Nya Aboriginal Corporation

1 INTRODUCTION

Catalyst Metals (Old Highway) Ltd (Catalyst) intends to develop the Old Highway Project (the Project), located 220 km south of the town of Newman, Western Australia. The Project is a greenfield site previously owned by Sandfire Resources Ltd. Catalyst purchased the Project on the 8th May 2025.

Green Values Australia (Green Values) was commissioned by Catalyst to prepare an *Environmental Protection Act 1986* (EP Act) Part V Native Vegetation Clearing Permit (NVCP) application to the Department of Mines, Petroleum and Energy (DMPE) to seek approval for clearing native vegetation on mining tenements M52/1080 and M52/1081 to facilitate the Project's resources development.

This document has been prepared to support the NVCP application, which seeks approval for the clearing of up to 250 ha of native vegetation within a 1138.7 ha proposed Purpose Permit Area. A description of the proposed Project activities is provided in Section 2.

The application for the NVCP is based primarily on the findings of the Flora and Fauna Survey undertaken by Ecoscape in 2021 for the Project area.

1.1 Document Purpose

Information is provided to enable assessment of the impacts of the proposed clearing on each of the ten 'Land Clearing Principles' described within Schedule 5 of the EP Act. This document presents the existing ecological information and environmental impact management and mitigation measures for the proposed clearing.

This NVCP document is aimed at and structured to provide the following:

- Provide a description and map of the proposed Purpose Permit Area proposed for clearing regarding location, size and purpose.
- Site overview, with a brief description of local climate, biogeographic region, geology, land use, soils, hydrology, and hydrogeology.
- Provide a description of the proposed Purpose Permit Area to be cleared regarding vegetation type, condition and representation in a regional context.
- Presence of significant flora species, including within the proposed Purpose Permit Area.
- Description of the broad fauna habitat within the proposed Purpose Permit Area.
- Provide a discussion of proposed vegetation clearing concerning the EP Act *Schedule 5 – Principles for clearing native vegetation*.

1.2 Background

Catalyst acquired Old Highway from Sandfire in May 2025. Catalyst is currently operating the Plutonic Gold Mine (Plutonic), located approximately 41.8 km from the Old Highway Project. The Project is located within the Shire of Meekatharra, with the closest main town being Newman, 220 km. The main access to the Project is via the Great Northern Highway. The location of the Project is shown in Figure 1-1.

Catalyst (owners of Vango Mining Limited and Dampier (Plutonic) Pty Ltd) has an extensive tenement holding the existing Trident Underground Mine comprising of 27 tenements, as well as owning several other tenements for prospecting and exploration leases.

1.3 The Proponent

The proponent's details are provided below; all compliance and regulatory requirements regarding this assessment document should be forwarded by email or post to the following details.

Proponent Details		
Company Name:		Catalyst (Old Highway) Pty Ltd
ABN:		36 686 388 376
Address:		Level 1, 30 Richardson Street, West Perth, Western Australia 6005
Postal Address:		As above.
Key Contact Representative	Name:	Mr. Anthony Buckingham
	Position:	Manager – Group Projects
	Phone Number:	+61 408 740 668
	Email:	Anthony.Buckingham@catalystmetals.com.au

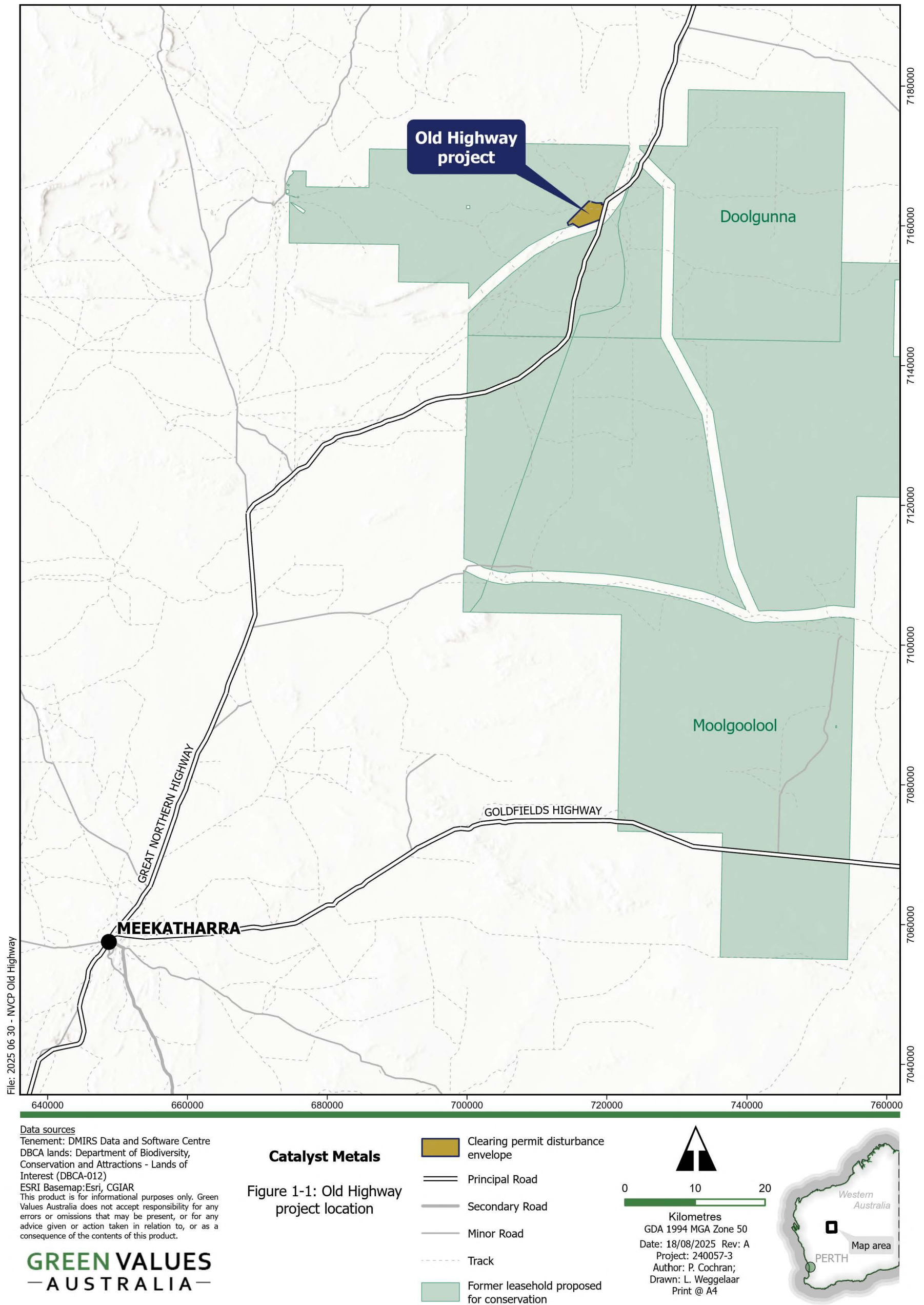


Figure 1-1: Project Location

2 PLANNED MINING ACTIVITIES

The Project will occur on tenements M52/1080 and M52/1081. Both tenements are held by Sandfire Resources Ltd.

Catalyst intends to develop the Project with several planned open pits, associated waste rock dumps (WRD), run-of-mine (ROM) pads, and supporting infrastructure and access roads. An indicative infrastructure layout is shown in Figure 2-1.

Mining will be undertaken by conventional drill and blast methods to release the ore and waste from the pits. Waste will be excavated and deposited on the WRD associated with each pit. The ore will be excavated and deposited using dump trucks on the ROM before being transported to the Plutonic for processing. Tailings from the process will be deposited onto the existing Plutonic tailing storage facility (TSF). Abandonment bunds will be built progressively during construction activities around the open pits under relevant regulations. The abandonment bunds will be placed on cleared land, and waste rock material will be used to create the bunds.

Dewatering will be undertaken using several of the smaller satellite pits, which will be mined initially above the water table, as ponds for the dewatering of the larger open pits. No water will be discharged into the environment, and Catalyst will recycle available groundwater from dewatering where possible.

Surface water management infrastructure, such as bunds and culverts, will be built to ensure that any flooding is directed around the infrastructure and minimise flood risk and impacts to the environment. This infrastructure, as well as sedimentation ponds, will ensure the separation of clean and dirty water.

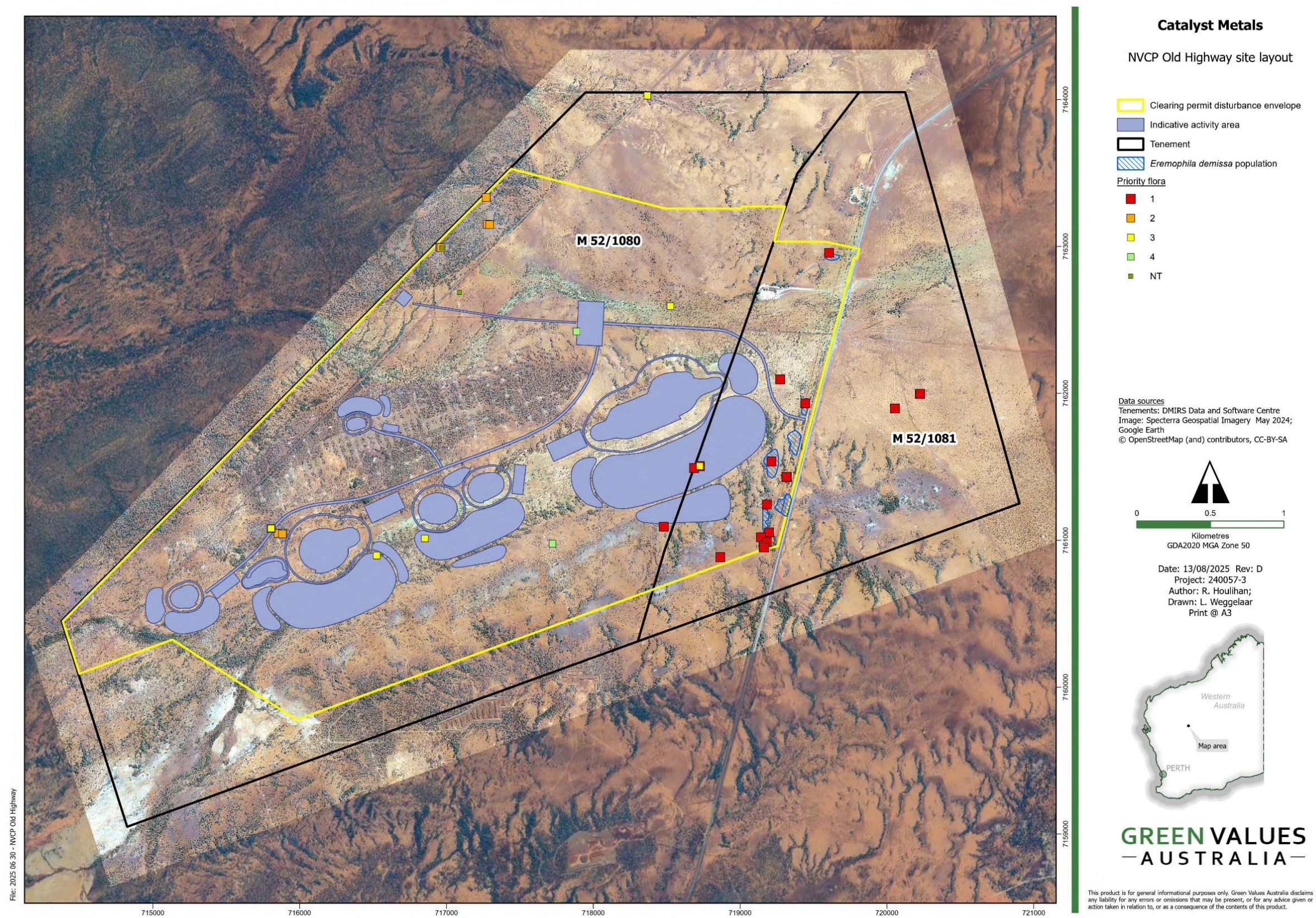


Figure 2-1: Indicative Project Layout Development Envelope Footprint

2.1 Estimated Vegetation Disturbance Requirements

The Project will result in 250 ha of native vegetation cleared within 1138.7 ha Purpose Permit Area to allow for the proposed infrastructure and activities. The area is a greenfield project; however, it is evident that there is some historical disturbance due to anthropogenic activities, resulting in degraded or poor vegetation.

The infrastructure layout, which is presented within this NVCP, is preliminary, and the project is still under development and may be subject to change within the approved clearing permit disturbance envelope. The NVCP boundary has been provided to allow for flexibility within the design.

2.2 Indicative Time

Catalyst proposes to commence vegetation clearing in 2026. Clearing activities will be implemented progressively over the life of mine, which will be three to five years from 2026.

2.3 Method of Vegetation Clearing

The following methods of vegetation clearing will be implemented during the construction phase of the Project:

- Prior to clearing, a project-specific internal Ground Disturbance Permit (GDP) will be completed and signed off by the Catalyst Manager - Projects.
- Clearing areas will be delineated under the project-specific internal GDP, and the clearing boundary will be surveyed and demarcated with survey pegs and flagging tape.
- Vegetation will be removed before topsoil stripping. Vegetation will generally be cleared 'blade up' with bulldozers or graders within the proposed Purpose Permit Area. Diggers and loaders may be used around drainage lines as required.
- Vegetation will typically be stripped and stored to the side of each disturbed area for use in rehabilitation works. Areas with thicker vegetation may need to have the vegetation pushed into piles and mulched.
- Topsoil will be salvaged to a depth of 0.2 m and placed in stockpiles. Topsoil shall be paddock dumped not greater than 2 m in height with adequate distance between them to create a series of mounds and troughs. Cleared scrub material shall be co-located with the topsoil stockpiles.
- Subsoil may also be stripped and stockpiled separately to ensure adequate capping material and growth medium are collected.

- Machinery operators will aim to minimise the frequency and intensity of disturbance, so they do not compromise the structural integrity of the soils. Handling of topsoil will be minimised as much as possible, especially when wet.
- Soil stripping is planned to occur as close as possible to the time when the proposed mining is scheduled to commence.

2.4 Operational Controls

The Flora and Vegetation survey (2021) identified the following:

- No weed species listed as declared under the *Biosecurity and Agricultural Management Act 2007* were recorded.
- No plant species listed as a Weed of National Significance (WoNS) under the Australian Weeds Strategy were encountered in the Project area.

Although no weed plant species were identified during the 2021 survey, management and control measures will be implemented to ensure that weed species do not occur and spread in the Project area. These include hygiene inspections of all vehicles prior to entering the Project area, seasonal weed inspections and ongoing management during operations.

A range of feral animals has also been identified on site, including cats and dogs. Management measures to control the risk of feral animals in the Project area will be developed and implemented. This will include measures such as fencing, particularly in any areas which may contain domestic waste (i.e. food), regular monitoring and recording.

2.5 Rehabilitation and Maintenance

In areas where topsoil has been disturbed, it will be spread back over the area and rehabilitated according to the specifications of Catalyst's Mine Closure Plan (MCP) and seeded with locally endemic species. Rehabilitation monitoring will be undertaken on all substantial rehabilitation areas within one year of seeding to determine whether germination and establishment have been successful.

Ongoing monitoring will determine if further management measures are required, including re-seeding or other interventions, and will be managed in accordance with the MCP.

3 EXISTING ENVIRONMENT BASELINE

This section provides a brief overview of existing studies relevant to the work proposed.

3.1 Climate

The climate within the proposed Purpose Permit Area is classified as Arid and characterised by low rainfall, hot, dry summers, and mild winters. Rainfall is evenly distributed between the summer and winter months, however, thunderstorm activity in the summer months results in slightly larger monthly averages. Evaporation exceeds rainfall in all months and averages over 3,000 mm per year. The Meekatharra Airport meteorological station (No. 007045) was used to estimate the baseline conditions at the Project site. The highest mean maximum temperature is 29.2 °C annually, with the highest temperatures during January and the minimum temperature is 16 °C annually with the lowest temperatures during July (BoM, 2025). The average rainfall is 232.1 mm annually, with the heaviest rainfall seen in February, March and June (Table 3-1).

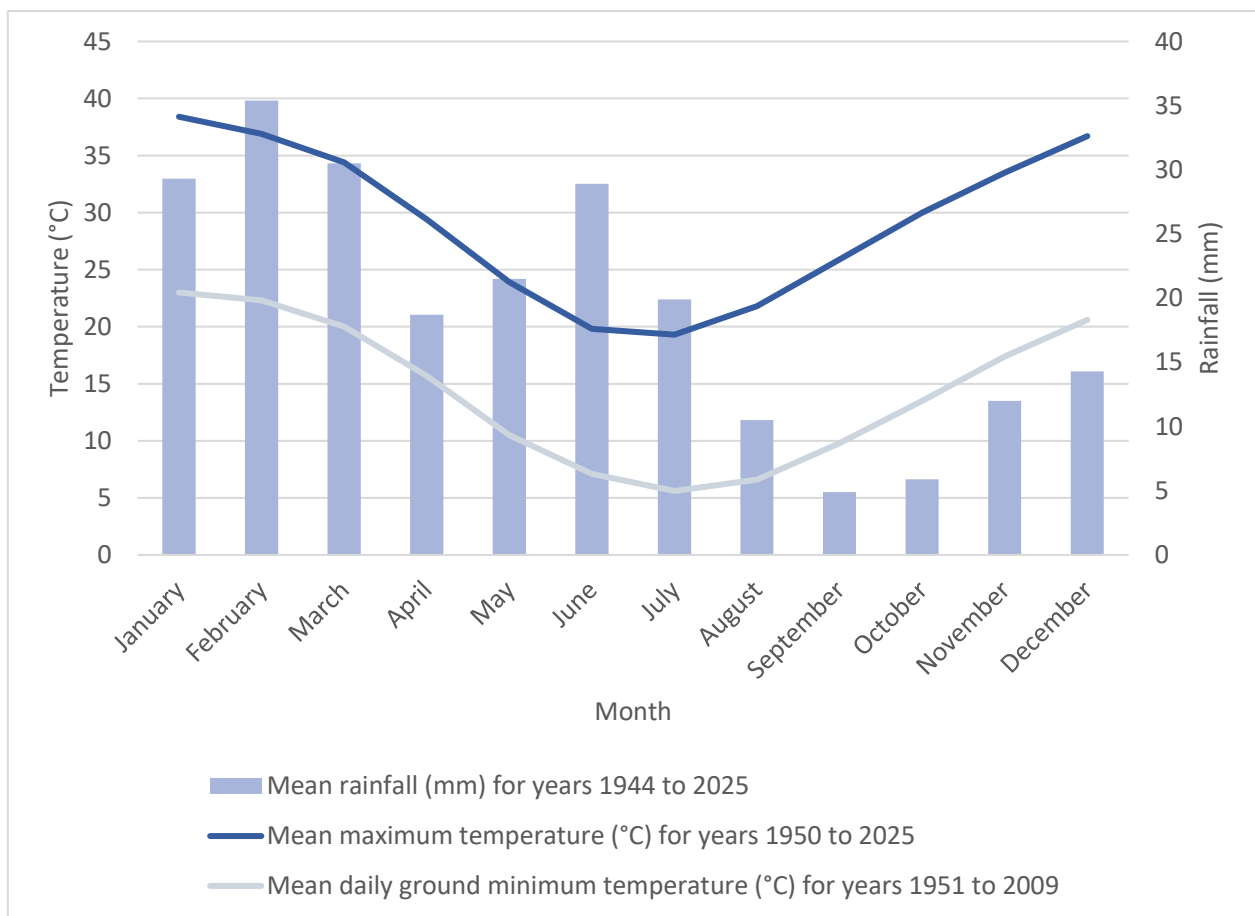


Figure 3-1: Monthly Weather for Meekatharra Meteorological Station (No. 007045). Source: BoM, 2025

3.2 Hydrology

MBS Environmental completed a soils and landform assessment for Sandfire Resources in 2021.

The area slopes eastwards towards the Gascoyne River tributarially. The headwaters are close to the catchment divide of the Murchison River Basin to the southwest and the draining salt lakes basin to the east. There are no permanent water courses, wetlands or groundwater-dependent ecosystems near the Project area (MBS Environmental, 2021).

The minor creeks and drainage lines in the Project area are ephemeral and only flow for short periods following heavy rainfall. Runoff flows off-site in a north-easterly direction via a combination of sheet flow and shallow concentrated flow.

Mapping completed by AQ2 (2021) shows that the site is likely constrained by culverts at low points along the highway; however, water depth would still be less than 0.5m in the mining operation area in a 1% Annual Exceedance Period (AEP) storm event. An updated hydrology assessment is being updated and is ongoing by Worley Consulting.

3.3 Hydrogeology

Sandfire obtained approval for two groundwater licences under the *Rights in Water and Irrigation Act 1914* for a total abstraction of 750,000 kL per annum. These licences have a combined groundwater operating strategy for the Project (GWL 206832 (1) and GWL 206834 (1)) (Sandfire, 2024).

All water is planned to be abstracted from the combined fractured rock aquifer underlying the Project. Sandfire (2024) summarised that there is a low predicted groundwater inflow rates; therefore, it is proposed that in-pit sumps to several satellite open pits above the groundwater table will be used to dewater the open pit mines. Surface water drainage in the pits will be diverted to the in-pit sumps and around the surface infrastructure for use. One production bore (DWB10) and four monitoring bores (OHMB0001, OHMB0002, OHMB0003, OHMB0005) have been developed to date and will be used for measuring water levels. Water level ranges between 7.49 and 23.41 metres below ground level. Details on the installed bores are provided in Table 3-1.

Water demand for the Project has been estimated at 500 – 1,000 kL per day and is mainly associated with dust suppression. The modelled groundwater drawdown is unlikely to impact the surrounding calcretes. No water balance was provided; however, it will be developed for the Project. Groundwater is marginal, with the Total Dissolved Solids (TDS) ranging between 520 – 810 mg/L and pH being neutral to slightly alkaline.

The proposed extraction from the weathered/fractured bedrock aquifer is highly unlikely to have any adverse impacts on the water supply and water quality potential of the fractured bedrock aquifer system, as the extraction will result in a localised piezometric level reduction in this aquifer. The

pumping will induce minor changes in the water levels in the shallow surficial aquifer, which contains groundwater with a lower TDS (but is still hypersaline); however, the drawdown extent is likely to be local.

The final Project layout has not been developed, and no water abstraction is being undertaken; therefore, no monitoring is currently required in compliance with the Groundwater License.

Table 3-1: Production and Monitoring Bore details

Hole ID	Bore Type	Coordinates (MGA94 Zone 50)		Ground EL	Hole Diam	Cased Depth	TOC EL	Casing Diameter	Casing Type	Screened Depth	Airlift Rate	EC	Static Water Level (SWL)	
		Easting	Northing	mAHD	(mm)	(m)	(mAHD)	(mm)		(m)	(L/s)	(uS/cm)	(mbtoc)	(mAHD)
OHMB0001	Monitoring	718918	7162106	560.1	143	148	560.91	50	CL-18, PVC	70-88 = 2mm, 88-148 = 1mm	1.7	1053	8.3	552.61
OHMB0002	Monitoring	717728.3	7161562	562.3	143	148	563.13	50	CL-18, PVC	85-103 = 2mm, 124-148 = 2mm	0.25	1135	11.74	551.39
OHMB0003	Monitoring	717064.5	7161268	564.4	143	148	565.31	50	CL-18, PVC	88-124 = 1mm, 124-148 = 2mm	1.1	1323	14.63	550.68
OHMB0004	Monitoring	715499.2	7160674	572.6	143	148	573.47	50	CL-18, PVC	64-112 = 1mm, 112-136 = 2mm, 136-148 = 1mm	0.25	1599	24.28	549.19
DWB10	Production	715965	7161087	568	254	135	568.35	155	CL-18, PVC	69-135 = 1mm	3.5	1400	20.59	547.76

3.3.1 Excess Water Management

Excess water not used for dust suppression is planned to be discharged into the turkey nest or into mined-out pits. It is considered that the mined-out pits are more than sufficient to hold excess water, together with natural groundwater inflows once the sump pumping ceases.

No discharge to the environment is planned from this mining operation.

3.4 Soils and Land Use

MBS completed two reports for the Project area, including:

- Old Highway Gold Deposit Waste Rock Characterisation (July 2021); and
- Old Highway Gold Project Baseline Soil and Landform Assessment (August 2021).

The regional landform for the Project is characterised as colluvial in nature; the southwest of the Project area contains more exposed rock, saprolite and saprock.

3.4.1 Soil and Landform

MBS (2021) provided the following summary of implications and management considerations:

- The site is heavily disturbed due to historical use as pastoral stations for livestock, the landforms are already disturbed, and thus the risk of severe ecological effects is minimal.
- The major landforms in the Project area included the following to support various vegetation communities:
 - Saline and non-saline plains.
 - Undulating gravel plains with low stony rises and minor saline plains.
 - Slopes and interfluves.
 - Calcrete tables.
- Surface and subsoils were similar and classified as either sandy loams or sandy clay-loams, with clay contents of up to 30% present in some samples.
- Soils varied from both dispersive (Emerson Class 2) and non-dispersive (Emerson Class 5).
- Soils were generally acidic, but non-saline.
- The three main soil types include Red-Brown Hardpan Shallow Loams, Stony Soils and Shallow Gravels.

- Surface soils contain between 20 – 40% gravel, whilst subsoils generally contain > 60% gravel.
- The closest geoheritage site to the Project area is Mt Lake, approximately 15 km south of the Project area; the Project area landforms are not considered geoheritage sites.

Soils will not result in any key issues with respect to mine closure or rehabilitation and are considered as desirable. This is due to the high gravel/stone content that can be used to secure sloping surfaces, and the high clay content can be used for WRD to reduce drainage and leaching into the groundwater.

3.5 Flora and Vegetation

Ecoscape Environmental Consultants (Ecoscape) (2021) was commissioned to conduct a detailed flora and vegetation survey for the Old Highway tenements. The field survey portion of the work was conducted between 30 March to 11 April 2021 (refer to APPENDIX 1 for full flora and vegetation assessment report).

As mentioned above, the Project area is degraded from historical grazing and past and current pastoral and mining activities.

A total of 182 vascular flora was recorded in the Project area, from 87 genera and 36 families. The most common genera were *Acacia* with 20 taxa, *Eremophila* (13) and *Ptilotus* (nine). The most recorded species were *Acacia aptaneura* recorded from 55 quadrats, *Ptilotus obovatus* (42 quadrats), *Ptilotus schwartzii* (40 quadrats) and *Aristida contorta* and *Hibiscus burtonii* (36 quadrats).

Other surveys completed in the region by Sandfire Resources as part of the De Grussa Project showed that all species were well represented outside of the tenement area.




3.5.1 Vegetation Types



A total of 22 vegetation types were mapped within the project development footprint (refer to Table 3-2 and Figure 3-2). Out of the identified vegetation types, four were considered significant (Ecoscape, 2021), being:



- Vegetation associated with the Robinson Range Priority Ecological Community (PEC), being **AinTOS**, **AapAsuTOS** and **SMAprLSS**. These areas occur within the ironstone structure and should be avoided. Other areas within the PEC boundary were not considered to form part of the PEC habitat.
- Sheet flow dependent (Mulga grove) vegetation, being **AapAsuAprLOF**.



Although the Doolgunna Calcrete is mapped as occurring on the eastern side of the highway, this area is unlikely to be impacted by the mining operation and therefore not considered under this assessment.



Table 3-2: Vegetation Types in the Project Area (Ecoscape, 2021)



Landform	Mapping unit	Vegetation type	Representative photograph	Other characteristic species	Area (ha) and extent (%)
Flats (quartz); Mulga intergrove	AapAinEgTSS	<i>Acacia aptaneura</i> , <i>Acacia incurvaneura</i> and <i>Eremophila galeata</i> tall sparse shrubland over <i>Eremophila margarethae</i> , and <i>Senna</i> sp. Meekatharra (E. Bailey 1- 26) low sparse shrubland with <i>Acacia pteraneura</i> low scattered trees		<i>Acacia pruinocarpa</i> <i>Acacia tetragonophylla</i> <i>Maireana georgei</i> <i>Maireana triptera</i> <i>Ptilotus obovatus</i> <i>Ptilotus schwartzii</i>	180.57 ha 13.70%
Flats (clay)	AapAinGbTSS	<i>Acacia aptaneura</i> , <i>Acacia incurvaneura</i> and <i>Grevillea berryana</i> tall sparse shrubland over <i>Eremophila demissa</i> , <i>Eremophila galeata</i> and <i>Ptilotus schwartzii</i> low scattered shrubs/forbs		<i>Acacia caesaneura</i> <i>Acacia pruinocarpa</i> <i>Cheilanthes sieberi</i> <i>Eragrostis eriopoda</i> <i>Eremophila forrestii</i> <i>Eremophila margarethae</i> <i>Eremophila spectabilis</i> <i>Hibiscus burtonii</i> <i>Psyrax suaveolens</i>	231.29 ha 17.55%
Flats (stony)	AapAptAcuLOW	<i>Acacia aptaneura</i> , <i>Acacia pteraneura</i> and <i>Acacia cuspidifolia</i> low open woodland over <i>Senna</i> sp. Meekatharra (E. Bailey 1- 26), <i>Eremophila phyllopoda</i> subsp. <i>phyllopoda</i> and <i>Eremophila linearis</i> low scattered shrubs		<i>Acacia incurvaneura</i> <i>Maireana georgei</i> <i>Maireana triptera</i> <i>Ptilotus exaltatus</i> <i>Ptilotus obovatus</i> <i>Ptilotus rotundifolius</i> <i>Rhagodia eremaea</i> <i>Salsola australis</i> <i>Senna artemisioides</i> subsp. <i>x artemisioides</i> <i>Solanum lasiophyllum</i>	41.82 ha 3.17%



Landform	Mapping unit	Vegetation type	Representative photograph	Other characteristic species	Area (ha) and extent (%)
Flats with sheetflow drainage	AapAsuAprLOF	<i>Acacia aptaneura</i> , <i>Acacia subcontorta</i> and <i>Acacia pruinocarpa</i> low open forest over <i>Psyrax latifolia</i> , <i>Eremophila galeata</i> and <i>Acacia kempeana</i> mid sparse shrubland over <i>Ptilotus obovatus</i> , <i>Eremophila forrestii</i> and <i>Eremophila spectabilis</i> low sparse shrubland		<i>Abutilon cryptopetalum</i> <i>Acacia aneura</i> <i>Acacia craspedocarpa</i> <i>Acacia mulganeura</i> <i>Acacia tetragonophylla</i> <i>*Bidens subalternans</i> <i>Cheilanthes sieberi</i> <i>Digitaria brownii</i> <i>Eremophila latrobei</i> subsp. <i>latrobei</i> <i>Hibiscus</i> sp. <i>Gardneri</i> (A.L. Payne PRP 1435) <i>Marsdenia australis</i> <i>Psyrax rigidula</i> <i>Psyrax suaveolens</i> <i>Rhagodia eremaea</i> <i>Sida picklesiana</i> (P3) <i>Sida</i> sp. L (A.M. Ashby 4202)	30.11 ha 2.28%
Riparian (creek)	AapAsuPILW	<i>Acacia aptaneura</i> , <i>Acacia subcontorta</i> and <i>Psyrax latifolia</i> low woodland over <i>Eremophila galeata</i> mid sparse shrubland over <i>Ptilotus obovatus</i> low open shrubland		<i>Acacia caesaneura</i> <i>Acacia kempeana</i> <i>Acacia pruinocarpa</i> <i>Acacia pteraneura</i> <i>Abutilon cryptopetalum</i> <i>Aristida contorta</i> <i>*Bidens subalternans</i> <i>Cymbopogon ambiguus</i> <i>Digitaria brownii</i> <i>Duperreya commixta</i> <i>Eragrostis kennedyae</i> <i>Eriachne pulchella</i> subsp. <i>pulchella</i> <i>Evolvulus alsinoides</i> var. <i>villosicalyx</i> <i>Glycine canescens</i> <i>Marsdenia australis</i> <i>Paspalidium clementii</i> <i>Perotis rara</i> <i>Psyrax rigidula</i> <i>Santalum spicatum</i> <i>Senna glaucifolia</i> <i>Sida</i> sp. L (A.M. Ashby 4202)	26.12 ha 1.98%



Landform	Mapping unit	Vegetation type	Representative photograph	Other characteristic species	Area (ha) and extent (%)
Quartz knolls (crest, flanks)	AapAsuTOS	<i>Acacia aptaneura</i> and <i>Acacia subcontorta</i> tall open shrubland over <i>Eremophila latrobei</i> subsp. <i>latrobei</i> , <i>Dodonaea viscosa</i> subsp. <i>spatulata</i> and <i>Eremophila margarethae</i> low sparse shrubland		<i>Acacia ayersiana</i> <i>Eremophila jucunda</i> subsp. <i>jucunda</i> <i>Eremophila margarethae</i> <i>Grevillea berryana</i> <i>Indigofera fractiflexa</i> subsp. <i>augustensis</i> (P2) <i>Marsdenia australis</i> <i>Ptilotus obovatus</i> <i>Ptilotus schwartzii</i>	1.61 ha 0.12%
Riparian (dispersed drainage/minor creeks)	AapAteAanLOF	<i>Acacia aptaneura</i> , <i>Acacia tetragonophylla</i> and <i>Acacia aneura</i> low open forest over <i>Eremophila galeata</i> , <i>Psydrax latifolia</i> and <i>Acacia craspedocarpa</i> mid sparse shrubland over <i>Ptilotus obovatus</i> , <i>Aristida contorta</i> and <i>Perotis rara</i> low sparse shrubland/tussock grassland/grassland		<i>Abutilon cryptopetalum</i> <i>Bidens subalternans</i> <i>Boerhavia coccinea</i> <i>Digitaria brownii</i> <i>Evolvulus alsinoides</i> var. <i>villosicalyx</i> <i>Heliotropium inexplicitum</i> <i>Hibiscus burtonii</i> <i>Maireana ?planifolia</i> <i>Portulaca oleracea</i> <i>Sida platycalyx</i> <i>Sida</i> sp. L (A.M. Ashby 4202)	88.87 ha 6.74%



Landform	Mapping unit	Vegetation type	Representative photograph		Other characteristic species	Area (ha) and extent (%)
Flats	AapGbAkeTSS	<i>Acacia aptaneura</i> , <i>Grevillea berryana</i> and <i>Acacia kempeana</i> tall sparse shrubland over <i>Ptilotus schwartzii</i> and <i>Eremophila incisa</i> low scattered forbs/shrubs			<i>Acacia incurvaneura</i> <i>Aristida contorta</i> <i>Eremophila margarethae</i> <i>Eremophila spectabilis</i> <i>Goodenia nuda</i> (P4) <i>Hibiscus burtonii</i> <i>Marsdenia australis</i> <i>Ptilotus obovatus</i> <i>Sclerolaena eriacantha</i>	231.36 ha 17.56%
Flats	AapLOW	<i>Acacia aptaneura</i> low open woodland over <i>Acacia caesaneura</i> , <i>Eremophila galeata</i> and <i>Acacia craspedocarpa</i> tall sparse shrubland over <i>Ptilotus obovatus</i> and <i>Aristida contorta</i> low scattered shrubs/tussock grasses			<i>Acacia aneura</i> <i>Eremophila margarethae</i> <i>Evolvulus alsinoides</i> var. <i>villosicalyx</i> <i>Santalum spicatum</i> <i>Sida picklesiana</i> (P3)	185.51 ha 14.08%



Landform	Mapping unit	Vegetation type	Representative photograph		Other characteristic species	Area (ha) and extent (%)
Flats (calcrete)	AbuApyAmaTOS	<i>Acacia burkittii</i> , <i>Acacia pyrifolia</i> var. <i>pyrifolia</i> and <i>Acacia macraneura</i> tall open shrubland over <i>Senna artemisioides</i> subsp. <i>x artemisioides</i> , <i>Eragrostis setifolia</i> and <i>Ptilotus obovatus</i> low shrubland/tussock grassland with <i>Codonocarpus cotinifolius</i> low scattered trees			<i>Abutilon fraseri</i> <i>Amyema fitzgeraldii</i> <i>Cenchrus ciliaris</i> <i>Duperreya commixta</i> <i>Enneapogon caerulescens</i> <i>Pimelea microcephala</i> <i>Santalum lanceolatum</i> <i>Senna stricta</i> <i>Sida</i> sp. L (A.M. Ashby 4202) <i>Teucrium teucriiflorum</i>	1.24 ha 0.09%
Flats (clay)	AinAsuTSS	<i>Acacia incurvaneura</i> and <i>Acacia subcontorta</i> tall sparse shrubland over <i>Ptilotus schwartzii</i> low scattered forbs			<i>Aristida contorta</i> <i>Eremophila galeata</i> <i>Eremophila latrobei</i> subsp. <i>latrobei</i> <i>Grevillea berryana</i> <i>Monachather paradoxus</i> <i>Ptilotus obovatus</i> <i>Solanum lasiophyllum</i>	118.51 ha 8.99%


Landform	Mapping unit	Vegetation type	Representative photograph		Other characteristic species	Area (ha) and extent (%)
Crest	AinLOW	<i>Acacia incurvaneura</i> low open woodland over <i>Aluta maisonneuvei</i> subsp. <i>auriculata</i> and <i>Aristida contorta</i> low sparse shrubland/tussock grassland with <i>Acacia subcontorta</i> tall scattered shrubs			<i>Acacia aneura</i> <i>Eragrostis eriopoda</i> <i>Eriachne pulchella</i> subsp. <i>dominii</i> <i>Hibiscus burtonii</i> <i>Homalocalyx echinulatus</i> <i>Psydrax latifolia</i> <i>Ptilotus obovatus</i> <i>Sida</i> sp. Golden calyces glabrous (H.N. Foote 32)	2.77 ha 0.21%
Hill slopes	AinTOS	<i>Acacia incurvaneura</i> tall open shrubland over <i>Aluta maisonneuvei</i> subsp. <i>auriculata</i> and <i>Sida</i> sp. Golden calyces glabrous (H.N. Foote 32) low open shrubland			<i>Acacia</i> sp. <i>Aristida contorta</i> <i>Brunonia australis</i> <i>Eragrostis eriopoda</i> <i>Eremophila jucunda</i> subsp. <i>jucunda</i> <i>Eriachne pulchella</i> subsp. <i>dominii</i> <i>Goodenia triodiophila</i> <i>Hibiscus burtonii</i> <i>Indigofera fractiflexa</i> subsp. <i>augustensis</i> (P2) <i>Monachather paradoxus</i> <i>Ptilotus schwartzii</i> <i>Senna glaucifolia</i> <i>Synaptantha tillaeacea</i> var. <i>tillaeacea</i>	15.62 ha 1.19%

Landform	Mapping unit	Vegetation type	Representative photograph	Other characteristic species	Area (ha) and extent (%)
Flats (stony)	AprLW	<i>Acacia pruinocarpa</i> low woodland over <i>Acacia pteraneura</i> and <i>Acacia kempeana</i> tall scattered shrubs		<i>Acacia aptaneura</i> <i>Aristida contorta</i> <i>Eremophila galeata</i> <i>Hibiscus burtonii</i> <i>Maireana triptera</i> <i>Monachather paradoxus</i> <i>Psydrax latifolia</i> <i>Psydrax suaveolens</i> <i>Ptilotus aervoides</i> <i>Ptilotus obovatus</i> <i>Ptilotus rotundifolius</i> <i>Ptilotus schwartzii</i> <i>Solanum lachnophyllum</i> <i>Tribulus astrocarpus</i>	5.11 ha 0.39%
Hill slopes	AptAapAsuTOS	<i>Acacia pteraneura</i> , <i>Acacia aptaneura</i> and <i>Acacia subcontorta</i> tall open shrubland over <i>Eremophila latrobei</i> and <i>Ptilotus schwartzii</i> low scattered shrubs/forbs		<i>Acacia incurvaneura</i> \ <i>Acacia pruinocarpa</i> <i>Grevillea berryana</i> <i>Senna glaucifolia</i> \ <i>Sida picklesiana</i> (P3) <i>Solanum lachnophyllum</i>	19.20 ha 1.46%

Landform	Mapping unit	Vegetation type	Representative photograph	Other characteristic species	Area (ha) and extent (%)
Flats (stony)	AptLOW	<i>Acacia pteraneura</i> low open woodland over <i>Acacia kempeana</i> mid sparse shrubland over <i>Eremophila spathulata</i> and <i>Eremophila margarethae</i> low sparse shrubland		<i>Acacia aptaneura</i> <i>Psydrax latifolia</i> <i>Ptilotus rotundifolius</i> <i>Ptilotus schwartzii</i> <i>Sida picklesiana</i> (P3)	10.86 ha 0.82%
Flats (clay)	AteAapAinTSS	<i>Acacia tetragonophylla</i> , <i>Acacia aptaneura</i> and <i>Acacia incurvaneura</i> tall sparse shrubland over <i>Ptilotus obovatus</i> and <i>Digitaria brownii</i> low scattered shrubs/tussock grasses		<i>Abutilon cryptopetalum</i> <i>Alternanthera angustifolia</i> <i>Aristida contorta</i> * <i>Bidens subalternans</i> <i>Boerhavia coccinea</i> <i>Chrysocephalum gilesii</i> <i>Duperreya commixta</i> <i>Enneapogon caeruleus</i> <i>Eragrostis pergracilis</i> <i>Eremophila forrestii</i> <i>Eremophila galeata</i> <i>Eremophila margarethae</i> <i>Euphorbia coghlanii</i> <i>Evolvulus alsinoides</i> var. <i>villosicalyx</i> <i>Goodenia prostrata</i> <i>Grevillea striata</i> <i>Hakea lorea</i> subsp. <i>lorea</i> <i>Heliotropium cunninghamii</i> <i>Hibiscus burtonii</i> <i>Iseilema membranaceum</i> <i>Maireana ?planifolia</i> <i>Paspalidium clementii</i> <i>Psydrax latifolia</i> <i>Sida</i> sp. dark green fruits (S. van Leeuwen 2260) <i>Sida</i> sp. L (A.M. Ashby 4202) <i>Solanum lasiophyllum</i>	35.53 ha 2.70%

Landform	Mapping unit	Vegetation type	Representative photograph	Other characteristic species	Area (ha) and extent (%)
Flats with sheet flow drainage	CcAapMOF	<i>Corymbia candida</i> and <i>Acacia aptaneura</i> mid open forest over <i>Psydrax latifolia</i> , <i>Acacia kempeana</i> and <i>Eremophila forrestii</i> tall open shrubland over <i>Eriachne helmsii</i> and * <i>Bidens subalternans</i> low tussock grassland/forbland		<i>Abutilon cryptopetalum</i> <i>Acacia tetragonophylla</i> <i>Boerhavia coccinea</i> <i>Duperreya commixta</i> <i>Eragrostis eriopoda</i> <i>Glycine canescens</i> <i>Hibiscus burtonii</i> <i>Isotropis iophyta</i> <i>Marsdenia australis</i> <i>Monachather paradoxus</i> <i>Paspalidium clementii</i> <i>Perotis rara</i> <i>Psydrax rigidula</i> <i>Ptilotus obovatus</i> <i>Sida</i> sp. dark green fruits (S. van Leeuwen 2260) <i>Sida</i> sp. L (A.M. Ashby 4202)	4.50 ha 0.34%
Riparian (river)	CcEvHIMW	<i>Corymbia candida</i> , <i>Eucalyptus victrix</i> and <i>Hakea lorea</i> subsp. <i>lorea</i> mid woodland over <i>Acacia tetragonophylla</i> , <i>Acacia aneura</i> and <i>Acacia aptaneura</i> tall open shrubland over <i>Chrysopogon fallax</i> and <i>Themeda triandra</i> mid open tussock grassland		<i>Abutilon cryptopetalum</i> <i>Acacia pteraneura</i> <i>Duperreya commixta</i> <i>Eremophila galeata</i> <i>Eriachne flaccida</i> <i>Marsilea hirsuta</i> <i>Paspalidium clementii</i> <i>Psydrax rigidula</i> <i>Santalum lanceolatum</i> <i>Santalum spicatum</i>	2.36 ha 0.18%

Landform	Mapping unit	Vegetation type	Representative photograph		Other characteristic species	Area (ha) and extent (%)
Flats (clay)	GbLOW	<i>Grevillea berryana</i> low open woodland over <i>Acacia aptaneura</i> and <i>Eremophila galeata</i> mid sparse shrubland over <i>Ptilotus schwartzii</i> , <i>Aristida contorta</i> and <i>Eremophila incisa</i> low scattered forbs/tussock grasses/shrubs			<i>Acacia fuscaneura</i> <i>Acacia incurvaneura</i> <i>Acacia subcontorta</i> <i>Eragrostis eriopoda</i> <i>Eremophila forrestii</i> <i>Eriachne mucronata</i> <i>Grevillea berryana</i> <i>Hibiscus burtonii</i> <i>Psyrax rigidula</i>	32.63 ha 2.48%
Flats (stony)	SMAprLSS	<i>Senna</i> sp. Meekatharra (E. Bailey 1-26) and <i>Acacia pruinocarpa</i> low sparse shrubland			<i>Acacia minyura</i> <i>Acacia tetragonophylla</i> <i>Eremophila galeata</i> <i>Eremophila spectabilis</i> <i>Maireana triptera</i> <i>Psyrax latifolia</i> <i>Ptilotus obovatus</i>	0.65 ha 0.05%

Landform	Mapping unit	Vegetation type	Representative photograph		Other characteristic species	Area (ha) and extent (%)
Hill slopes	TLMSS	<i>Thryptomene</i> sp. Leinster (B.J. Lepschi & L.A. Craven 4362) mid sparse shrubland with <i>Acacia aptaneura</i> low scattered trees			<i>Acacia pteraneura</i> <i>Acacia subcontorta</i> <i>Eremophila demissa</i> (P1) <i>Eremophila latrobei</i> <i>Eriachne helmsii</i> <i>Eriachne mucronata</i> <i>Mirbelia rhagodioides</i> <i>Ptilotus schwartzii</i>	1.57 ha 0.12%
Not native vegetation (cleared)						49.92 ha 3.79%
TOTAL EXTENT						1,317.73 ha 100%

Definitions: (P1) – Priority 1, (P2) – Priority 2, (P3) – Priority 3, (P4) – Priority 4

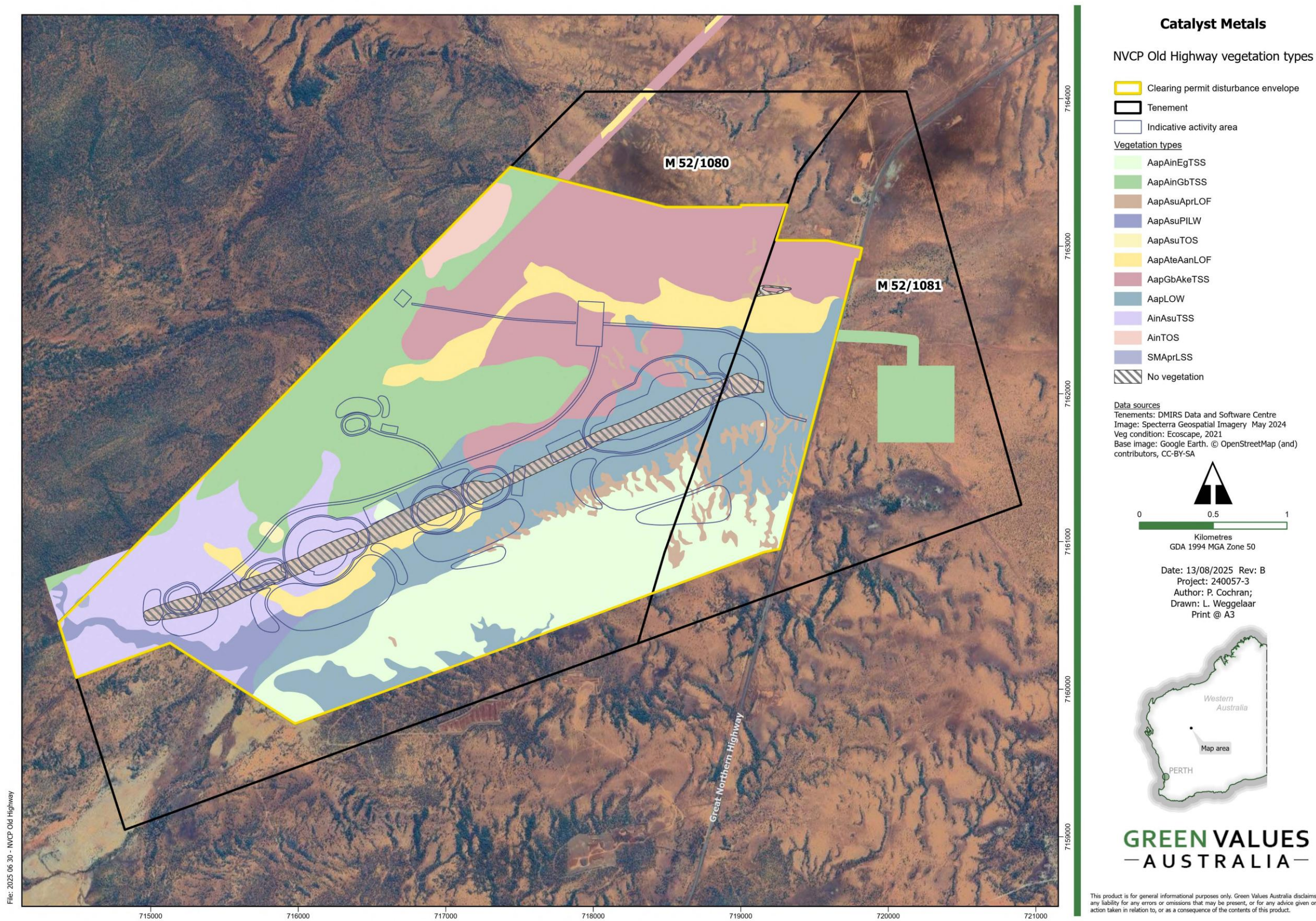


Figure 3-2: Vegetation Types within the Project Area

3.5.2 Vegetation Conditions

Vegetation condition ranges between Excellent to Completely Degraded. Most of the vegetation (>60%) was in Good to Very Good condition. The main impacts on the vegetation in the Project area are weeds, primarily *Bidens subalternans* in Mulga groves and dispersed drainage lines. The conditions of the vegetation present in the Project area are shown in Table 3-3.

Table 3-3: Vegetation Conditions (Ecoscape, 2021)

Vegetation Condition	Extent (ha)	Proportion (%)
Excellent	135.45	10.28
Very Good	442.38	33.57
Good	355.69	26.99
Poor	275.32	20.89
Degraded	58.14	4.41
Completely Degraded	0.38	0.06
Not Vegetated (cleared)	49.92	3.79
Total	1,317.28	100%

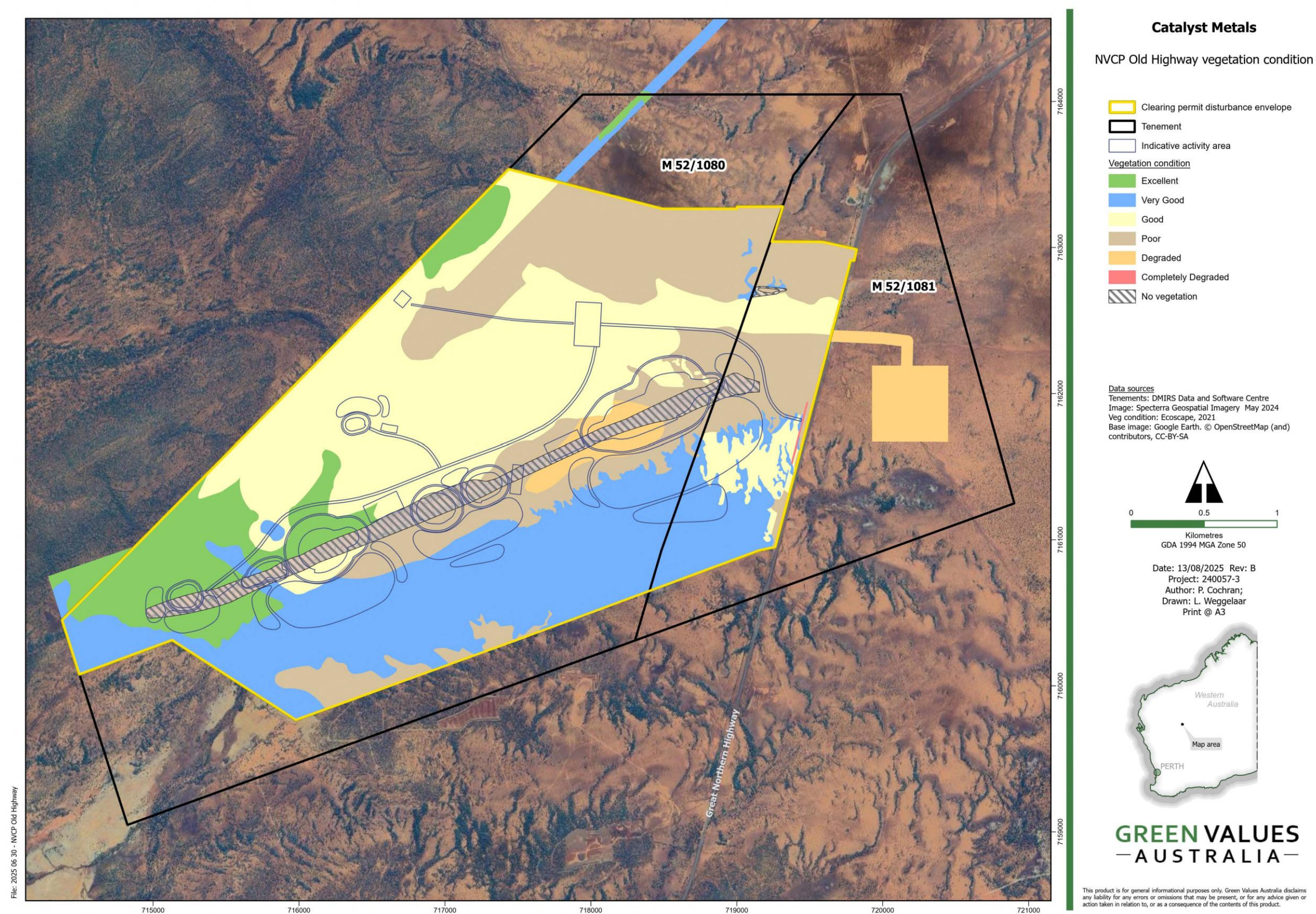


Figure 3-3: Vegetation Conditions within the Project Area

3.5.3 Conservation Significant Flora Species

Seven priority flora were recorded within the area, including (Figure 3-4):

- *Eromophila demissa* (P1);
- *Ptilotus actinocladus* (P1);
- *Indigofera fractiflexa* subsp. *Augeustensis* (P2);
- *Homalocalyx echinulatus* (P3);
- *Sida picklesiana* (P3);
- *Thryptomene* sp. *Leinster* (B.J. Lepschi & L.A. Craven 4362) (P3); and
- *Goodenia nuda* (P4).

Rhodanthe sphaerocephala (P1), although not recorded, may occur within the Project development footprint as it is an annual species. Vegetation types that were considered significant under the Flora and Vegetation Technical Guidance (EPA, 2016) include:

- Within the Robinson Range PEC (P1), vegetation types **AinTOS** occupying 15.62 ha (1.19% of the survey area), **AapAsuTOS** occupying 1.61 ha (0.12%) and **SMAprLSS** occupying 0.65 ha (0.05%).
- **CcEvHIMW**, which represents the Gascoyne River South riparian area and is important to maintain ecological integrity and provides habitat and refuge for a range of flora and fauna species. These vegetation types were historically disturbed by grazing and are unlikely to be dependent on groundwater.
- **AapAsuAprLOF** and **CcAapMOF**, which represent the sheet flow dependent (Mulga Gove) vegetation, which is important to maintain ecological integrity and provides habitat to flora and fauna. This area has historically been impacted by grazing. These vegetation types are considered common; their significance lies in their ecological function rather than rarity.
- **TLMSS**, occurring on a calcrete hill that occupied a small extent and was an unusual habitat for *Eremophila demissa* (P1) that was otherwise recorded on flats, as well as being characterised by a conservation-listed species, *Thryptomene* sp. *Leinster* (P3). For these reasons, it is considered to have an element of significance.

No threatened flora species were identified for protection under the Commonwealth Environment Protection and Biodiversity Conservation (EPBC) Act 1999 or the Western Australian Biodiversity Conservation (BC) Act. A portion of *Indigofera fractiflexa* subsp. *Augeustensis* (P2) is present where the indicative Project development footprint is and will likely be disturbed. The project does not traverse the Doolgunna calcrete groundwater assemblage. One assemblage of *Sida picklesiana* (P3) and three assemblages of *Eromophila demissa* (P1) are present in the indicative Project development footprint and will also likely be disturbed.

3.5.4 Threatened and Priority Ecological Communities

Two Threatened Ecological Communities (TECs) or PECs listed under the *Environment Protection and Biodiversity Conservation Act 1999* (Cth) (EPBC Act), or the *Biodiversity Conservation Act 2016* (WA) (BC Act), were identified during the assessment (Ecoscape, 2021) and are in proximity to the project. These are the *Robinson Range vegetation complexes (banded ironstone formation)*, PEC (P1 under the DBCA) and the *Doolgunna calcrete groundwater assemblage type on Gascoyne palaeodrainage on Doolgunna Station* (P1).

The Robinson Range PEC (P1 under the DBCA) boundary was identified as intersecting the western portion of the Old Highway survey area. Only three vegetation types were confirmed in the PEC, including AinTOS occupying 15.62 ha (1.19% of the survey area), AapAsuTOS occupying 1.61 ha (0.12%) and SMAprLSS occupying 0.65 ha (0.05%) (Ecoscape, 2021). These vegetation types within the PEC are likely to be the most significant; however, they occupy a small portion of the surveyed area. The Project avoids vegetation types AinTOS and SMAprLSS; however will likely impact vegetation type AapAsuTOS due to its proximity to the indicative open pit (Figure 3-4).

The Doolgunna Calcrete Groundwater Assemblage (DCGA) PEC is located to the northeast of the project in the riverbed of a Gascoyne River tributary. The edge of the overall PEC boundary is ~700 m from the biggest proposed open pit; however, the actual ecological community (calcrete) is located within the main channel of a tributary to the Gascoyne River, some 3 km from the pit. The PEC will not be directly impacted by the project, including groundwater level drawdown (AQ, 2021).

The vegetation types mapped in the Project area are widespread across the area and are unlikely to have specific significance regarding the PEC (Ecoscape, 2021).

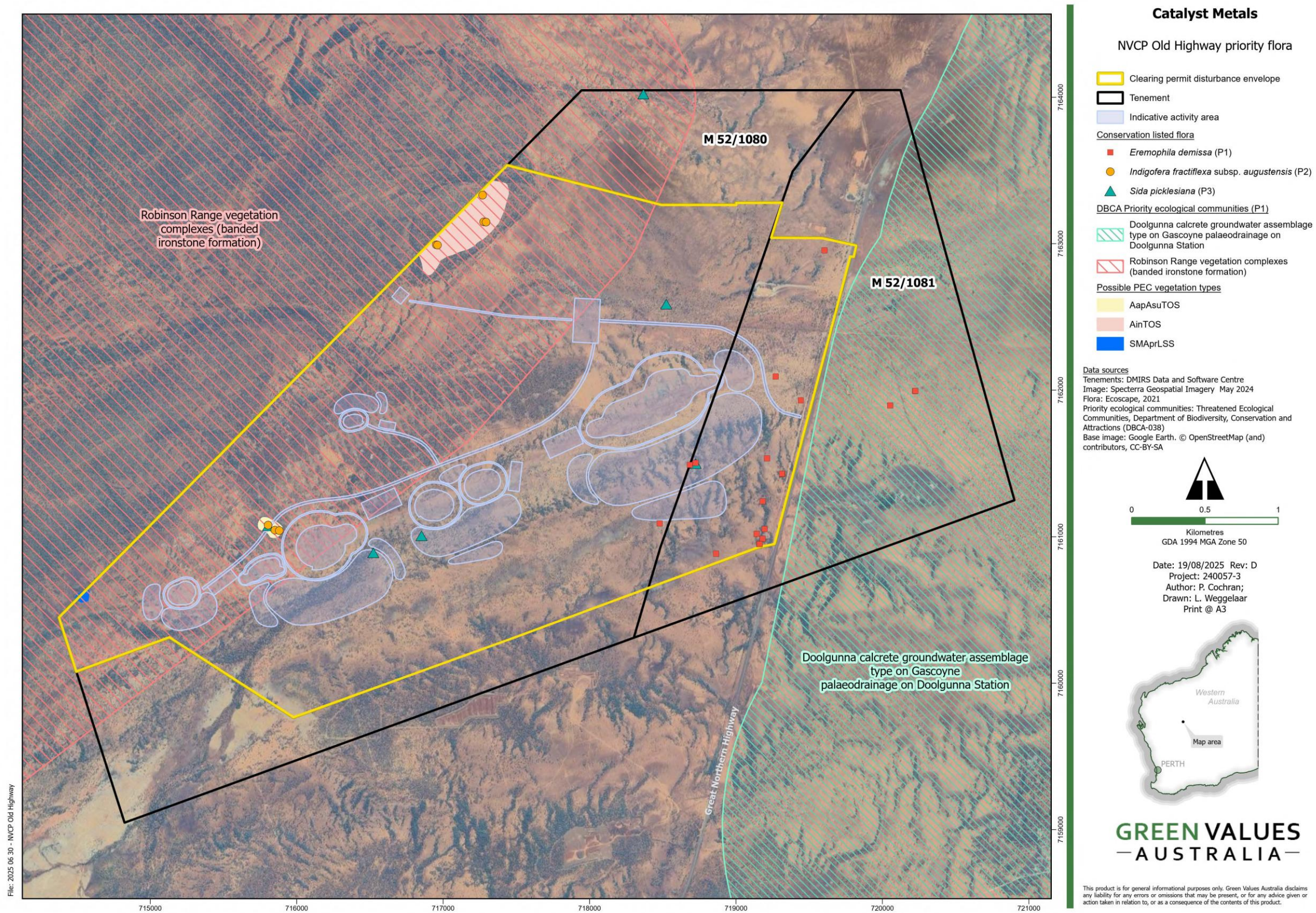


Figure 3-4: Priority Listed Flora Species and TEC/PEC

3.6 Fauna

Ecoscape (2021a) undertook a fauna survey for the Project footprint and associated haul road (to DeGrussa). Field assessments were undertaken between 6th and 16th April 2021 (Ecoscape 2021a) (refer to APPENDIX 2 for the full fauna assessment report).

Three habitat types were identified within the Project footprint that were typical of the bioregion, including:

- Mulga/Mixed Acacia shrubland (~60%, 798.07 ha)
- Stony clay plain and ridges (gibber/boulder) (~25%, 314.94 ha)
- Drainage Line (<15%, 154.8 ha)

Of particular importance was that no Hummock Grasslands were identified within the survey area, as this represents potential habitat for Brush-tailed Mulgara, Priority 4 (P4) species under the Biodiversity Conservation Act 2016. No habitat suitable for EPBC-listed species, Malleefowl or the Greater Bilby occurred within the Project footprint.

A total of 69 species have been recorded in the area, and no fauna species are listed under the EPBC Act 1999 in the study area. Ecoscape (2021b) identified three species of conservation significance likely to occur within the Project area:

- Grey Falcon (*Falco hypoleucos*) (EPBC Act Vulnerable);
- Peregrine Falcon (*Falco peregrinus*) (BC Act – OS);
- Long-tailed Dunnart (*Sminthopsis longicaudata*) (DBCA P4).

None of these species was identified during surveys. The habitat was considered not ideal for the species, except for the Grey Falcon (*Falco hypoleucos*), which may be a vagrant species. The likelihood of these species occurring in the Project area was High to Low for the Grey Falcon and Medium to Low for the Peregrine Falcon (*Falco peregrinus*) and Long-tailed Dunnart (*Sminthopsis longicaudata*).

No authorisation to take under Section 40 of the *Biodiversity Conservation Act 2016* (BC Act) is required. No referral under the *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) is required.

3.7 Short-Range Endemics

Ecoscape (2021b) completed a desktop analysis of Short-Range Endemics (SREs) as part of the fauna assessment of the study. The desktop analysis identified 19 records of potential SRE occurring within the previous 25 years outside of the survey area.

Ecoscape concluded that the survey area is exposed to climatic extremes and does not support the sheltered habitats typically favoured by many potential SRE taxa. The habitat types recorded within the survey area are well represented within the greater bioregion, further decreasing the likelihood that the survey area hosts range-restricted species such as SRE.

3.8 Subterranean Fauna

Phoenix Environmental Services (Phoenix) completed a subterranean pilot survey and risk assessment for the Project in July 2021 (Phoenix, 201).

The works included a pilot/reconnaissance subterranean fauna survey, sampling 10 bores for stygofauna and 12 bores for troglotaunal.

No stygofauna or troglotauna were recorded during the fieldwork. Lithological descriptions of the bores indicate that the majority of the study area is not a suitable habitat for subterranean fauna, as it is characterised by layers of clay and siltstone. These geological formations are not sufficiently porous to allow for the interconnected spaces holding adequate air or water that are essential for subterranean fauna survival.

Suitable habitat may be present towards the edges of the study area where it borders the Doolgunna calcrete and Robinson Range PECs; however, the proposed pits and drawdown for the Project do not overlap with these areas.

Phoenix concluded that, based on the H2 hydrogeological assessment, it was unlikely that the drawdown from dewatering would adversely affect any nearby or adjacent subterranean fauna communities.

The Doolgunna Calcrete PEC and Robinson Range PEC, located adjacent to the indicative mine pit footprint, are the closest sensitive receptors associated with the Project. The groundwater modelling for the Project does show that these areas would not be impacted; however, if groundwater drawdown exceeds the modelled extent, then the subterranean communities associated have the potential to be compromised. Ongoing monitoring is recommended.

3.9 Social Settings

3.9.1 Land Use and Community

The Project is within the Shire of Meekatharra. The Shire is sparsely populated, with an estimated population of 1,200 people. Gold mining is the largest employment industry, followed by beef cattle farming (ABS, 2021).

3.9.2 Native Title

The Project tenement M52/1080 lies within the Nharnuwangga Wajarri and Ngarlawangga (NWN) native title determination area, which is managed by the Jidi Jidi Aboriginal Corporation (JJAC) (WCD 2000/001). The Project tenement, M52/1081, and part of M52/1080, lie within the Yungunga-Nya People's native title determination area (WCD2021/008), which is managed by the Yungunga-Nya Native Title Aboriginal Corporation (YNAC). There are land access and heritage agreements in place with both the NWN and Yungunga-Nya People covering the Project area, which are still under discussion, and an agreement is in place with the Yungunga-Nya people.

3.9.3 Aboriginal Heritage

Five Aboriginal cultural heritage sites were identified within the tenement areas through a search of the Department of Planning, Lands, and Heritage (DPLH) Aboriginal Cultural Heritage Inquiry System (ACHIS) and a range of surveys (Figure 3-5). The following surveys were relevant to this Project area:

- SVR-00200928: Archaeological and Ethnographic work area and work program clearance survey of Far West Bryah, Old Highway, Peak Hill Infill, South Horse Shoe and West Bryah – Trip 5, with NWN Traditional Owners for Sandfire Resources NL (Terra Rosa, August 2019).
- Archaeological and Ethnographic site identification assessment at the Old Highway survey area – Trip 1, with NWN Traditional Owners for Sandfire Resources Limited – Trip 5 (Terra Rosa, April 2020).
- Preliminary Advice for an archaeological salvage program of DPLH ID 38333 (SAN20-01) with NWN Traditional Owners for Sandfire Resources Limited (Terra Rosa, August 2021).
- Archaeological and Ethnographic site avoidance survey of Old Highway with NWN Traditional Owners for Sandfire Resources Limited – Trip 5 (Terra Rosa, October 2021).

A search of the DPLH AHIS on 8th May 2025 identified a potential additional report not provided within the data room for the Project:

- SVR-00201499: Archaeological and ethnographic site avoidance and work area clearance survey of the Old Highway and Horseshoe Project Areas with the NWN Traditional Owners for Sandfire Resources Limited (Natalie Guetlich, Liam Hotinski, and Sarah Keiller, July 2022)

The five sites include the following:

- DPLH Site# 38333 (SAN20-01) - Sandfire obtained consent under section 18 of the Aboriginal Heritage Act (AHA), with conditions to disturb the site on the 2nd of July 2021

(Ministerial Consent 62-27143). An archaeological salvage of this site occurred between 18 – 24 August 2021. Artefacts were placed within site SAN21-02 (Protest Camp Keeping Place); this location is to the north of the project development footprint and will be avoided, as it still sits within the tenement boundary.

- DPLH Site# 38331 (SAN20-02) (water source and artefact scatter) – recorded through a site identification survey (2020). Site will be directly impacted.
- DPLH Site# 39448 (SAN21-03) – Site will be avoided.
- DPLH Site# 39446 (SAN21-04) – Site will be directly impacted.
- DPLH Site# 39447 (SAN21-05) - Site will be avoided.

Sites SAN21-03, SAN21-04 and SAN21-05 were recorded in 2021 to a site avoidance level, each place consisting of artefact scatters. A site identification survey with the JJAC was undertaken in August 2025 at DPLH Site# 39446 (SAN21-04) to further define the site. In addition, an on-country discussion was undertaken in August 2025 to discuss the proposed impact and a section 18 notice. These two sites will be directly impacted by the indicative Project development footprint; site avoidance was not feasible as the sites are in proximity to the open pits/WRD. Due to the location of the targeted deposit, the open pits could not be relocated. Following the site identification survey and subsequent section 18 consent, the cultural materials at DPLH Site# 39446 (SAN21-04) and DPLH Site# 38331 (SAN20-02) will be recovered and relocated to a keeping place, likely the Protest Camp Keeping place. Site DPLH Site# 39447 (SAN21-05) will be avoided; however, it is within the NVCP boundary and will require management measures to ensure this area is not impacted by clearing. This includes fencing off the area and awareness training.

A heritage survey over the Yugunga-Nya area is planned in the near term.

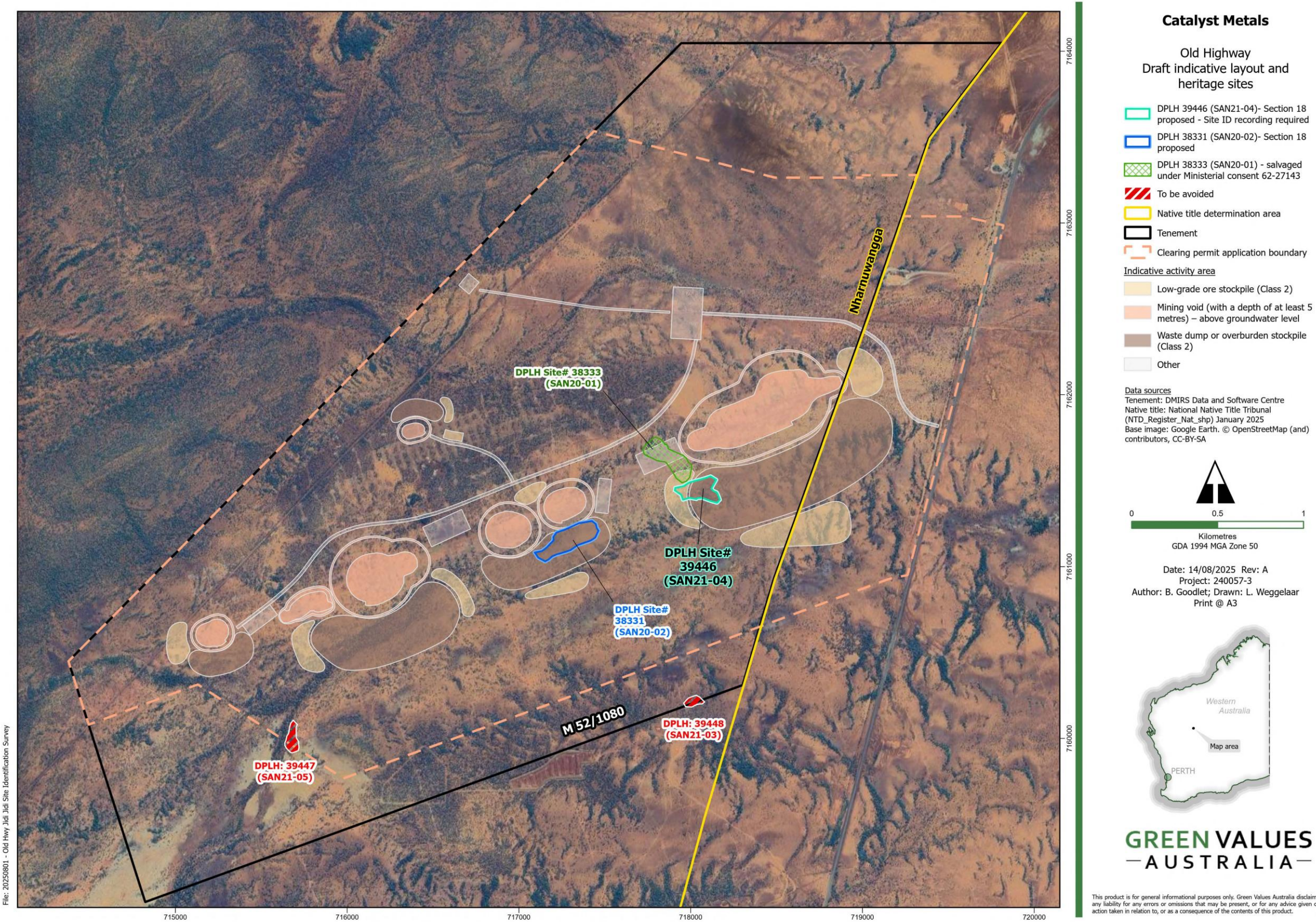


Figure 3-5: Heritage surveys and recorded sites

3.9.4 Non-Aboriginal Heritage

A search of the Heritage Council of Western Australia's State Register of Heritage Places was undertaken on 8th May 2025. The Doolgunna Station Shearing Shed is located approximately 7km southeast of the site.

4 ASSESSMENT AGAINST THE 10 CLEARING PRINCIPLES

4.1 Scale of Proposed Land Clearing

The proposed Purpose Permit Area covers an area of 250 ha of native vegetation, which will be cleared. The vegetation and flora survey undertaken by Ecoscape (2021) covered an area of 1317.28 ha, which was considered the proposed Project footprint area in 2021. Within this area, 442.38 ha of the vegetation was considered to be in 'Very Good' condition (33.57 %) (refer to Table 3-3 and Figure 3-3), followed by 355.69 ha considered to be 'Good' (26.99 %), with 135.45 ha considered to be 'Excellent' (10.28%). The remaining vegetation was 'Poor' (275.32, 20.89%), 'Degraded' (58.14 ha, 4.41%), 'Completely Degraded' (0.38 ha, 0.06%) and 'Not Vegetated (cleared)' (49.92 ha, 3.79%) (Figure 3-3).

Figure 4-1 presents the proposed Project layout in relation to environmental (flora and fauna) and heritage surveys undertaken.

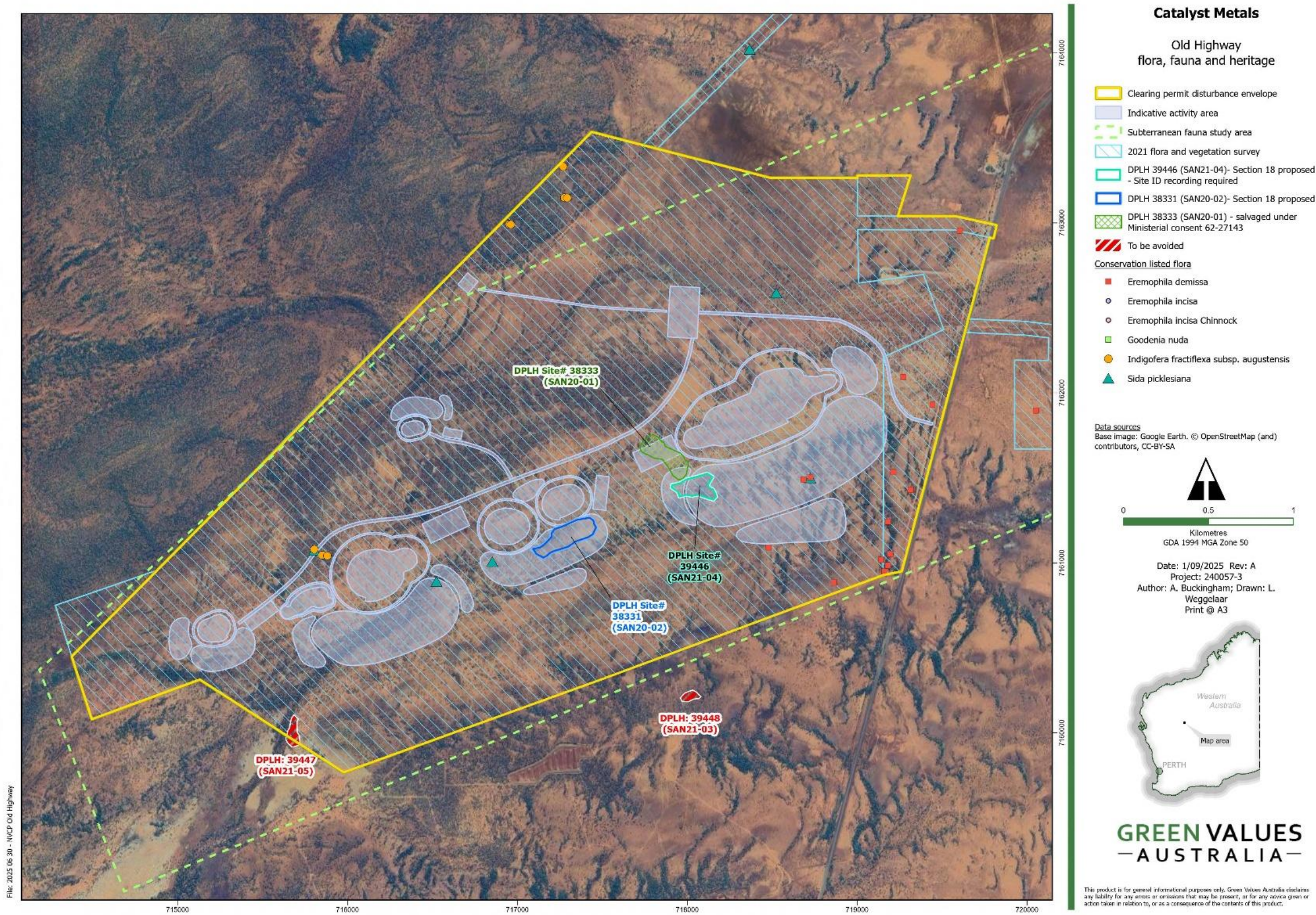


Figure 4-1: Project Layout in Relation to Environmental and Heritage Surveys

4.2 Assessment of 10 Clearing Principles

Clearing applications are to be assessed against 10 principles as outlined in *Schedule 5 of the EP Act*. These principles aim to ensure that all potential impacts resulting from the removal of native vegetation can be assessed in an integrated way and applied to all lands throughout Western Australia. The principles address the four main environmental areas of biodiversity significance, land degradation, conservation estate and ground and surface water quality.

Table 4-1 provides the assessment against the 10 clearing principles.

Table 4-1: Assessment Against the 10 Clearing Principles of Native Vegetation: Clearing of the Project

Clearing Principle	Assessment	Assessed Outcome
Biodiversity Significance		
a) Native vegetation should not be cleared if it comprises a high level of biological diversity.	<p>The vegetation to be cleared is not considered to support a high level of biological diversity.</p> <p>The vegetation communities and fauna habitats are considered to be common in the bio-region.</p> <p>No significant flora or fauna were recorded in the proposed Purpose Permit Area.</p> <p>The Robinson Range PEC (P1) consists of vegetation types AinTOS occupying 15.62 ha (1.19% of the survey area), AapAsuTOS occupying 1.61 ha (0.12%) and SMAprLSS occupying 0.65 ha (0.05%) (Ecoscape, 2021). These vegetation types cover a small area of the surveyed area, and the majority of the project will disturb poor or degraded vegetation.</p>	<p>The proposed clearing is unlikely to significantly impact the biodiversity at a local or regional level.</p> <p>Unlikely to be at variance with this principle.</p>
b) Native vegetation should not be cleared if it comprises the whole or part of, or is necessary for the maintenance of, a significant habitat for fauna indigenous to Western Australia.	<p>Three habitat types were identified within the Project footprint Mulga/Mixed Acacia shrubland, Stony clay plain and ridges (gibber/boulder) and Drainage Line.</p> <p>No conservation significant species were identified in the survey area.</p> <p>These habitats are not considered to be a significant habitat for fauna indigenous to Western Australia. The habitat identified was not suitable for significant species such as Brush-tailed Mulgara (P4), Malleefowl (VU) or the Greater Bilby (VU).</p>	<p>Unlikely to be at variance with this principle.</p>
c) Native vegetation should not be cleared if it includes, or is necessary for the continued existence of, rare flora.	<p>Seven priority flora were recorded within the area, including <i>Eromophila demissa</i> (P1), <i>Ptilotus actinocladus</i> (P1), <i>Indigofera fractiflexa</i> subsp. <i>Augeustensis</i> (P2), <i>Homalocalyx echinulatus</i> (P3), <i>Sida picklesiana</i> (P3), <i>Thyptomene</i> sp. <i>Leinster</i> (P3) and <i>Goodenia nuda</i> (P4).</p>	<p>Unlikely to be at variance with this principle.</p>

Clearing Principle	Assessment	Assessed Outcome
	<p>No rare flora or threatened flora species protected under state or federal legislation were recorded during the surveys.</p> <p>The project will avoid the priority flora species where possible, as the final infrastructure layout is still under development.</p>	
d) Native vegetation should not be cleared if it comprises the whole or a part of, or is necessary for the maintenance of, a PEC/TEC.	<p>The proposed Project and indicative infrastructure encroaches onto the Robinson Range vegetation complex (banded ironstone formation) PEC; however, the Project avoids vegetation types AinTOS and SMaprLSS but will likely impact vegetation type AapAsuTOS due to its proximity to the indicative open pit. The infrastructure layout is still under finalisation and will try to avoid PEC and priority flora where possible. Due to the position of the targeted deposit and therefore proposed open pit, it is unlikely that the infrastructure can be relocated.</p> <p>The Doolgunna calcrete groundwater assemblage type on Gascoyne palaeodrainage on Doolgunna Station is located to the east of the Project development footprint (M52/1081); however, the project avoids this PEC.</p>	Unlikely to be at variance with 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.	Vegetation of the area is not considered a remnant, with limited clearing in a vastly uncleared environment.	Unlikely to be at variance with this principle.
f) Native vegetation should not be cleared if it is growing in, or in association with, an environment associated with a watercourse or wetland.	There are no wetlands or permanent surface water features in the Project area. All drainage lines near the Project are ephemeral and remain dry for most of the year.	Not at Variance with this principle.
Land Degradation		
g) Native vegetation should not be cleared if the clearing of the	The proposed clearing of 250 ha of native vegetation for the development of the Project is not likely to cause any further significant land degradation.	Unlikely to be at variance with this principle.

Clearing Principle	Assessment	Assessed Outcome
vegetation is likely to cause appreciable land degradation.	<p>The Project is unlikely to cause significant land degradation as the survey area consists of poor (275.32 ha), degraded (58.14 ha), completely degraded (0.38 ha) and not vegetated (cleared) (49.92 ha) as delineated by Ecoscape, 2021 (refer to Table 3-3 and Figure 3-3). The Project will look to avoid natural and undisturbed areas where possible. Most of the indicative Project development footprint will likely be over-degraded, poor or good vegetation.</p> <p>Management measures will be developed and include measures for erosion, weeds, biodiversity loss and rehabilitation.</p> <p>Note: this is indicative as the final Project layout is still to be finalised.</p>	
Conservation Estate		
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.	There is no conservation estate in the immediate vicinity.	Not at Variance with this principle.
Ground and Surface Water Quality		
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.	<p>The closest watercourse to the Project is the Gascoyne River tributarly and there are minimal drainages in the Project area. The Project is not located in proximity to any public drinking water sources.</p> <p>Surface water and groundwater resources are unlikely to be significantly impacted by the Project. Surface water management measures will be implemented where required to divert the water flow away from mining infrastructure and ensure no contact water is released into the environment.</p>	Not at Variance with this principle.
j) Native vegetation should not be cleared if clearing the vegetation is likely to cause, or exacerbate, the incidence of flooding.	The proposed Purpose Permit Area is not located within any major drainage lines or watercourses. Therefore, clearing is not expected to alter the hydrological regime of the area, leading to an increase in the frequency or intensity of flooding. Any flooding will be managed through a surface water management plan.	Not at Variance with this principle.

Clearing Principle	Assessment	Assessed Outcome
	A Surface Water Assessment and floodline modelling is being undertaken to ensure that the final Project infrastructure layout is not in the direct line of watercourses or potential flooding events.	

5 REHABILITATION

Rehabilitation is the return of disturbed land to a safe, stable, productive, non-polluting and self-sustaining condition in consideration of beneficial uses of the land. Appropriate rehabilitation will ensure that the long-term impacts of mining in the area are minimised. Rehabilitation will be implemented progressively and in conjunction with Catalyst's Plutonic. Rehabilitation of disturbed areas will generally involve:

- Design of landforms to produce safe and stable slopes.
- Design of landforms to manage water, including the construction of water management strategies.
- If required and subject to available material, armouring of final surfaces with cover material to increase surface stability.
- Replacement of available topsoil and vegetation.
- Ripping along the contour to break soil compaction and increase water infiltration ability.
- Seeding/planting with local provenance native species and fertilising as required.
- Monitoring to measure progress against meeting closure criteria.

Rehabilitation, closure monitoring and maintenance programs will be undertaken as described in the Mine Development and Closure Plan, with the objectives of ensuring the success of rehabilitation works, identifying the need for any maintenance works and demonstrating achievement of completion criteria.

6 STAKEHOLDER ENGAGEMENT

A register of the Stakeholder Engagement associated with Old Highway has been developed and maintained as an ongoing stakeholder engagement management tool. The key engagement is presented in Table 6-1 below.

Table 6-1: Key Stakeholder for the Purpose Permit Area

Date	Relevant Project	Stakeholder	Stakeholder Representative	CYL Representative	Engagement Type	Key Topic/s	Details
18-Dec-23	Catalyst General	Jid Jidi Aboriginal Corporation	JJAC Board of Directors	James Champion de Crispigny	Written Correspondence	Letter of Introduction	Letter from JCdC Advising JJAC Catalyst acquisition of Superior Gold (Billabong Gold) Proposal to arrange a meeting with JJAC Board early 2024. Commitment by Catalyst to work positively with JJAC and ensure cultural heritage is protected.
27-Feb-24	Catalyst General	Houston Legal	Rob Houston	Craig Dingley (Catalyst)	Telephone Call	Other	Call with Rob to indicate Catalyst's preparedness to sign compensation deed. Request engagement with Jidi Jidi to progress surveys on Hermes. Rob suggested a follow-up email, which he would share with the group
9-Sep-24	Catalyst General	Jid Jidi Aboriginal Corporation	JJAC Board of Directors	Craig Dingley (Catalyst) Rob Buchanon (Catalyst)	Face to Face Meeting	Mine Planning, Operations &/or Infrastructure	CYL/JJAC Annual Meeting. Items covered include: Heritage Agreement Deed of Variation Deed of Settlement Projects update inc Hermes Surveys Update Tenement access arrangement Employment, contracts, training opportunities Tenement payments Review of Agreement
11-May-25	Plutonic	Jid Jidi Aboriginal Corporation	JJAC Board Directors	Craig Dingley (Catalyst)	Face-to-Face Meeting	Project Update	Site Visit by JJAC Directors to Plutonic Mine and update presentation and discussion inc. Plutonic growth plans and Jidi Jid feedback Hermes project update Old Highway project update Site visit
11-May-25	Catalyst General	Jid Jidi Aboriginal Corporation	JJAC Board of Directors	Craig Dingley (Catalyst)	Site Visit	Project Update	Site Visit (Annual Meeting) of JJAC Directors to Plutonic Mine Inc. project update presentation. Topics covered: Plutonic growth plans JJAC feedback Hermes project update Old Highway project update Site visit
28-Jul-25	Hermes	Jid Jidi Aboriginal Corporation	Jeremiah Riley	Craig Dingley (Catalyst)	E-mail	Cultural Heritage Survey	Request to meet with JJAC to discuss heritage surveys for Hermes licences E52/1668 & E52/1678 to conduct exploration drilling
1-Aug-25	Old Highway	Jid Jidi Aboriginal Corporation	Jeremiah Riley	Craig Dingley (Catalyst)	E-mail	Cultural Heritage Survey	Response to JJAC survey availability Request for survey 18-23 Aug to be conducted at Old Highway.
6-Aug-25	Old Highway	Jid Jidi Aboriginal Corporation	Jeremiah Riley	Mikayla Banks (Green Values)	E-mail	Cultural Heritage Survey	Heritage Survey Request correspondence - Old Highway including: Heritage Notice, including a map, outlining the heritage requirements. Letter - providing context and Catalysts' intention to lodge a section 18 notice per the Land Access Deed between the parties Spatial data for the two heritage places subject to the heritage notice and proposed section 18. PDF of map

Date	Relevant Project	Stakeholder	Stakeholder Representative	CYL Representative	Engagement Type	Key Topic/s	Details
7-Aug-25	Old Highway	Other (please detail)	Coral Montero-Lopez	Mikayla Banks (Green Values)	E-mail	Cultural Heritage Survey	Survey the scope of work and shape files.
7-Aug-25	Old Highway	Jid Jidi Aboriginal Corporation	Jeremiah Riley	Mikayla Banks (Green Values)	Telephone Call	Cultural Heritage Survey	Discussion on Old Highway Heritage Survey scope, impact of planned activities and CYL's intentions to undertake the Section 18 application process in consultation with JJAC JJAC is ok with the survey scope and information shared regarding Section 18 application
11-Aug-25	Old Highway	Jid Jidi Aboriginal Corporation	Jeremiah Riley	Mikayla Banks (Green Values)	E-mail	Cultural Heritage Survey	Provision of a quote for Old Highway Heritage Survey
13-Aug-25	Old Highway	Jid Jidi Aboriginal Corporation	Jeremiah Riley	Brad Goodlet (Green Values)	E-mail	Cultural Heritage Survey	Email response to JR that whilst some items exceed cost schedule in HA, CYL is ok to proceed as per the quotation. Clarification that salvage works won't be undertaken during the survey CYL requests to review HA cost schedule with JJAC t reflect 2025 expectations Clarification to be sought that the survey is Site Identification not Work Area Clearance as per the quote Clarification of TOs attending survey and logistics - travel, accommodation, timing Pre-start meeting (Catalyst, JJAC, Terra Rosa) organised for 14 Aug. Responses/clarifications received from Jeremiah and Coral
14-Aug-25	Old Highway	Jid Jidi Aboriginal Corporation	Jeremiah Riley Coral Montero-Lopez Dan Monks (Terra Rosa)	Brad Goodlet (Green Values)	Telephone Call	Cultural Heritage Survey	Pre-start meeting to discuss Survey scope and objectives Logistics and organisation TOs attending the survey WHS and induction Timing and accommodation Items as agreed upon are provided in the meeting minutes sent to attendees.

Date	Relevant Project	Stakeholder	Stakeholder Representative	CYL Representative	Engagement Type	Key Topic/s	Details
18-Aug-25	Old Highway	Jid Jidi Aboriginal Corporation	NWN Traditional Owners - Leonard Smith (Snr) Phillip Robinson (Snr) Latisha Smith Bobbi-Lee Robinson Cheryl-Rose Riley Trisha Robinson Garry "Cowboy" Robinson (Snr) Brent Culshaw (TR Archaeologist) Sophie Lee (TR Archaeologist)	Anthony Buckingham (Catalyst) Brad Goodlet (Green Values)	Site Visit	Cultural Heritage Survey	<p>Old Highway Site Identification Survey on tenement M52/1080 . Scope included: DPLH Lodged site 39446 (SAN21-04) was recorded to site avoidance level in August 2021 and reported to be an artefact scatter, associated with 38333 (SAN20-01).</p> <p>Catalyst Metals disturbance footprint for the Old Highway Project will impact sites 38331 (SAN20-02) and 39446 (SAN21-04)</p> <p>Key survey activities included:</p> <ol style="list-style-type: none"> 1. Site identification recording of 39446 (SAN21-04), to support a section 18 notice under the Aboriginal Heritage Act. 2. On Country validation of outcomes recorded in Site Identification Survey Report of DPLH Site #38331 (SAN20-02) 3. On Country inspection of DPLH Site #38333 (SAN20-01) with TOs for which salvage of Aboriginal Heritage objects was completed by TOs and Terra Rosa during Sandfire Resources ownership of tenement in March 2025 4. Visit to Protest Camp Keeping Place with TOs where salvaged material (approx. 3000 artefacts) from Site#38333 (SAN20-01) has been relocated 5. On Country discussion with TOs regarding Catalyst Metals intention to lodge a section 18 over both 38331 (SAN20-02) and 39446 (SAN21-04), so that management strategies and processes can be agreed and documented between the parties. <p>Heritage consultants with TOs identified Aboriginal objects across the site, including stone tool core, flakes, scraping and cutting artefacts and a large grinding stone</p> <p>Discussions were held with Jidi Jidi Knowledge Holders about proposed future mining activities that CYL intends to undertake on M521080 and M52/1081. This included sharing maps and information about mine site layout and infrastructure Catalyst to liaise with JJAC to arrange for Jidi Jidi Rangers or TO members to reflag with pink and black striped heritage tape or sleeves, the star pickets that demarcate Sites #38333 (AN20-01), 39446 (SAN21-04) and 38331 (SAN 20-02). The existing plastic chain and tape has perished and the sites not as well marked as they could be. Whilst not visited during survey, Sites 39447(SAN21-05) and 39448(SAN21-03) should also be taped if star pickets have been installed at these places</p> <p>As planned activities will impact #38333 (SAN20-01) and 38331 (SAN 20-02), Catalyst's intention to seek Section 18 approval was discussed and measure were discussed for how the sites will be managed by salvage and relocation to a Keeping Place were identified.</p>
20-Oct-25	Hermes	Jid Jidi Aboriginal Corporation	Leonard Smith (Snr) Phillip Robinson (Snr) Garry "Cowboy" Robinson (Snr) Gracelyn Robinson Aleshia Smith (21 Oct) Leticia Smith (20,22 Oct) Valdaris Mippy	Brad Goodlet (Green Values) Paul Quigley Helen Barling	On-country Survey	Cultural Heritage Survey	<p>Survey (20-23 Oct) conducted by JJAC and Terra Rosa</p> <p>Survey for future exploration program of:</p> <p>Hermes South – 28.8ha – Priority 1 (completed)</p> <p>Hermes Central – 106.1ha – Priority 2 (completed)</p> <p>Hermes North – 32.3ha – Priority 3 (completed)</p> <p>TOTAL 167.2ha Plus access as required</p> <p>Scope included work area survey and access tracks to activity area.</p> <p>Minimal isolated Heritage objects located and no sites identified</p> <p>Findings and recommendations to be included in Heritage Report to be provided by Terra Rosa Heritage Consultants</p>

Date	Relevant Project	Stakeholder	Stakeholder Representative	CYL Representative	Engagement Type	Key Topic/s	Details
			Stewart Robertson(23 Oct)				
13-May-25	Old Highway	Yugunga Nya Aboriginal Corporation	Martie Oosthuizen	Shannon Bamforth (Catalyst)	E-mail	TO Engagement/Liaison	Invite to meet YNAC CEO Dale Brown
20-May-25	Old Highway	Yugunga Nya Aboriginal Corporation	Martie Oosthuizen	Craig Dingley (Catalyst)	E-mail	TO Engagement/Liaison	Request for Catalyst Exec Team to meet with Dale Brown Meeting arranged for 1/9/2025 YNAC receptive to working with Catalyst on Heritage Surveys The expectation of YNAC is for Catalyst to enter a new Heritage Agreement to replace the current arrangement
26-May-25	Old Highway	Yugunga Nya Aboriginal Corporation	Sandfire Resources Lisa Maher - Manager - Heritage & Community Engagement	Shannon Bamforth (Catalyst)	E-mail	TO Engagement/Liaison	E-Introduction of Catalyst to Martie Oosthuizen - YNAC Ops Manager
26-Sep-25		Yugunga Nya Aboriginal Corporation	Martie Oosthuizen	Sarah Winton (Catalyst)	E-mail	Heritage Agreement	Advice from YNAC that the group doesn't recognise current agreement or that it is bound by its terms. YNAC considers the current agreement is outdated and was not negotiated by PBC or determined NT holders. Request by YNAC for discussions to be initiated with Catalyst to negotiate a new agreement
8-Oct-25		Yugunga Nya Aboriginal Corporation	Martie Oosthuizen	Sarah Winton (Catalyst)	E-mail		E-mail from Catalyst acknowledging YNAC's position re current agreement and meeting outcomes. Seeking understanding/clarification related to: 1. Clause 25.11 of Amended and Restated LAA re agreement is assumed by NT Claim Group upon determination of NT. 2. Signed YN people in Agreement being the named applicants in the NT Determination Acknowledgement of YN concerns regarding Agreement needing to reflect updated standards of engagement, heritage protection and enviro assessment. Offer by Catalyst to work with YNAC to revise specific terms of current agreement to address concerns Desire by Catalyst to have positive relationship with YNAC and for actions of previous tenement holders to not be approach adopted by the company

7 CONCLUSION

Catalyst wishes to start mining operations at the old Highway deposit, with mined material hauled to their operating mine, Plutonic Gold Mine, for processing.

The Project is proposed to clear 250 ha of native vegetation with 1138.7 ha of Purpose Permit Area. The proposed clearing was assessed against the 10 clearing principles and is unlikely to be at variance with the EP Act Schedule 5 clearing principles. The Project will result in the loss of some P1 vegetation, located within the disturbance footprint. Priority species will be avoided as far as practicable.

There are no flora or fauna significant species that were identified during the survey and are likely to reside in the Project area. The Robinson Range PEC (P1) boundary is present in a portion of the Project surveyed area; however, the project will avoid vegetation types AinTOS and SMaprLSS but will likely impact vegetation type AapAsuTOS due to its proximity to the indicative open pit. The project will avoid directly impacting the BCGA and dewatering activities are unlikely to impact the calcrete; only minor changes to the water levels in the shallow surficial aquifer will result from groundwater extraction. The indicative Project development footprint is located on degraded, poor or good vegetation and will not result in the significant loss of very good or excellent vegetation.

Catalyst is committed to implementing management measures and rehabilitation to minimise the impacts on native vegetation.

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APPENDIX 1. VEGETATION AND FLORA ASSESSMENT (ECOSCAPE 2021)

OLD HIGHWAY AND PROPOSED HAUL ROUTE FLORA AND VEGETATION SURVEY

Sandfire Resources

ecoscape



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TABLE OF CONTENTS

Acknowledgements	1
Executive Summary.....	2
Acronyms and Abbreviations.....	5
1 Introduction	6
1.1 Background	6
1.2 Survey Area.....	6
1.3 Survey requirements.....	7
1.4 Compliance.....	7
2 Desktop Assessment	8
2.1 Physical Environment.....	8
2.1.1 Climate.....	8
2.1.2 Land Systems	9
2.1.3 Wetlands and Drainage	9
2.1.4 Groundwater Dependent Ecosystems.....	9
2.1.5 Environmentally Sensitive Areas	10
2.1.6 Conservation Lands	10
2.1.7 Land Use History.....	10
2.2 Biological Environment	10
2.2.1 Biogeographic Region	10
2.2.2 Pre-European Vegetation	10
2.2.3 Threatened and Priority Ecological Communities	11
2.2.4 Threatened and Priority Flora	11
2.3 Relevant Literature.....	13
2.3.1 Previous Surveys	13
2.3.2 IBSA Data Search	13
3 Methods.....	14
3.1 Survey Aims	14
3.2 Guiding Principles.....	14
3.3 Flora and Vegetation Field Survey	14
3.3.1 Field Survey Methods	14
3.3.2 Statistical Analysis.....	16
4 Field Survey Results	17
4.1 Flora.....	17
4.1.1 Flora Inventory.....	17
4.1.2 Conservation-listed Flora	17
4.1.3 Other Significant Flora	22
4.1.4 Taxonomic Note	22
4.1.5 Introduced Flora	22

4.2	Vegetation	23
4.2.1	Vegetation Types	23
4.2.2	Vegetation Significance	36
4.2.3	Floristic Analysis.....	36
4.2.4	Vegetation Condition	37
4.2.5	Adequacy of Survey	37
4.3	Botanical Limitations.....	38
5	Discussion	41
5.1	Flora Significance.....	41
5.1.1	Local and Regional Assessment of Flora Significance.....	41
5.2	Vegetation Significance	44
5.2.1	Priority Ecological Communities	45
5.2.2	Other Significant Vegetation	46
5.2.3	Local and Regional Assessment of Vegetation Significance	47
5.2.4	Vegetation Condition	48
6	Conclusions.....	49
	References	51
	Maps.....	55
	Appendix One Legislative Context, Definitions and Criteria	77
	Commonwealth Environment Protection and Biodiversity Conservation Act 1999.....	77
	Western Australian Environmental Protection Act 1986	78
	Western Australian Biodiversity Conservation Act 2016	79
	Priority-listed Flora and Fauna	79
	Threatened and Priority Ecological Communities	81
	Flora Criteria.....	84
	Other Significant Flora	84
	Introduced Flora.....	84
	Vegetation Criteria.....	84
	Other Significant Vegetation.....	84
	Environmentally Sensitive Areas.....	86
	Conservation Estate	86
	Appendix Two Field Survey Criteria	87
	Appendix Three Desktop Assessment Results and Likelihood Assessments	89
	Appendix Four Field Survey Results.....	91
	Appendix Five Floristic Quadrat Data	96
	Appendix Six Floristic Analysis Dendrogram	263
	Addendum: Old Highway Extension Survey	263

Introduction	263
Methods	263
Results	263
Vegetation Types	263
Vegetation Condition.....	264
Conservation-listed Flora	265
Discussion	266

FIGURES

Figure 1: Survey area location	6
Figure 2: Rainfall and temperature data for the survey area (BoM 2021a)	8
Figure 3: Species accumulation curve	37
Figure 4: Rainfall deciles for the 6 months prior to the field survey (BoM 2021c)	40
Figure 5: DeGrussa rainfall (Ben McLernon, Sandfire Resources <i>pers. comm.</i>).....	40
Figure 6: Floristic analysis dendrogram	263

TABLES

Table 1: Acronyms and abbreviations	5
Table 2: Land systems (DPIRD 2020).....	9
Table 3: Pre-European vegetation association representation (DBCA 2019a)	11
Table 4: TECs and PECs identified by PMST and DBCA database searches	11
Table 5: Categories for likelihood of occurrence of TF and PF.....	12
Table 6: PF recorded during the field survey.....	18
Table 7: Vegetation types.....	24
Table 8: Vegetation condition	37
Table 9: Botanical limitations.....	38
Table 10: EPBC Act categories for flora, fauna and ecological communities	77
Table 11: Conservation codes for Western Australian flora and fauna (DBCA 2019b).....	79
Table 12: DBCA definitions and criteria for TECs and PECs (DEC 2013)	82
Table 13: NVIS structural formation terminology, terrestrial vegetation (NVIS Technical Working Group & DotEE 2017)	87
Table 14: NVIS height classes (NVIS Technical Working Group & DotEE 2017)	88
Table 15: Vegetation condition scale for the Eremaean and Northern Botanical Provinces (EPA 2016)	88

Table 16: Flora database search results, habitat and likelihood assessment..... 89

Table 17: Flora inventory (site x species matrix)..... 91

MAPS

Map 1: Soil landscapes..... 56

Map 2: Pre-European vegetation associations 57

Map 3: Flora and ecological communities database search results..... 58

Map 4: Vegetation types, quadrat and conservation-listed flora..... 59

Map 5: Vegetation condition..... 68

IMAGES

Image 1: *Eremophila demissa* flowers.....265

Image 2: Small shrubs are mostly dead *Eremophila demissa*.....265

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EXECUTIVE SUMMARY

Sandfire Resources Limited (Sandfire) operates the DeGrussa Copper-Gold Mine and satellite Monty underground mine in Western Australia's Gascoyne region. Sandfire is conducting exploration activities in the vicinity of these mines and appointed Ecoscape to conduct flora, vegetation and fauna surveys of a number of areas of current interest. This report documents the findings of a Detailed flora and vegetation survey undertaken in the Old Highway project area and proposed off-highway haul route. In 2019 Ecoscape conducted a Reconnaissance level flora and vegetation survey of part of the Old Highway survey area.

The desktop assessment identified the following significant findings:

- the survey area intersects the Gascoyne River South along the proposed haul route. However, there is only a moderate potential for this area to represent a Groundwater Dependent Ecosystem.
- the survey area intersects the mapped extents of the *Robinson Range vegetation complexes (banded ironstone formation)* P1 Priority Ecological Community
- 41 Threatened Flora (TF) and Priority Flora (PF) species have been recorded from within 100 km of the survey area
- one P1 species has been previously confirmed within the survey area (*Rhodanthe sphaerocephala*)
- Ecoscape's 2019 survey also identified *Eremophila demissa* (P1), *Indigofera fractiflexa* subsp. *augustensis* (P2) and *Goodenia nuda* (P4) from the Old Highway survey area
- a further two P1 (*Eucalyptus semota*, *Ptilotus actinocladus*), three P3 (*Homalocalyx echinulatus*, *Sida picklesiana*, *Thryptomene* sp. Leinster (B.J. Lepschi & L.A. Craven 4362) and one P4 (*Dodonaea amplisemina*) were identified as having a Possible (high) likelihood of occurring based on the information available at desktop stage.

The Detailed flora and vegetation survey of 1,317.73 ha was conducted during March/April 2021.

The significant findings of the field survey identified:

- 182 vascular flora species from 88 floristic quadrats, supplemented by an additional 10 species from seven quadrats recorded during Ecoscape's 2019 survey of part of Old Highway
- seven PF were recorded:
 - *Eremophila demissa* (P1)
 - *Ptilotus actinocladus* (P1)
 - *Indigofera fractiflexa* subsp. *augustensis* (P2)
 - *Homalocalyx echinulatus* (P3)
 - *Sida picklesiana* (P3)
 - *Thryptomene* sp. Leinster (B.J. Lepschi & L.A. Craven 4362) (P3)
 - *Goodenia nuda* (P4)
- of the conservation-listed flora considered as possibly occurring but not recorded during the field survey, *Eucalyptus semota* was re-evaluated as unlikely to occur and *Dodonaea amplisemina* was retained its possible likelihood. *Rhodanthe sphaerocephala* was not recorded but may occur as it is an annual species and may not always be present or identifiable.
- 22 vegetation types:
 - **AapAinEgTSS:** *Acacia aptaneura*, *Acacia incurvaneura* and *Eremophila galeata* tall sparse shrubland
 - **AapAinGbTSS:** *Acacia aptaneura*, *Acacia incurvaneura* and *Grevillea berryana* tall sparse shrubland
 - **AapAptAcuLOW:** *Acacia aptaneura*, *Acacia pteraneura* and *Acacia cuspidifolia* low open woodland
 - **AapAsuAprLOF:** *Acacia aptaneura*, *Acacia subcontorta* and *Acacia pruinocarpa* low open forest
 - **AapAsuPILW:** *Acacia aptaneura*, *Acacia subcontorta* and *Psydrax latifolia* low woodland
 - **AapAsuTOS:** *Acacia aptaneura* and *Acacia subcontorta* tall open shrubland
 - **AapAteAanLOF:** *Acacia aptaneura*, *Acacia tetragonophylla* and *Acacia aneura* low open forest
 - **AapGbAkeTSS:** *Acacia aptaneura*, *Grevillea berryana* and *Acacia kempeana* tall sparse shrubland
 - **AapLOW:** *Acacia aptaneura* low open woodland

- **AbuApyAmaTOS**: *Acacia burkittii*, *Acacia pyrifolia* var. *pyrifolia* and *Acacia macraneura* tall open shrubland
- **AinAsuTSS**: *Acacia incurvaneura* and *Acacia subcontorta* tall sparse shrubland
- **AinLOW**: *Acacia incurvaneura* low open woodland
- **AinTOS**: *Acacia incurvaneura* tall open shrubland
- **AprLW**: *Acacia pruinocarpa* low woodland
- **AptAapAsuTOS**: *Acacia pteraneura*, *Acacia aptaneura* and *Acacia subcontorta* tall open shrubland
- **AptLOW**: *Acacia pteraneura* low open woodland
- **AteAapAinTSS**: *Acacia tetragonophylla*, *Acacia aptaneura* and *Acacia incurvaneura* tall sparse shrubland
- **CcAapMOF**: *Corymbia candida* and *Acacia aptaneura* mid open forest
- **CcEvHIMW**: *Corymbia candida*, *Eucalyptus victrix* and *Hakea lorea* subsp. *lorea* mid woodland
- **GbLOW**: *Grevillea berryana* low open woodland
- **SMAprLSS**: *Senna* sp. Meekatharra (E. Bailey 1-26) and *Acacia pruinocarpa* low sparse shrubland
- **TLMS**: *Thryptomene* sp. Leinster (B.J. Lepschi & L.A. Craven 4362) mid sparse shrubland.

The vegetation condition ranged from Excellent to Completely Degraded, with the majority (60.57%) in Good-Very Good condition.

The following vegetation types were considered significant:

- vegetation types occurring within the mapped extent of the Robinson Range PEC:
 - **AinTOS** that floristically and visually resembles the 'Robinson Range community group 3' and occurs on banded ironstone
 - **AapAsuTOS** that was confined to a single area of two quartzite knolls; no similar landforms were observed elsewhere in the survey area
 - **SMAprLSS** that was confined to a small area of ironstone conglomerate; no similar soil or vegetation structure were observed elsewhere in the survey area
 - other vegetation types within the mapped extent of the PEC were not considered significant as they were widespread elsewhere in the survey area and beyond
- sheet flow dependent (Mulga grove) vegetation: **AapAsuAprLOF** and **CcAapMO** were considered significant due to their historical impact from threats, ecological function and role as a refuge
- riparian vegetation: **CcEvHIMW** was considered significant due to its historical impact from threats, ecological function and role as a refuge. However, it is unlikely to represent a Groundwater Dependent Ecosystem.
- vegetation type **TLMS** was considered significant as it occurred on a calcrete hill that occupied a small extent and was unusual habitat for *Eremophila demissa* (P1) that was otherwise recorded on flats, and was characterised by a Priority-listed species *Thryptomene* sp. Leinster (B.J. Lepschi & L.A. Craven 4362) (P3).

Addendum: Old Highway Extension Survey

Following the field survey Sandfire identified that, for safety reasons, it had to move the proposed highway crossing area necessitating a survey of an additional area between Old Highway and Great Northern Highway. As the vegetation was contiguous with that of the previous survey, this survey documented the vegetation of the extension area through 14 descriptive relevés and included searches for conservation-listed flora.

The field survey of the extension area was conducted on 6 August 2021. The key findings from the extension area were:

- the vegetation types within the survey area extended to the east into the extension area, with vegetation types **AapAinEgTSS**, **AapAsuAprLOF** (Mulga groves), **AapAteAanLOF**, **AapGbAkeTSS** and **AapLOW** occurring in the extension area
- the vegetation ranged in condition from Completely Degraded (close to Great Northern Highway) to Very Good

- *Eremophila demissa* occurred mostly towards the south of the extension area with only sparse occurrences towards the north.

Population estimates for conservation-listed flora within the main report have been amended to take into consideration the findings of the Old Highway extension survey and an additional targeted survey of East Shed Well, conducted on 5 August 2021.

ACRONYMS AND ABBREVIATIONS

Table 1: Acronyms and abbreviations

Acronyms	
BAM Act	Western Australian <i>Biosecurity and Agriculture Management Act 2007</i>
BC Act	Western Australian <i>Biodiversity Conservation Act 2016</i>
BoM	Bureau of Meteorology
C1, C2, C3	Declared Pest categories under the BAM Act
CALM	Western Australian Department of Conservation and Land Management (1985-2006, now DBCA)
CR	Critically Endangered (listed under Commonwealth EPBC Act and/or Western Australian BC Act)
DAWE	Commonwealth Department of Agriculture, Water and Environment (2020-)
DBCA	Western Australian Department of Biodiversity, Conservation and Attractions
DEC	Western Australian Department of Environment and Conservation (2006-2013, now DBCA)
DPaW	Western Australian Department of Parks and Wildlife (2013-2017, now DBCA)
DotEE	Commonwealth Department of the Environment and Energy (2016-2020)
DPIRD	Western Australian Department of Primary Industries and Rural Development
DWER	Western Australian Department of Water and Environmental Regulation
EN	Endangered (listed under Commonwealth EPBC Act and/or Western Australian BC Act)
Ecoscape	Ecoscape (Australia) Pty Ltd
EP Act	Western Australian <i>Environmental Protection Act 1986</i>
EPA	Western Australian Environmental Protection Authority
EPBC Act	Commonwealth <i>Environment Protection and Biodiversity Conservation Act 1999</i>
GDA 94	Geographic Datum of Australia 1994
GDE	Groundwater Dependent Ecosystem
GPS	Global Positioning System
ha	hectare/hectares
IBRA	Interim Biogeographic Regionalisation for Australia
IDE	Inflow Dependent Ecosystem
IUCN	International Union for Conservation of Nature
km	kilometre/kilometres
m	metre/metres
NVIS	National Vegetation Inventory System
MNES	Matters of National Environmental Significance
P; P1, P2, P3, P4, P5	Priority Flora species rankings (P1-P4) or Priority Ecological Communities (P1-P5)
PEC	Priority Ecological Community
PF	Priority Flora
PMST	Protected Matters Search Tool (hosted by DAWE, used to search for MNES)
sp.	Species (generally referring to an unidentified taxon or when a phrase name has been applied)
subsp.	Subspecies (infrataxon)
TEC	Threatened Ecological Community
TF	Threatened Flora (formerly termed Declared Rare Flora, DRF, in Western Australia)
var.	Variety (infrataxon)
VU	Vulnerable (listed under Commonwealth EPBC Act and/or Western Australian BC Act)
WAH	Western Australian Herbarium
WAOL	Western Australian Organism List
WoNS	Weeds of National Significance
*	Introduced flora species (i.e. weed)

1 INTRODUCTION

1.1 BACKGROUND

Sandfire Resources Limited (Sandfire) is an Australian mining and exploration company that operates the DeGrussa Copper-Gold Mine and satellite Monty underground mine in Western Australia's Gascoyne region.

Sandfire is conducting exploration activities in the vicinity of these mines and appointed Ecoscape to conduct flora, vegetation and fauna surveys of a number of areas of current interest. This report details the findings of a Detailed flora and vegetation survey of an area known as 'Old Highway' located approximately 20 km south of the existing mine and a proposed off-highway haul route. The report will be used to support the regulatory and environmental approvals process for both exploration activities and, if it proceeds, the mine development site and haul route.

1.2 SURVEY AREA

The Sandfire project area is located within the Shire of Meekatharra in the Gascoyne bioregion, approximately 160 km north of Meekatharra, 280 km south of Newman and approximately 900 km north-east of Perth (Figure 1).

The survey was conducted within an area known as 'Old Highway', occupying 1,110.24 ha, and a proposed haul route approximately 24 km in length between Old Highway and the existing DeGrussa infrastructure (207.49 ha); combined these are herein known as the 'survey area'.

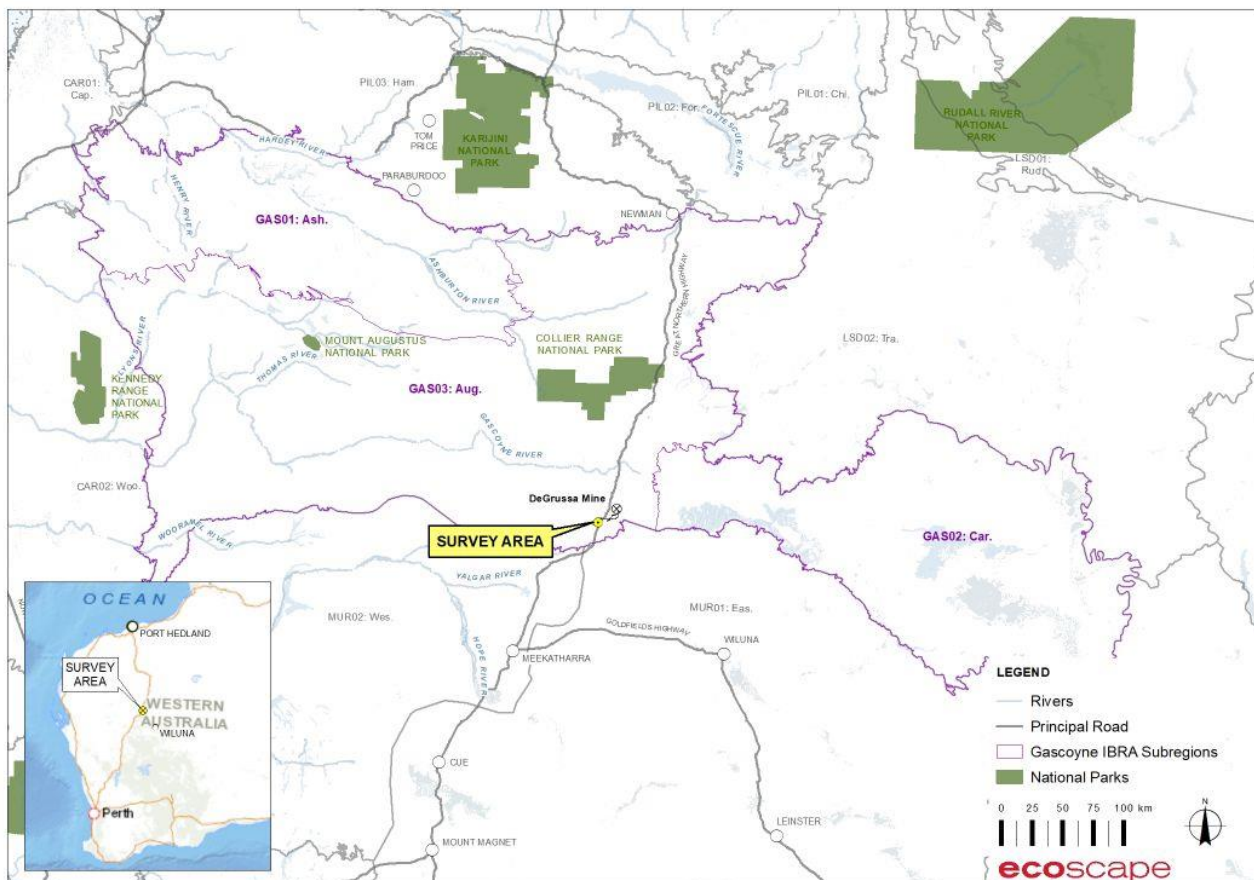


Figure 1: Survey area location

1.3 SURVEY REQUIREMENTS

The requirements of the survey were to:

- conduct a Detailed flora and vegetation survey of the Old Highway and proposed haul route areas
- conduct targeted searches for conservation-listed flora in these areas
- identify significant locations (including conservation-listed flora locations, Priority Ecological Communities and groundwater dependent vegetation) and provide alternative routes if possible.

1.4 COMPLIANCE

This environmental assessment was conducted in accordance with Commonwealth and State legislation and guidelines:

- Commonwealth *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act)
- Western Australian *Environmental Protection Act 1986* (EP Act)
- Western Australian *Biodiversity Conservation Act 2016* (BC Act)
- Western Australian *Biodiversity Conservation Regulations 2018*.

Summaries of the main Acts under which this assessment was conducted, and related criteria and definitions, are available in **Appendix One**.

As well as those listed above, the assessment complied with Environmental Protection Authority (EPA) requirements for environmental survey and reporting in Western Australia, as outlined in:

- EPA (2016) *Technical Guidance – Flora and Vegetation Surveys for Environmental Impact Assessment*, known herein as the Flora and Vegetation Technical Guidance
- EPA (2020) *Statement of Environmental Principles, Factors and Objectives*.

Additional details (definitions and criteria) relevant to these works are available in **Appendix One**.

2 DESKTOP ASSESSMENT

2.1 PHYSICAL ENVIRONMENT

2.1.1 CLIMATE

According to the Köppen-Geiger climate classification, the survey area has a hot arid desert (Class BWh) (Peel, Finlayson & McMahon 2007). This classification is considered to represent a desert climate where annual rainfall is generally less than 200 mm or the region loses more water via evapotranspiration than it receives as rain, generally a result of hot, sunny weather without significant cloud. The mean average temperature exceeds 18°C, and summer temperatures are frequently over 40°C.

The closest Bureau of Meteorology (BoM) station with long term records is Neds Creek (BoM 2021a station number 7103, operating since 1947) which is located approximately 45 km to the east of the survey area. The mean annual rainfall is 235.5 mm falling during the late summer (January to March). The rainfall during the six month period prior to the field survey was 62% of the long-term average for this period.

The closest BoM station with long term temperature records is Meekatharra Airport (BoM 2021a station number 7045, operating since 1950) located approximately 135 km south-west from the survey area. January is the hottest month with a mean maximum temperature of 42.1°C and minimum of 34.1°C. June is the coldest month with a mean maximum of 23.3°C and minimum of 15.1°C.

Figure 2 shows the average rainfall and temperatures of the survey area, with rainfall for the months preceding the field survey.

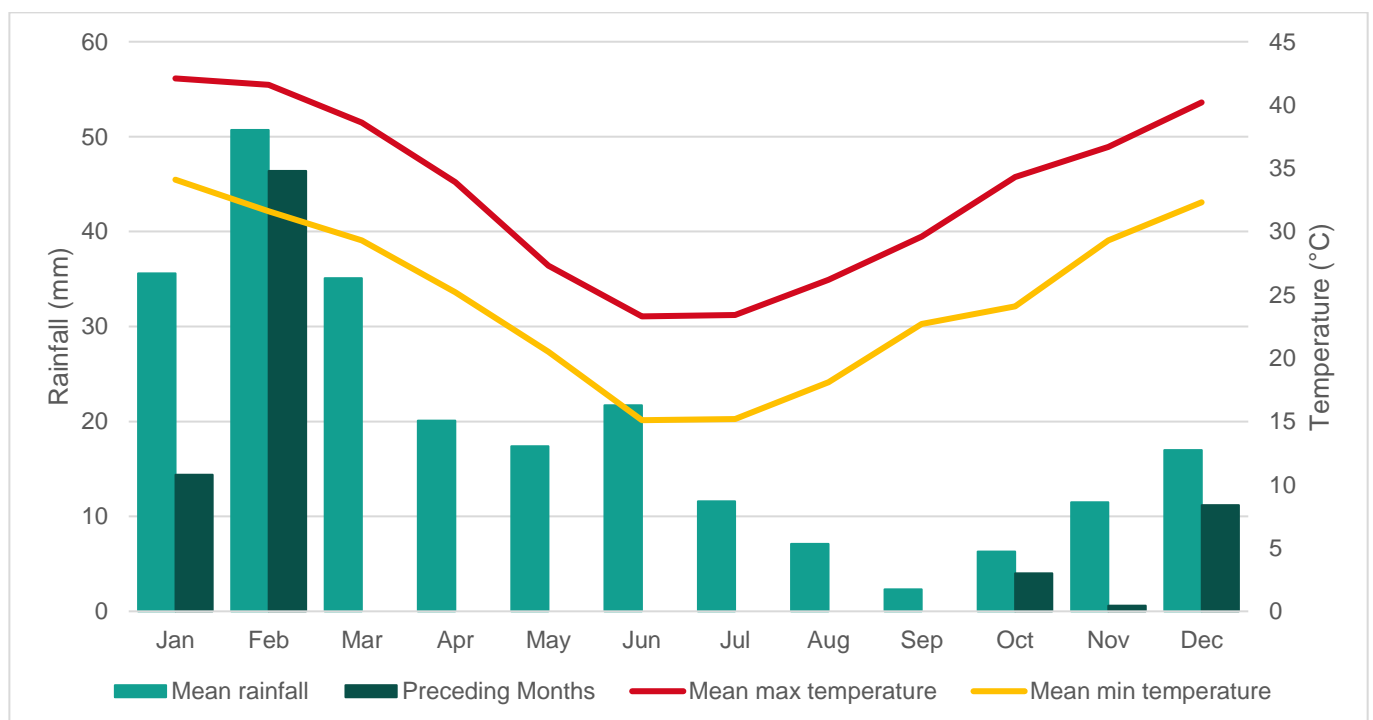


Figure 2: Rainfall and temperature data for the survey area (BoM 2021a)

2.1.2 LAND SYSTEMS

According to the Department of Primary Industries and Rural Development (DPIRD 2020) soil landscape mapping, the following land systems intersect the survey area (**Table 2** and **Map 1**).

Table 2: Land systems (DPIRD 2020)

	Mapping unit	Land system	Description	Extent (ha)	% of the survey area
Old Highway	293Ho	Horseshoe System	Gently undulating stony plains and low rounded hills with partially saline drainage foci and alluvial tracts supporting acacia and eremophila tall shrublands, and chenopod low shrublands.	391.53	35.26
	293Pe	Peak Hill System	Rugged, sinuous ranges and rounded hills of banded ironstone and hematitic shale, supporting stunted mulga and cottonbush shrublands.	1.12	0.10
	295Fr	Frederick System	Hardpan wash plains with broad, reticulate mulga groves and wanderrie banks supporting acacia tall shrublands with grassy understorey.	113.29	10.20
	295Tr	Three Rivers System	Hardpan plains and minor sandy banks supporting sparse mulga shrublands.	604.31	54.43
Haul Route	293Be	Beasley System	Low ridges, hills and lateritised residuals above stony footslopes and broad, stony lower plains supporting scattered mulga and snakewood shrublands.	25.83	12.44
	293Ho	Horseshoe System	Gently undulating stony plains and low rounded hills with partially saline drainage foci and alluvial tracts supporting acacia and eremophila tall shrublands, and chenopod low shrublands.	62.65	30.16
	295Fr	Frederick System	Hardpan wash plains with broad, reticulate mulga groves and wanderrie banks supporting acacia tall shrublands with grassy understorey.	28.57	13.75
	295Tr	Three Rivers System	Hardpan plains and minor sandy banks supporting sparse mulga shrublands.	77.93	37.51
	295Wa	Warri System	Low calcrete platforms and plains supporting mulga and cassia shrublands and minor chenopod low shrublands.	12.76	6.14

2.1.3 WETLANDS AND DRAINAGE

The survey area is located in the Gascoyne River catchment (Landgate 2021). The proposed haul route intersects the Gascoyne River South which is non-perennial where it intersects the survey area. A number of unnamed and minor ephemeral creeklines, tributaries of the Gascoyne River South, also intersect the survey area.

2.1.4 GROUNDWATER DEPENDENT ECOSYSTEMS

The Groundwater Dependent Ecosystems Atlas (BoM 2021b) indicates that the majority of the survey area is considered as having low potential for terrestrial GDEs to occur, with an IDE likelihood of 1 (low). A small proportion of the survey area is considered to have moderate potential for terrestrial GDEs to occur with an IDE likelihood of 3.

2.1.5 ENVIRONMENTALLY SENSITIVE AREAS

The survey area does not intersect any mapped Environmentally Sensitive Areas (ESAs) (Landgate 2021). The nearest ESAs are:

- approximately 75 km to the north, corresponding with Collier Range National Park and
- approximately 105 km to the east, corresponding with an unknown area.

The proposed works are not anticipated to impact these ESAs due to their distance from any potential works.

2.1.6 CONSERVATION LANDS

The survey area does not directly intersect any lands of conservation interest. Collier Range National Park is the closest conservation land located approximately 75 km to the north of the survey area and is unlikely to be impacted by the proposed.

The survey was undertaken in part on land comprising the former Doolgunna Pastoral lease which was deregistered in 2001 and is now under the management of the Department of Biodiversity Conservation and Attractions (DBCA) as a potential future conservation park.

2.1.7 LAND USE HISTORY

Dominant land uses in the region include grazing and to a lesser extent Aboriginal or Crown Reserves (Department of Agriculture Water and the Environment (DAWE) 2020). The survey area shows evidence of past and current pastoral and mining activity including frequent ongoing access by prospectors. The survey area is intersected by one major sealed road (Great Northern Highway).

2.2 BIOLOGICAL ENVIRONMENT

2.2.1 BIOGEOGRAPHIC REGION

Biogeographic regions are delineated on the basis of similar climate, geology, landforms, vegetation and fauna and are defined in the Interim Biogeographical Regionalisation for Australia (IBRA) (DAWE 2020).

The survey area is located in the Gascoyne IBRA region in the Augustus subregion (GAS3), described as:

Rugged low Proterozoic sedimentary and granite ranges divided by broad flat valleys. Also includes the Narryera Complex and Bryah Basin of the Proterozoic Capricorn Orogen (on northern margin of the Yilgarn Craton), as well as the Archaean Marymia and Sylvania Inliers. Although the Gascoyne River System provides the main drainage of this subregion, it is also the headwaters of the Ashburton and Fortescue Rivers. There are extensive areas of alluvial valley-fill deposits. Mulga woodland with Triodia occur on shallow stony loams on rises, while the shallow earthy loams over hardpan on the plains are covered by Mulga parkland. A desert climate with bimodal rainfall. The subregional area for GAS3 is 10,687,739ha.

2.2.2 PRE-EUROPEAN VEGETATION

During the 1970s, John Beard and associates conducted a systematic survey of native vegetation, describing the vegetation systems in Western Australia at a scale of 1:250 000 in the south-west and at a scale of 1:1,000,000 in less developed areas.

Beard's vegetation maps attempted to depict the native vegetation as it was presumed to be at the time of settlement and is known as the pre-European vegetation type and extent. Beard's vegetation maps have since been developed in digital form by Shepherd, Beeston & Hopkins (2002) and updated by DPIRD (2019). Extents are updated every two years by DBCA (2019a). This mapping indicates that the survey area intersects two pre-European vegetation units:

- Association 18: described as low woodland; Mulga (*Acacia aneura*) and
- Association 29: described as sparse low woodland; Mulga, discontinuous in scattered groups.

The pre-European vegetation associations identified from the survey area (DPIRD 2019) and their pre-European and current extents are listed in **Table 3** (DBCA 2019a) and shown on **Map 2**.

Table 3: Pre-European vegetation association representation (DBCA 2019a)

Region	Vegetation association	Original extent (ha)	Current extent (ha)	% remaining
Western Australia	18	19,892,306.46	19,843,148.07	99.75
	29	7,903,991.45	7,898,973.24	99.94
IBRA biogeographic region (Gascoyne)	18	3,273,579.72	3,271,339.12	99.93
	29	3,802,459.63	3,799,635.88	99.93
IBRA biogeographic sub-region (Augustus)	18	2,425,858.38	2,424,368.49	99.94
	29	2,188,768.66	2,185,968.53	99.87
LGA (Shire of Meekatharra)	18	3,117,900.46	3,111,264.68	99.79
	29	2,854,683.44	2,851,596.18	99.89

2.2.3 THREATENED AND PRIORITY ECOLOGICAL COMMUNITIES

Threatened and Priority *Ecological Communities intersecting the survey area and nearby were identified by a Protected Matters Search Tool (PMST) search* (DAWE 2021, search reference NR0JAJ using a 50 km buffer) and DBCA database search request (search reference 34-0321EC using a 30 km buffer).

The results of these searches are indicated in **Table 4** and, for the DBCA data, shown on **Map 3**.

Table 4: TECs and PECs identified by PMST and DBCA database searches

PMST	DBCA database	Ecological Community	DBCA status
None identified	X	<i>Blech Land System</i>	Priority 3
	X	<i>Doolgunna calcrete groundwater assemblage type on Gascoyne palaeodrainage on Doolgunna Station</i>	Priority 1
	X	<i>Robinson Range vegetation complexes (banded ironstone formation)</i>	Priority 1
	X	<i>Three Rivers Plutonic calcrete groundwater assemblage types on Gascoyne palaeodrainage on Three Rivers Station</i>	Priority 1

The survey area directly intersects the *Doolgunna calcrete groundwater assemblage type on Gascoyne palaeodrainage on Doolgunna Station* and the *Robinson Range vegetation complexes (banded ironstone formation)* PECs. Investigation of the *Doolgunna calcrete groundwater assemblage type on Gascoyne palaeodrainage on Doolgunna Station* PEC is outside the scope of these works.

2.2.4 THREATENED AND PRIORITY FLORA

The PMST search (as above) identified one EPBC-listed TF that is likely to occur within the 50 km search buffer area.

The requested DBCA databases (search reference 23-0321FL) was conducted using a 100 km buffer around the supplied shapefiles. The results incorporate the TPFL List, taken from Threatened and Priority Flora Report Forms and DBCA surveys, and WA Herb, taken from vouchered specimens held in the Western Australian Herbarium. **Map 3** shows the locations of conservation-listed flora identified by the DBCA database search.

The combined database searches identified 41 species, listed in **Table 16** in **Appendix Three**, consisting of two TF (one from records known to occur within the database search buffer and a further one from the PMST where associated habitat is likely to occur), 15 P1, one P2, 21 P3 and two P4.

2.2.4.1 Threatened and Priority Flora Likelihood Assessment

Ecoscape conducted a likelihood assessment to identify the TF and PF species that have potential to occur within the survey area. Information to assess the likelihood of a species occurring includes the following sources: ecology as listed on *FloraBase* (WAH 1998-2021; 2021, including specimen collection information) and information from recent nearby surveys incorporating an assessment of habitats likely to be present in the survey area.

The attributes taken into consideration were:

- broad soil type usually associated with the species
- broad landform usually associated with the species
- usual vegetation (characteristic species) with which the species is usually associated
- species having previously been recorded from within approximately 20 km of the survey area (considered as 'nearby') taking locational accuracy into consideration
- time since recorded (i.e. within the previous 25 years), taking into consideration land use changes since collection
- reliability of record: species identified by only a TPFL record, without an accompanying verified vouchered specimen, may have been incorrectly identified or been subject to taxonomic updates since the record was entered
- number of records for the species
- if the record is for a not naturally occurring population (planted).

The likelihood rating is assigned using the categories listed in **Table 5**.

Table 5: Categories for likelihood of occurrence of TF and PF

Likelihood	Category
Recorded	Species recorded within the survey area.
Possible	May occur within the survey area (but has not been recorded); broadly, 2-4 of the first-listed attributes (but always including natural records from nearby) are present in the survey area.
Unlikely	Could occur but is not expected; 1-3 of the first-listed attributes are present in the survey area but: <ul style="list-style-type: none"> • it is not known from nearby, or • it is known from nearby but has no other required attributes, or • it is known from nearby but has at least one well-defined attribute that does not occur in the survey area (e.g. it is associated with a specific landform or soil type that does not occur in the survey area), or • it is known from nearby but: <ul style="list-style-type: none"> ○ the record is old (>25 years), or ○ the locational data is highly likely to be inaccurate, or ○ the area has been significantly cleared at and around the location of the record and survey area and as such the habitat almost certainly no longer occurs within the survey area ○ the record is unlikely to be naturally occurring (i.e. planted).
Highly unlikely	The species characteristics include only one or none of the first-listed attributes of soil, landform, associated vegetation and having previously been recorded nearby, or a critical element (often landform) is not within the survey area and as such it almost certainly does not occur.

The likelihood assessment is available in **Table 16** in **Appendix Three**. According to the database searches one species (*Rhodanthe sphaerocephala*; P1) has been previously recorded from within the survey area. Additionally, *Eremophila demissa* (P1, identified in the 2019 Ecoscape report as *Eremophila ? demissa* due to lack of diagnostic material, but confirmed during this survey), *Indigofera fractiflexa* subsp. *augustensis* (P2) and *Goodenia nuda* (P4; although this species was not identified as likely by the DBCA database search) were recorded during Ecoscape's 2019 survey of Old Highway (Ecoscape 2019a).

In addition to the above, two P1 (*Eucalyptus semota*, *Ptilotus actinocladus*), three P3 (*Homalocalyx echinulatus*, *Sida picklesiana*, *Thryptomene* sp. Leinster (B.J. Lepschi & L.A. Craven 4362) and one P4 (*Dodonaea amplisemina*) were identified as having a Possible (high) likelihood of occurring based on the information available during the desktop assessment. These were considered the most likely to occur and, with those already known to occur, were prioritised for field survey.

The likelihood of occurrence was re-evaluated following the field survey when actual survey area characteristics (vegetation types, vegetation condition, visibility for individual species) were better understood, and the level of survey effort was considered. The post-survey likelihood is also incorporated into this table and discussed further in **Section 5.1.1.2**.

2.3 RELEVANT LITERATURE

2.3.1 PREVIOUS SURVEYS

The survey area has been subject to at least two known flora and vegetation surveys, the results of which were taken into consideration during this assessment:

- Ecoscape (2019a) *Old Highway Flora and Vegetation survey*, occupying a portion of the current Old Highway portion of the survey area
- Mattiske Consulting Pty Ltd (2010) *Flora and Vegetation Survey of the Doolgunna Project*.

The following documents have been identified as having additional relevance to the current survey:

- Ecoscape (2019b) *Thaduna and Enigma Flora and Vegetation Survey*
- GHD (2012) *Report for Thaduna/Green Dragon Flora and Fauna Assessment. September 2012*
- Meissner, Owen & Bayliss (2009) *Flora and vegetation of the banded iron formation of the Yilgarn Craton: Robinson Ranges and Mount Gould*.

2.3.2 IBSA DATA SEARCH

The Department of Water and Environmental Regulation's (DWER's) *Index of Biodiversity Surveys for Assessments (IBSA)* Portal (DWER 2021) was searched for recent environmental surveys in the vicinity of the survey area.

No available survey reports were identified by this search.

3 METHODS

3.1 SURVEY AIMS

The aims of the survey were to:

- undertake a Targeted flora survey, searching for conservation-listed flora and mapping their extent where they occurred in large numbers
- conduct a Detailed flora and vegetation survey of the proposed mine area (Old Highway) and potential off-highway haul route that satisfies the EPA requirements for flora impact assessment for a mining and infrastructure project and to inform Native Vegetation Clearing Permit applications
- record opportunistic weed observations
- provide advice in relation to avoiding impacts on significant attributes included conservation-listed flora, significant ecological communities and groundwater dependent vegetation.

3.2 GUIDING PRINCIPLES

The flora and vegetation survey was conducted as a Detailed survey according to the Flora and Vegetation Technical Guidance (EPA 2016). The EPA considers that a Detailed survey requires:

- a comprehensive survey design, including giving consideration to the survey timing that should be conducted during the primary season of survey for the bioregion and disturbance events, and the potential requirement for supplementary surveys
- a minimum of three quadrats (in proportion to the extent of the vegetation unit), located throughout each preliminary vegetation types sampled throughout its geographic range, with additional quadrats and rescoring during supplementary surveys to clarify vegetation unit boundaries
- regional surveys if there is insufficient information available (identified during the desktop assessment) to provide local and regional context
- the survey may include a number of sampling techniques including quadrats, relevés, transects and traverses, as well as opportunistic observations
- the flora inventory should be comprised of data collected from quadrats and relevés, supplemented by opportunistic observations, systematic surveys and targeted inspections of various habitat areas
- it may be appropriate to increase survey effort in areas of unusual habitat
- sampling sites that are placed at representative locations throughout the survey area considering landform, geology, elevation, slope, aspect, surface or groundwater expression and soil type, as well as vegetation structure, composition and condition.

Targeted searches were also conducted in areas of habitat suitable for TF and PF identified during the desktop assessment and previous surveys as having potential to occur.

3.3 FLORA AND VEGETATION FIELD SURVEY

3.3.1 FIELD SURVEY METHODS

The methods utilised during the field survey followed those outlined in the Flora and Vegetation Technical Guidance (EPA 2016), conducted as a single phase Detailed survey.

Conservation criteria used in this assessment are outlined in **Table 10**, **Table 11** and **Table 12** in **Appendix One**.

Survey method details are outlined below.

3.3.1.1 Floristic Quadrats

Floristic quadrat ('quadrat') locations were selected using aerial photography, environmental values and field observations to represent the vegetation values existing at the site. The unmarked quadrats were

20 m x 20 m in dimension, as required according to the Flora and Vegetation Technical Guidance (EPA 2016). Where the vegetation consisted of a narrow linear corridor, quadrats were linear but of the same overall size i.e. 400 m².

The following information was collected from within each quadrat:

- observer
- date
- quadrat/site number
- GPS location (GDA94) of the northwest corner
- digital photograph (spatially referenced with a reference number), taken from the northwest corner, looking diagonally across the quadrat
- broad soil type and colour
- topography
- list of flora species recorded with the average height and total cover within the quadrat for each species
- vegetation description (as per below)
- vegetation condition.

At least three quadrats per vegetation type were recorded for the Detailed survey where there was sufficient extent. Quadrat locations are displayed on the **Map 4** series.

Quadrats located in Old Highway have been designated with an 'OH' suffix and those in the haul route portion of the survey area designated with an 'HR' suffix.

3.3.1.2 Targeted Searches

Threatened and Priority Flora identified during the desktop analysis and previous surveys as known or having potential to occur were targeted for searches in areas of potential habitat. Targeted searches were conducted in potentially suitable habitat of target species, with the remainder of the site opportunistically searched during site traverses.

The locations of all targeted taxa collected were recorded using a handheld GPS with the following data recorded:

- observer, date and time
- local abundance/population size and/or population boundary, including outside the development envelopes where possible
- landform
- brief vegetation community description
- representative photos of each species and habitat
- collection of representative specimens.

3.3.1.3 Introduced Species

Introduced species (weeds) were recorded during the collection of the overall flora inventory.

3.3.1.4 Vegetation Description and Classification

Vegetation was described from each of the quadrats using the height and estimated cover of dominant and characteristic species of each stratum based on the National Vegetation Information System, recorded at Level V (NVIS Technical Working Group & DotEE 2017) (**Table 13** and **Table 14** in **Appendix Two**). Up to three species per stratum from each stratum (upper, mid and ground) were used to formulate vegetation descriptions for each quadrat and each vegetation type.

Vegetation type descriptions were created by combining quadrat descriptions and modifying, where necessary, based on the wider vegetation. Vegetation codes for these were formulated using the characteristic species of the highest stratum within the vegetation type that had >2% cover (i.e. not scattered) if present, with the first

series of letter codes referring to the component species (upper case first letter referring to the genus, lower case one or, for *Acacia* species, two letters referring to the species, with the upper case letters at the end referring to the stratum structure e.g. **AapGbAkeTSS** refers to *Acacia aptaneura*, *Grevillea berryana* and *Acacia kempeana* tall sparse shrubland.

3.3.1.5 Vegetation Condition Assessment

Vegetation condition was assessed broadly and continuously throughout the survey area and at each quadrat using the Vegetation Condition Scale for the Eremaean Botanical Province (EPA 2016) (**Table 15** in **Appendix Two**). As quadrats are located in the best condition parts of a vegetation type, the condition rating of the quadrat may not match that of the broader vegetation type due to the scale of mapping.

Extents of cleared vegetation have been estimated.

3.3.1.6 Field Survey Timing

The field survey was conducted during March/April which is within the optimal period for a primary survey within the bioregion according to the Flora and Vegetation Technical Guidance (EPA 2016).

3.3.2 STATISTICAL ANALYSIS

3.3.2.1 Post-survey Likelihood Assessment

Following the field survey, a post-survey likelihood assessment was conducted to identify conservation-listed species that have potential to occur on site. This assessment was based on survey results, survey effort and habitat identified within in the survey area.

3.3.2.2 Floristic Analysis

PATN© software (Blatant Fabrications Pty Ltd 2013) was used to undertake statistical analysis to generate floristic groups using the data collected from the quadrats and relevés, in order to better understand local significance of floristic units. PATN analysis has been used for several local floristic analyses including Gibson *et al.* (1994) for the Swan Coastal Plain.

PATN is a multivariate analysis tool that generates estimates of association (resemblance, affinity, distance) between sets of objects described by a suite of variables (attributes) and classifies the objects into groups and condenses the information and displays the patterns in the data graphically. It offers a choice of data transformations prior to multivariate analysis.

Floristic groups, identified using a dendrogram output of the analysis, are used as a tool to inform vegetation type groups at various levels and scales.

For this project we used the Bray Curtis similarity coefficient for rows (species) and Kulczynski coefficient for columns (sites) as this provides a good estimation of association for ecological applications (Blatant Fabrications Pty Ltd 2013) .

Interpretation of these purely floristic groups into recognisable and mappable on-ground units is a tool used to identify broad vegetation types. Generally, quadrats that are closely floristically related on the dendrogram form identifiable vegetation units, however, interpretation is frequently required for imperfect results. Vegetation types are therefore determined as a combination of floristic analysis and on-ground interpretation using dominant and characteristic species.

3.3.2.3 Adequacy of Sampling

In order to demonstrate adequacy of sampling, a species accumulation curve was generated by the software Species Diversity and Richness IV (Pisces Conservation Ltd 2010) using five random selections of sample order, using quadrat data only.

4 FIELD SURVEY RESULTS

The flora and vegetation survey was conducted by Lyn Atkins (Principal Ecologist/Botanist, Flora Collecting Permit FB62000003; Threatened Flora Collecting Permit TFL 73-1920), Kyla Pannell (Botanist, FB62000261) and Louisa Carlsson (Ecologist/Botanist, FB62000295) during 30 March to 11 April 2021.

Taxonomic species identification was by Stephen Kern (Principal Botanist, Ecoscape) and Britta Matthews (consultant botanist).

4.1 FLORA

4.1.1 FLORA INVENTORY

Eighty-eight floristic quadrats were recorded from within the survey area; 36 from Old Highway and 52 from the proposed haul route.

A total of 182 vascular flora were recorded from 87 genera and 36 families from the quadrats, opportunistic observations and searches for conservation-listed flora. Of these, two were introduced (1.10% of the flora inventory) and nine (4.95%) could not be identified to species level due to insufficient diagnostic reproductive material.

The most commonly represented families were Fabaceae (33 identified taxa), Poaceae (29) and Malvaceae and Scrophulariaceae (14). The most commonly represented genera were *Acacia* with 20 taxa, *Eremophila* (13) and *Ptilotus* (nine).

The number of species per quadrat ranged from 38 in quadrat HR2171 to four in quadrats OH2122, OH2187 and OH2188, with an average species diversity per quadrat of 13.62. The most commonly recorded species were *Acacia aptaneura* recorded from 55 quadrats, *Ptilotus obovatus* (42 quadrats), *Ptilotus schwartzii* (40 quadrats) and *Aristida contorta* and *Hibiscus burtonii* (36 quadrats).

The combined flora inventory is presented in **Table 17** in **Appendix Four**. Quadrat data is presented in **Appendix Five**. Ten additional species were added to the inventory when the quadrats recorded during 2019 were added to the data (Ecoscape 2019a).

4.1.2 CONSERVATION-LISTED FLORA

Threatened Flora

No Commonwealth EPBC Act or Western Australian BC Act-listed TF were recorded during the field survey.

Priority Flora

Seven PF were recorded during the field survey:

- *Eremophila demissa* (P1)
- *Ptilotus actinocladius* (P1)
- *Indigofera fractiflexa* subsp. *augustensis* (P2)
- *Homalocalyx echinulatus* (P3)
- *Sida picklesiana* (P3)
- *Thryptomene* sp. Leinster (B.J. Lepschi & L.A. Craven 4362) (P3)
- *Goodenia nuda* (P4).

Locations of PF are indicated on the **Map 4** series and described in more detail in **Table 6**.

Eremophila demissa was subject to two additional targeted surveys in other Sandfire tenements (Cow Hole Bore; Ecoscape (2021a) and East Shed Well; Ecoscape (2021b)) and also recorded opportunistically where observed outside the Old Highway and proposed haul route.

Table 6: PF recorded during the field survey

Eremophila demissa* (P1)*Description:**

Eremophila demissa is a small, compact grey to yellowish grey shrub to 40 cm high with felted leaves and purple flowers (Chinnock 2007).

Within the survey area this species was observed to reflect the taxonomic description.



Habitat: Generally on flat, stony clay or rarely clayey plains without (or few) stones, occasionally adjacent to Mulga groves and lower slopes. Recorded from six vegetation types: **AapAinEgTSS**, **AapAinGbTSS**, **AapAsuAprLOF**, **AptAapAsuTOS**, **AteAapAinTSS**, **TLMSS**.

Location: South-eastern portion of Old Highway; east of Old Highway; scattered records along the proposed haul route east of the Gascoyne River South. Most records are from separate targeted searches.

Survey results: 173 individual plants (103 plants from Old Highway and 70 plants from the proposed haul route) were recorded from 19 point locations in the survey area. A total population of 6,374 individuals has been recorded overall from the concurrent surveys (this survey and Ecoscape 2021a, 2021b). However, it is expected that significantly more plants exist in the survey area as these counts only quantify plants observed at specific point locations (e.g. within quadrats).

Populations: Due to how common the habitat is and connectivity, likely to be a single population.

Known records and distribution: According to *Atlas of Living Australia* (ALA 2021) there are 20 records of this species from the Gascoyne and Murchison bioregions, with an overall distribution of approximately 150 km (north-south) by 85 km (east-west), largely within 30 km and to the north of the survey area.



Ptilotus actinocladus* (P1)*Description:**

Ptilotus actinocladus is a multi-stemmed, glabrous or nearly so, prostrate annual herb to 10 cm high by 25 cm wide with pink flowers (Hammer & Davis 2018).

Within the survey area this species was observed as a small herb with papery flowers.

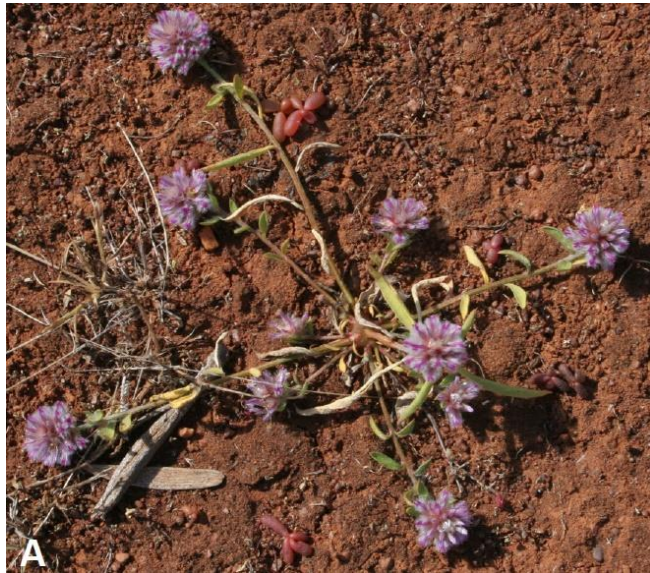


Photo from Hammer & Davies (2018)

Habitat: Clay flats. One record was associated with a *Corymbia candida/Eucalyptus victrix* woodland with a grassy understorey (vegetation type **CcEvHIMW**); the other was in an *Acacia* shrubland with sparse grassy understorey (vegetation type **AteAapAinTSS**).

Location: West and east of Gascoyne River South.

Survey results: Recorded from two quadrats along the proposed haul route. As this species was identified from voucher specimens no actual counts are available and the population within the quadrats is estimated at 20 plants per quadrat.

Populations: Although the two recorded locations are approximately 1.2 km apart it is likely that the population extends between them thus representing a single population.

Known records and distribution: According to *NatureMap* (DBCA 2007-2021) there are six records of this species from the Gascoyne and Murchison bioregions, with an overall distribution of approximately 170 km (north-south) by 125 km (east-west). The majority of the previous records for this species are from approximately 8 km south of these records, close to the same drainage channel and potentially included in the same population.

Indigofera fractiflexa* subsp. *augustensis* (P2)*Description:**

Indigofera fractiflexa sens. lat. is an erect or spreading shrub to 1.2 m high with characteristic zig-zag stems and pink pea flowers. Subsp. *augustensis* grows to 1 m high and has glabrous upper leaflet surfaces and dark hairs on the pods (Wilson & Rowe 2015).

Within the survey area this species was observed to be an erect shrub that is representative of the described subspecies.



Habitat: An isolated quartz outcrop and banded ironstone of the Robinson Range in *Acacia* shrubland in vegetation types **AapAsuTOS** and **AinTOS**.

Location: Associated with a small quartz outcrop and the Robinson Range slopes in the western portion of Old Highway.

Survey results: Recorded from within five quadrats located as above; 229 plants were recorded although additional individuals will be present in the Robinson Range. The population is likely to be widespread within the Robinson Range.

Populations: Two populations in Old Highway.

Known records and distribution: According to *Atlas of Living Australia* (ALA 2021) there are 22 records of this species from the Gascoyne and Murchison bioregions, with an overall distribution of approximately 200 km (north-south) by 320 km (east-west), occurring in three foci (Mt Augustus, Robinson Range and Jack Hills).



Homalocalyx echinulatus* (P3)*Description:**

According to *FloraBase* (WAH 1998-2021; 2021) this species is a shrub to 1 m high with pink flowers.

Within the survey area this species was observed to be a small shrub to 40 cm high.



Habitat: Stony flats and rocky ridge in *Acacia* shrublands and woodlands in vegetation types **AinLOW**, **AprLW** and **AptAapAsuTOS**.

Location: All records are from the northern extent of the proposed haul route.

Survey results: Three quadrats and one additional observation in survey area (proposed haul route).

Populations: Potentially a single population; the observation noted approximately 75 individual plants. There are no numbers recorded from the quadrats although, in one quadrat, this was a dominant species in the ground stratum.

Known records and distribution: According to *Atlas of Living Australia* (ALA 2021) there are 54 records of this species from the Gascoyne, Great Victoria Desert and Murchison bioregions, with an overall distribution of approximately 300 km (north-south) by 600 km (east-west), with the survey area being towards the northern range edge of the species.



Photo from Ecologia Environment (2010)

Sida picklesiana* (P3)*Description:**

Sida picklesiana is an erect twiggy shrub usually to 1 m high and similar width with a compact rounded shape, hairy leaves and yellow flowers (Markey *et al.* 2011).

Within the survey area this species was observed as an open twiggy shrub to 1 m high.



Habitat: Recorded from Mulga groves and drainage lines, quartz knolls, clay flats and lower slopes in vegetation types **AapAsuAprLOF**, **AapAsuTOS**, **AapAteAanLOF**, **AapLOW**, **AinLOW** and **AptAapAsuTOS**.

Location: Recorded from scattered locations within Old Highway and proposed haul route.

Survey results: Recorded from 10 quadrats (in Old Highway and the proposed haul route) and 10 additional observations (including outside the survey area). At times a dominant ground stratum species. Overall 122 individuals were recorded although the species would be scattered over much of the survey area.

Populations: Likely scattered sparsely throughout the entire survey area thus a single population.

Known records and distribution: According to *Atlas of Living Australia* (ALA 2021) there are 42 records of this species from Gascoyne and Murchison bioregions, with an overall distribution of approximately 200 km (north-south) by 240 km (east-west). The survey area is near the northern range edge of the species.

***Thryptomene* sp. Leinster (B.J. Lepschi & L.A. Craven (P3)****Description:**

Thryptomene sp. Leinster (B.J. Lepschi & L.A. Craven) is an upright to sprawling shrub to 2.5 m high with white and pink flowers (Western Botanical 2017).

Within the survey area this species was observed to be an erect shrub, usually open, to 2.5 m but more commonly less than 1.5 m high.



Habitat: Recorded from stony hills and stony plain in vegetation types **AinLOW**, **AptAapAsuTOS** and **TLMS** for which it was a characteristic species.

Location: Northern extent of the proposed haul route; approximately mid-point of the haul route (between Cow Hole Bore and East Shed Well).


Survey results: Five quadrats and six additional records in survey area, consisting of hundreds of individuals. At times this was the dominant mid stratum species.

Populations: 2 populations

Known records and distribution: According to *Atlas of Living Australia* (ALA 2021) there are 24 records of this species from Gascoyne and Murchison bioregions, with an overall distribution of approximately 400 km (north-south) by 270 km (east-west), largely to the south although the Robinson Range and associated banded ironstone ranges are also known habitat areas.



Photo from Western Botanical (2017)

<i>Goodenia nuda</i> (P4)	
<p>Description: According to <i>FloraBase</i> (WAH 1998-2021; 2021) <i>Goodenia nuda</i> is an erect or ascending herb to 50 cm high with yellow flowers.</p> <p>Within the survey area this species was observed growing to approximately 30 cm high although frequently less.</p> 	<p>Habitat: Flat areas with various substrates (clay, quartz) and stony slopes in vegetation types AapAinEgTSS, AapGbAkeTSS, AinLOW, AptAapAsuTOS, AteAapAinTSS.</p> <p>Location: Scattered throughout.</p> <p>Survey results: Recorded from eight quadrats in Old Highway and the proposed haul route, as well as 24 additional observations in the survey area. Overall 128 individual plants were recorded, however, hundreds more would be scattered throughout the survey area.</p> <p>Populations: Likely to be sparsely distributed on flat clay and stony plains, and less commonly on stony slopes, throughout the survey area thus likely to represent a single population.</p> <p>Known records and distribution: According to <i>Atlas of Living Australia</i> (ALA 2021) there are 130 records of this species from Gascoyne, Little Sandy Desert and (primarily) Pilbara bioregions, with an overall distribution of approximately 500 km (north-south) by 670 km (east-west), largely to the north. The survey area is an outlier population.</p>

4.1.3 OTHER SIGNIFICANT FLORA

No flora taxa having other significance according to the Flora and Vegetation Technical Guidance (EPA 2016) were recorded during the field survey.

4.1.4 TAXONOMIC NOTE

Due to the lack of flowering material some species could only be identified to species level, and not to subspecies level. There is no significance accorded to this negligible constraint as none of the species would have been of conservation significance if they had been identified to a higher taxonomic level.

4.1.5 INTRODUCED FLORA

Two introduced flora species (weeds) were recorded during the field survey, representing 1.10% of the overall flora inventory.

Bidens subalternans* (Beggartick) was the most commonly recorded introduced species occurring in 16 of 88 quadrats assessed during this survey (plus two quadrats recorded during 2019), however, it was not a major contributor to overall vegetation condition assessment except in Mulga groves (vegetation types **AapAsuPILW, **CcAapMOF**) and along minor drainage lines and areas of dispersed drainage (**AapAteAanLOF**) where it was at times a dominant ground stratum species.

**Cenchrus ciliaris* (Buffel Grass) was recorded in only one quadrat.

Neither of the introduced flora have any specific significance i.e. they are not Declared Pest plants or WoNS species.

4.2 VEGETATION

4.2.1 VEGETATION TYPES

Twenty-two vegetation types were recorded from within the survey area (**Table 7, Map 4** series) based on a combination of structural vegetation type as identified in the field, floristic analysis (see **Section 4.2.3**) and subsequent desktop review.



Overall, most vegetation types were defined by various Mulga species (*Acacia aneura*, *Acacia aptaneura*, *Acacia incurvaneura*, *Acacia macraneura*, *Acacia pteraneura*), most of which can occur in both shrub-form (forming shrubland structures) or tree-form (forming woodlands and forests) or other *Acacia* species (*Acacia burkittii*, *Acacia kempeana*, *Acacia pruinocarpa*, *Acacia pyrifolia* var. *pyrifolia*, *Acacia subcontorta*, *Acacia tetragonophylla*).



The vegetation types within the survey area, grouped broadly based on landform types, were:



- flats with various substrates (clay, stony, quartz, calcrete):
 - **AapAinEgTSS**: *Acacia aptaneura*, *Acacia incurvaneura* and *Eremophila galeata* tall sparse shrubland
 - **AapAinGbTSS**: *Acacia aptaneura*, *Acacia incurvaneura* and *Grevillea berryana* tall sparse shrubland
 - **AapAptAcuLOW**: *Acacia aptaneura*, *Acacia pteraneura* and *Acacia cuspidifolia* low open woodland
 - **AapGbAkeTSS**: *Acacia aptaneura*, *Grevillea berryana* and *Acacia kempeana* tall sparse shrubland
 - **AapLOW**: *Acacia aptaneura* low open woodland
 - **AbuApyAmaTOS**: *Acacia burkittii*, *Acacia pyrifolia* var. *pyrifolia* and *Acacia macraneura* tall open shrubland
 - **AinAsuTSS**: *Acacia incurvaneura* and *Acacia subcontorta* tall sparse shrubland
 - **AprLW**: *Acacia pruinocarpa* low woodland
 - **AptLOW**: *Acacia pteraneura* low open woodland
 - **AteAapAinTSS**: *Acacia tetragonophylla*, *Acacia aptaneura* and *Acacia incurvaneura* tall sparse shrubland
 - **GbLOW**: *Grevillea berryana* low open woodland
 - **SMAprLSS**: *Senna* sp. Meekatharra (E. Bailey 1-26) and *Acacia pruinocarpa* low sparse shrubland
- flats with sheetflow drainage (Mulga groves):
 - **AapAsuAprLOF**: *Acacia aptaneura*, *Acacia subcontorta* and *Acacia pruinocarpa* low open forest
 - **CcAapMOF**: *Corymbia candida* and *Acacia aptaneura* mid open forest
- riparian (creeks, rivers, dispersed drainage)
 - **AapAsuPILW**: *Acacia aptaneura*, *Acacia subcontorta* and *Psydrax latifolia* low woodland
 - **AapAteAanLOF**: *Acacia aptaneura*, *Acacia tetragonophylla* and *Acacia aneura* low open forest
 - **CcEvHIMW**: *Corymbia candida*, *Eucalyptus victrix* and *Hakea lorea* subsp. *lorea* mid woodland
- hills, slopes and crests:
 - **AapAsuTOS**: *Acacia aptaneura* and *Acacia subcontorta* tall open shrubland
 - **AinLOW**: *Acacia incurvaneura* low open woodland
 - **AinTOS**: *Acacia incurvaneura* tall open shrubland
 - **AptAapAsuTOS**: *Acacia pteraneura*, *Acacia aptaneura* and *Acacia subcontorta* tall open shrubland
 - **TLMSS**: *Thryptomene* sp. Leinster (B.J. Lepschi & L.A. Craven 4362) mid sparse shrubland.



Table 7: Vegetation types



The quadrats shown as the representative photograph are identified by **bold** font.



Landform	Mapping unit	Vegetation type	Floristic quadrats	Representative photograph	Other characteristic species	Area (ha) and extent (%)
Flats (quartz); Mulga intergrove	AapAinEgTSS	<p><i>Acacia aptaneura</i>, <i>Acacia incurvaneura</i> and <i>Eremophila galeata</i> tall sparse shrubland over <i>Eremophila margarethae</i>, and <i>Senna</i> sp. Meekatharra (E. Bailey 1-26) low sparse shrubland with <i>Acacia pteraneura</i> low scattered trees</p> <p>NVIS: U+ ^<i>Acacia pteraneura</i>\^tree\6\bi;M+ ^<i>Acacia aptaneura</i>,^<i>Acacia incurvaneura</i>,<i>Eremophila galeata</i>\^shrub\4\r;G ^<i>Eremophila margarethae</i>,^<i>Senna</i> sp. Meekatharra (E. Bailey 1-26)\^shrub\1\r</p>	<p>OH2113 OH2117 OH2118 OH2119</p>		<p><i>Acacia pruinocarpa</i> <i>Acacia tetragonophylla</i> <i>Maireana georgei</i> <i>Maireana triptera</i> <i>Ptilotus obovatus</i> <i>Ptilotus schwartzii</i></p>	<p>180.57 ha 13.70%</p>
Flats (clay)	AapAinGbTSS	<p><i>Acacia aptaneura</i>, <i>Acacia incurvaneura</i> and <i>Grevillea berryana</i> tall sparse shrubland over <i>Eremophila demissa</i>, <i>Eremophila galeata</i> and <i>Ptilotus schwartzii</i> low scattered shrubs/forbs</p> <p>NVIS: M+ ^<i>Acacia aptaneura</i>,^<i>Acacia incurvaneura</i>,<i>Grevillea berryana</i>\^shrub\4\r;G ^<i>Eremophila demissa</i>,^<i>Eremophila galeata</i>,<i>Ptilotus schwartzii</i>\^shrub\1\bi</p>	<p>OH2101 OH2120 OH2121 OH2122 OH2127 OH2160 OH2162 SR1964</p>		<p><i>Acacia caesaneura</i> <i>Acacia pruinocarpa</i> <i>Cheilanthes sieberi</i> <i>Eragrostis eriopoda</i> <i>Eremophila forrestii</i> <i>Eremophila margarethae</i> <i>Eremophila spectabilis</i> <i>Hibiscus burtonii</i> <i>Psyrax suaveolens</i></p>	<p>231.29 ha 17.55%</p>



Landform	Mapping unit	Vegetation type	Floristic quadrats	Representative photograph	Other characteristic species	Area (ha) and extent (%)
Flats (stony)	AapAptAcuLOW	<p><i>Acacia aptaneura</i>, <i>Acacia pteraneura</i> and <i>Acacia cuspidifolia</i> low open woodland over <i>Senna</i> sp. Meekatharra (E. Bailey 1-26), <i>Eremophila phyllopoda</i> subsp. <i>phyllopoda</i> and <i>Eremophila linearis</i> low scattered shrubs</p> <p>NVIS: U ^<i>Acacia aptaneura</i>, ^<i>Acacia pteraneura</i>, ^<i>Acacia cuspidifolia</i> ^tree\6\r;G ^<i>Senna</i> sp. Meekatharra (E. Bailey 1-26), ^<i>Eremophila phyllopoda</i> subsp. <i>phyllopoda</i>, ^<i>Eremophila linearis</i> ^shrub\2\bi</p>	HR2138 HR2139 HR2140 HR2152 HR2166 HR2167 HR2173 HR2176 HR2177		<i>Acacia incurvaneura</i> <i>Maireana georgei</i> <i>Maireana triptera</i> <i>Ptilotus exaltatus</i> <i>Ptilotus obovatus</i> <i>Ptilotus rotundifolius</i> <i>Rhagodia eremaea</i> <i>Salsola australis</i> <i>Senna artemisioides</i> subsp. <i>x artemisioides</i> <i>Solanum lasiophyllum</i>	41.82 ha 3.17%
Flats with sheetflow drainage	AapAsuAprLOF	<p><i>Acacia aptaneura</i>, <i>Acacia subcontorta</i> and <i>Acacia pruinocarpa</i> low open forest over <i>Psyrax latifolia</i>, <i>Eremophila galeata</i> and <i>Acacia kempeana</i> mid sparse shrubland over <i>Ptilotus obovatus</i>, <i>Eremophila forrestii</i> and <i>Eremophila spectabilis</i> low sparse shrubland</p> <p>NVIS: U+ ^^<i>Acacia aptaneura</i>, ^<i>Acacia subcontorta</i>, ^<i>Acacia pruinocarpa</i> ^tree\6\c;M ^<i>Psyrax latifolia</i>, ^<i>Eremophila galeata</i>, ^<i>Acacia kempeana</i> ^shrub\3\r;G ^<i>Ptilotus obovatus</i>, ^<i>Eremophila forrestii</i>, <i>Eremophila spectabilis</i> ^shrub\2\r</p>	HR2170 HR2172 OH2128 SR1968		<i>Abutilon cryptopetalum</i> <i>Acacia aneura</i> <i>Acacia craspedocarpa</i> <i>Acacia mulganeura</i> <i>Acacia tetragonophylla</i> <i>*Bidens subalternans</i> <i>Cheilanthes sieberi</i> <i>Digitaria brownii</i> <i>Eremophila latrobei</i> subsp. <i>latrobei</i> <i>Hibiscus</i> sp. <i>Gardneri</i> (A.L. Payne PRP 1435) <i>Marsdenia australis</i> <i>Psyrax rigidula</i> <i>Psyrax suaveolens</i> <i>Rhagodia eremaea</i> <i>Sida picklesiana</i> (P3) <i>Sida</i> sp. L (A.M. Ashby 4202)	30.11 ha 2.28%



Landform	Mapping unit	Vegetation type	Floristic quadrats	Representative photograph	Other characteristic species	Area (ha) and extent (%)
Riparian (creek)	AapAsuPILW	<p><i>Acacia aptaneura</i>, <i>Acacia subcontorta</i> and <i>Psyrax latifolia</i> low woodland over <i>Eremophila galeata</i> mid sparse shrubland over <i>Ptilotus obovatus</i> low open shrubland</p> <p>NVIS: U+ ^<i>Acacia aptaneura</i>, <i>Acacia subcontorta</i>, <i>Psyrax latifolia</i> ^tree\6i;M ^<i>Eremophila galeata</i> ^shrub\3r;G ^<i>Ptilotus obovatus</i> ^shrub\2i</p>	OH2104 OH2107 HR2171		<p><i>Acacia caesaneura</i> <i>Acacia kempeana</i> <i>Acacia pruinocarpa</i> <i>Acacia pteraneura</i> <i>Abutilon cryptopetalum</i> <i>Aristida contorta</i> *<i>Bidens subalternans</i> <i>Cymbopogon ambiguus</i> <i>Digitaria brownii</i> <i>Duperreya commixta</i> <i>Eragrostis kennedyae</i> <i>Eriachne pulchella</i> subsp. <i>pulchella</i> <i>Evolvulus alsinoides</i> var. <i>villosicalyx</i> <i>Glycine canescens</i> <i>Marsdenia australis</i> <i>Paspalidium clementii</i> <i>Perotis rara</i> <i>Psyrax rigidula</i> <i>Santalum spicatum</i> <i>Senna glaucifolia</i> <i>Sida</i> sp. L (A.M. Ashby 4202)</p>	26.12 ha 1.98%
Quartz knolls (crest, flanks)	AapAsuTOS	<p><i>Acacia aptaneura</i> and <i>Acacia subcontorta</i> tall open shrubland over <i>Eremophila latrobei</i> subsp. <i>latrobei</i>, <i>Dodonaea viscosa</i> subsp. <i>spatulata</i> and <i>Eremophila margarethae</i> low sparse shrubland</p> <p>NVIS: M+ ^<i>Acacia aptaneura</i>, ^<i>Acacia subcontorta</i> ^shrub\4i;G ^<i>Eremophila latrobei</i> subsp. <i>latrobei</i>, <i>Dodonaea viscosa</i> subsp. <i>spatulata</i>, <i>Eremophila margarethae</i> ^shrub\2r</p>	OH2112 OH2163		<p><i>Acacia ayersiana</i> <i>Eremophila jucunda</i> subsp. <i>jucunda</i> <i>Eremophila margarethae</i> <i>Grevillea beryana</i> <i>Indigofera fractiflexa</i> subsp. <i>augustensis</i> (P2) <i>Marsdenia australis</i> <i>Ptilotus obovatus</i> <i>Ptilotus schwartzii</i></p>	1.61 ha 0.12%


Landform	Mapping unit	Vegetation type	Floristic quadrats	Representative photograph	Other characteristic species	Area (ha) and extent (%)
Riparian (dispersed drainage/minor creeks)	AapAteAanLOF	<p><i>Acacia aptaneura</i>, <i>Acacia tetragonophylla</i> and <i>Acacia aneura</i> low open forest over <i>Eremophila galeata</i>, <i>Psyrax latifolia</i> and <i>Acacia craspedocarpa</i> mid sparse shrubland over <i>Ptilotus obovatus</i>, <i>Aristida contorta</i> and <i>Perotis rara</i> low sparse shrubland/tussock grassland/grassland</p> <p>NVIS: U+ ^<i>Acacia aptaneura</i>,<i>Acacia tetragonophylla</i>,<i>Acacia aneura</i>\^tree\6;c;M ^<i>Eremophila galeata</i>,^<i>Psyrax latifolia</i>,<i>Acacia craspedocarpa</i>\^shrub\3;r;G ^<i>Ptilotus obovatus</i>,^<i>Aristida contorta</i>,<i>Perotis rara</i>\^shrub,^tussock grass\1\r</p>	HR2134 HR2148 OH2105 OH2106 OH2115 OH2125 OH2129 SR1966 SR1969		<i>Abutilon cryptopetalum</i> <i>Bidens subalternans</i> <i>Boerhavia coccinea</i> <i>Digitaria brownii</i> <i>Evolvulus alsinoides</i> var. <i>villosicalyx</i> <i>Heliotropium inexplicitum</i> <i>Hibiscus burtonii</i> <i>Maireana ?planifolia</i> <i>Portulaca oleracea</i> <i>Sida platycalyx</i> <i>Sida</i> sp. L (A.M. Ashby 4202)	88.87 ha 6.74%
Flats	AapGbAkeTSS	<p><i>Acacia aptaneura</i>, <i>Grevillea berryana</i> and <i>Acacia kempeana</i> tall sparse shrubland over <i>Ptilotus schwartzii</i> and <i>Eremophila incisa</i> low scattered forbs/shrubs</p> <p>NVIS: M+ ^<i>Acacia aptaneura</i>,<i>Grevillea berryana</i>,<i>Acacia kempeana</i>\^shrub\4\r;G ^<i>Ptilotus schwartzii</i>,^<i>Eremophila incisa</i>\^forb,^shrub\1\bi</p>	HR2147 HR2150 HR2157 HR2187 HR2188 OH2110 OH2114 OH2123 OH2124 OH2126 SR1963		<i>Acacia incurvaneura</i> <i>Aristida contorta</i> <i>Eremophila margarethae</i> <i>Eremophila spectabilis</i> <i>Goodenia nuda</i> (P4) <i>Hibiscus burtonii</i> <i>Marsdenia australis</i> <i>Ptilotus obovatus</i> <i>Sclerolaena eriacantha</i>	231.36 ha 17.56%



Landform	Mapping unit	Vegetation type	Floristic quadrats	Representative photograph	Other characteristic species	Area (ha) and extent (%)
Flats	AapLOW	<p><i>Acacia aptaneura</i> low open woodland over <i>Acacia caesaneura</i>, <i>Eremophila galeata</i> and <i>Acacia craspedocarpa</i> tall sparse shrubland over <i>Ptilotus obovatus</i> and <i>Aristida contorta</i> low scattered shrubs/tussock grasses</p> <p>NVIS: U+ ^<i>Acacia aptaneura</i>\^tree\6\r;M ^<i>Acacia caesaneura</i>,^<i>Eremophila galeata</i>,<i>Acacia craspedocarpa</i>\^shrub\4\r;G ^^<i>Ptilotus obovatus</i>,^<i>Aristida contorta</i>\^shrub,^tussock grass\2\bi</p>	OH2111 OH2116 SR1967		<p><i>Acacia aneura</i> <i>Eremophila margarethae</i> <i>Evolvulus alsinoides</i> var. <i>villosicalyx</i> <i>Santalum spicatum</i> <i>Sida picklesiana</i> (P3)</p>	185.51 ha 14.08%
Flats (calcrete)	AbuApyAmaTOS	<p><i>Acacia burkittii</i>, <i>Acacia pyrifolia</i> var. <i>pyrifolia</i> and <i>Acacia macraneura</i> tall open shrubland over <i>Senna artemisioides</i> subsp. <i>x artemisioides</i>, <i>Eragrostis setifolia</i> and <i>Ptilotus obovatus</i> low shrubland/tussock grassland with <i>Codonocarpus cotinifolius</i> low scattered trees</p> <p>NVIS: U ^<i>Codonocarpus cotinifolius</i>\^tree\6\bi;M+ ^^<i>Acacia burkittii</i>,<i>Acacia pyrifolia</i> var. <i>pyrifolia</i>,<i>Acacia macraneura</i>\^shrub\4\i;G ^^<i>Senna artemisioides</i> subsp. <i>x artemisioides</i>,<i>Eragrostis setifolia</i>,<i>Ptilotus obovatus</i>\^shrub,tussock grass\2\c</p>	HR2165		<p><i>Abutilon fraseri</i> <i>Amyema fitzgeraldii</i> <i>Cenchrus ciliaris</i> <i>Duperreya commixta</i> <i>Enneapogon caeruleus</i> <i>Pimelea microcephala</i> <i>Santalum lanceolatum</i> <i>Senna stricta</i> <i>Sida</i> sp. L (A.M. Ashby 4202) <i>Teucrium teucriiflorum</i></p>	1.24 ha 0.09%



Landform	Mapping unit	Vegetation type	Floristic quadrats	Representative photograph	Other characteristic species	Area (ha) and extent (%)
Flats (clay)	AinAsuTSS	<p><i>Acacia incurvaneura</i> and <i>Acacia subcontorta</i> tall sparse shrubland over <i>Ptilotus schwartzii</i> low scattered forbs</p> <p>NVIS: M+ ^<i>Acacia incurvaneura</i>, ^<i>Acacia subcontorta</i> ^shrub\4\;G ^<i>Ptilotus schwartzii</i> ^forb\1\bi</p>	OH2108 OH2109 SR1965		<p><i>Aristida contorta</i> <i>Eremophila galeata</i> <i>Eremophila latrobei</i> subsp. <i>latrobei</i> <i>Grevillea berryana</i> <i>Monachather paradoxus</i> <i>Ptilotus obovatus</i> <i>Solanum lasiophyllum</i></p>	118.51 ha 8.99%
Crest	AinLOW	<p><i>Acacia incurvaneura</i> low open woodland over <i>Aluta maisonneuvei</i> subsp. <i>auriculata</i> and <i>Aristida contorta</i> low sparse shrubland/tussock grassland with <i>Acacia subcontorta</i> tall scattered shrubs</p> <p>NVIS: U+ ^<i>Acacia incurvaneura</i> ^tree\6\;M+ ^<i>Acacia subcontorta</i> ^shrub\4\bi;G ^<i>Aluta maisonneuvei</i> subsp. <i>auriculata</i>, ^<i>Aristida contorta</i> ^shrub, tussock grass\1\</p>	HR2135 HR2153 HR2186		<p><i>Acacia aneura</i> <i>Eragrostis eriopoda</i> <i>Eriachne pulchella</i> subsp. <i>dominii</i> <i>Hibiscus burtonii</i> <i>Homalocalyx echinulatus</i> <i>Psyrax latifolia</i> <i>Ptilotus obovatus</i> <i>Sida</i> sp. Golden calyces glabrous (H.N. Foote 32)</p>	2.77 ha 0.21%


Landform	Mapping unit	Vegetation type	Floristic quadrats	Representative photograph	Other characteristic species	Area (ha) and extent (%)
Hill slopes	AinTOS	<p><i>Acacia incurvaneura</i> tall open shrubland over <i>Aluta maisonneuvei</i> subsp. <i>auriculata</i> and <i>Sida</i> sp. Golden calyces glabrous (H.N. Foote 32) low open shrubland</p> <p>NVIS: M+ ^<i>Acacia incurvaneura</i>^shrub\4\i;G ^<i>Aluta maisonneuvei</i> subsp. <i>auriculata</i>,^<i>Sida</i> sp. Golden calyces glabrous (H.N. Foote 32)^shrub\2\i</p>	OH2102 OH2103 OH2159		<p><i>Acacia</i> sp. <i>Aristida contorta</i> <i>Brunonia australis</i> <i>Eragrostis eriopoda</i> <i>Eremophila jucunda</i> subsp. <i>jucunda</i> <i>Eriachne pulchella</i> subsp. <i>dominii</i> <i>Goodenia triodiophila</i> <i>Hibiscus burtonii</i> <i>Indigofera fractiflexa</i> subsp. <i>augustensis</i> (P2) <i>Monachather paradoxus</i> <i>Ptilotus schwartzii</i> <i>Senna glaucifolia</i> <i>Synaptantha tillaeacea</i> var. <i>tillaeacea</i></p>	15.62 ha 1.19%
Flats (stony)	AprLW	<p><i>Acacia pruinocarpa</i> low woodland over <i>Acacia pteraneura</i> and <i>Acacia kempeana</i> tall scattered shrubs</p> <p>NVIS: U+ ^<i>Acacia pruinocarpa</i>^tree\6\i;M ^<i>Acacia pteraneura</i>,^<i>Acacia kempeana</i>^shrub\4\bi;</p>	HR2178 HR2179 HR2180 HR2181		<p><i>Acacia aptaneura</i> <i>Aristida contorta</i> <i>Eremophila galeata</i> <i>Hibiscus burtonii</i> <i>Maireana triptera</i> <i>Monachather paradoxus</i> <i>Psyrax latifolia</i> <i>Psyrax suaveolens</i> <i>Ptilotus aervoides</i> <i>Ptilotus obovatus</i> <i>Ptilotus rotundifolius</i> <i>Ptilotus schwartzii</i> <i>Solanum lachnophyllum</i> <i>Tribulus astrocarpus</i></p>	5.11 ha 0.39%

Landform	Mapping unit	Vegetation type	Floristic quadrats	Representative photograph	Other characteristic species	Area (ha) and extent (%)
Hill slopes	AptAapAsuTOS	<p><i>Acacia pteraneura</i>, <i>Acacia aptaneura</i> and <i>Acacia subcontorta</i> tall open shrubland over <i>Eremophila latrobei</i> and <i>Ptilotus schwartzii</i> low scattered shrubs/forbs</p> <p>NVIS: M+ ^<i>Acacia pteraneura</i>,<i>Acacia aptaneura</i>,<i>Acacia subcontorta</i>^shrub\4i;G ^<i>Eremophila latrobei</i>,^<i>Ptilotus schwartzii</i>^shrub,^forb\2\bi</p>	<p>HR2137 HR2169 HR2182 HR2183</p>		<p><i>Acacia incurvaneura</i>^ <i>Acacia pruinocarpa</i> <i>Grevillea berryana</i> <i>Senna glaucifolia</i>^ <i>Sida picklesiana</i> (P3) <i>Solanum lachnophyllum</i></p>	<p>19.20 ha 1.46%</p>
Flats (stony)	AptLOW	<p><i>Acacia pteraneura</i> low open woodland over <i>Acacia kempeana</i> mid sparse shrubland over <i>Eremophila spathulata</i> and <i>Eremophila margarethae</i> low sparse shrubland</p> <p>NVIS: U+ ^<i>Acacia pteraneura</i>^tree\6r;M+ ^<i>Acacia kempeana</i>^shrub\3r;G ^<i>Eremophila spathulata</i>,^<i>Eremophila margarethae</i>^shrub\2r</p>	<p>HR2151 HR2174 HR2175</p>		<p><i>Acacia aptaneura</i> <i>Psyrax latifolia</i> <i>Ptilotus rotundifolius</i> <i>Ptilotus schwartzii</i> <i>Sida picklesiana</i> (P3)</p>	<p>10.86 ha 0.82%</p>

Landform	Mapping unit	Vegetation type	Floristic quadrats	Representative photograph	Other characteristic species	Area (ha) and extent (%)
Flats (clay)	AteAapAinTSS	<p><i>Acacia tetragonophylla</i>, <i>Acacia aptaneura</i> and <i>Acacia incurvaneura</i> tall sparse shrubland over <i>Ptilotus obovatus</i> and <i>Digitaria brownii</i> low scattered shrubs/tussock grasses</p> <p>NVIS: M+ ^<i>Acacia tetragonophylla</i>, ^<i>Acacia aptaneura</i>, ^<i>Acacia incurvaneura</i> \shrub\4\;G ^<i>Ptilotus obovatus</i>, ^<i>Digitaria brownii</i> \shrub, tussock grass\1\bi</p>	HR2146 HR2149 HR2154 HR2158 HR2164		<p><i>Abutilon cryptopetalum</i> <i>Alternanthera angustifolia</i> <i>Aristida contorta</i> <i>*Bidens subalternans</i> <i>Boerhavia coccinea</i> <i>Chrysocephalum gilesii</i> <i>Duperreya commixta</i> <i>Enneapogon caerulescens</i> <i>Eragrostis pergracilis</i> <i>Eremophila forrestii</i> <i>Eremophila galeata</i> <i>Eremophila margarethae</i> <i>Euphorbia coghlanii</i> <i>Evolvulus alsinoides</i> var. <i>villosicalyx</i> <i>Goodenia prostrata</i> <i>Grevillea striata</i> <i>Hakea lorea</i> subsp. <i>lorea</i> <i>Heliotropium cunninghamii</i> <i>Hibiscus burtonii</i> <i>Iseilema membranaceum</i> <i>Maireana ?planifolia</i> <i>Paspalidium clementii</i> <i>Psyrax latifolia</i> <i>Sida</i> sp. dark green fruits (S. van Leeuwen 2260) <i>Sida</i> sp. L (A.M. Ashby 4202) <i>Solanum lasiophyllum</i></p>	35.53 ha 2.70%

Landform	Mapping unit	Vegetation type	Floristic quadrats	Representative photograph	Other characteristic species	Area (ha) and extent (%)
Flats with sheetflow drainage	CcAapMOF	<p><i>Corymbia candida</i> and <i>Acacia aptaneura</i> mid open forest over <i>Psyrax latifolia</i>, <i>Acacia kempeana</i> and <i>Eremophila forrestii</i> tall open shrubland over <i>Eriachne helmsii</i> and *<i>Bidens subalternans</i> low tussock grassland/forbland</p> <p>NVIS: U+ ^<i>Corymbia candida</i>,^<i>Acacia aptaneura</i>^tree\7\c;M ^<i>Psyrax latifolia</i>,^<i>Acacia kempeana</i>,<i>Eremophila forrestii</i>^shrub\4\i;G ^^<i>Eriachne helmsii</i>,<i>Bidens subalternans</i>^tussock grass,forb\1\c</p>	HR2145 HR2155 HR2156 HR2168		<p><i>Abutilon cryptopetalum</i> <i>Acacia tetragonophylla</i> <i>Boerhavia coccinea</i> <i>Duperreya commixta</i> <i>Eragrostis eriopoda</i> <i>Glycine canescens</i> <i>Hibiscus burtonii</i> <i>Isotropis iophyta</i> <i>Marsdenia australis</i> <i>Monachather paradoxus</i> <i>Paspalidium clementii</i> <i>Perotis rara</i> <i>Psyrax rigidula</i> <i>Ptilotus obovatus</i> <i>Sida</i> sp. dark green fruits (S. van Leeuwen 2260) <i>Sida</i> sp. L (A.M. Ashby 4202)</p>	4.50 ha 0.34%
Riparian (river)	CcEvHIMW	<p><i>Corymbia candida</i>, <i>Eucalyptus victrix</i> and <i>Hakea lorea</i> subsp. <i>lorea</i> mid woodland over <i>Acacia tetragonophylla</i>, <i>Acacia aneura</i> and <i>Acacia aptaneura</i> tall open shrubland over <i>Chrysopogon fallax</i> and <i>Themeda triandra</i> mid open tussock grassland</p> <p>NVIS: U+ ^<i>Corymbia candida</i>,^<i>Eucalyptus victrix</i>,^<i>Hakea lorea</i> subsp. <i>lorea</i>^tree\7\i;M ^^<i>Acacia tetragonophylla</i>,<i>Acacia aneura</i>,<i>Acacia aptaneura</i>^shrub\4\i;G ^^<i>Chrysopogon fallax</i>,<i>Themeda triandra</i>^tussock grass\2\i</p>	HR2131		<p><i>Abutilon cryptopetalum</i> <i>Acacia pteraneura</i> <i>Duperreya commixta</i> <i>Eremophila galeata</i> <i>Eriachne flaccida</i> <i>Marsilea hirsuta</i> <i>Paspalidium clementii</i> <i>Psyrax rigidula</i> <i>Santalum lanceolatum</i> <i>Santalum spicatum</i></p>	2.36 ha 0.18%

Landform	Mapping unit	Vegetation type	Floristic quadrats	Representative photograph	Other characteristic species	Area (ha) and extent (%)
Flats (clay)	GbLOW	<p><i>Grevillea berryana</i> low open woodland over <i>Acacia aptaneura</i> and <i>Eremophila galeata</i> mid sparse shrubland over <i>Ptilotus schwartzii</i>, <i>Aristida contorta</i> and <i>Eremophila incisa</i> low scattered forbs/tussock grasses/shrubs</p> <p>NVIS: U+ ^<i>Grevillea berryana</i>\^tree\6\r;M ^^<i>Acacia aptaneura</i>,^<i>Eremophila galeata</i>\^shrub\3\r;G ^<i>Ptilotus schwartzii</i>,^<i>Aristida contorta</i>,^<i>Eremophila incisa</i>\^forb,\^tussock grass,\^shrub\1\bi</p>	HR2141 HR2142 HR2143 HR2144		<p><i>Acacia fuscaneura</i> <i>Acacia incurvaneura</i> <i>Acacia subcontorta</i> <i>Eragrostis eriopoda</i> <i>Eremophila forrestii</i> <i>Eriachne mucronata</i> <i>Grevillea berryana</i> <i>Hibiscus burtonii</i> <i>Psyrax rigidula</i></p>	32.63 ha 2.48%
Flats (stony)	SMAprLSS	<p><i>Senna</i> sp. Meekatharra (E. Bailey 1-26) and <i>Acacia pruinocarpa</i> low sparse shrubland</p> <p>NVIS: G+ ^<i>Senna</i> sp. Meekatharra (E. Bailey 1-26),^<i>Acacia pruinocarpa</i>\^shrub\2\r</p>	OH2161		<p><i>Acacia minyura</i> <i>Acacia tetragonophylla</i> <i>Eremophila galeata</i> <i>Eremophila spectabilis</i> <i>Maireana triptera</i> <i>Psyrax latifolia</i> <i>Ptilotus obovatus</i></p>	0.65 ha 0.05%

Landform	Mapping unit	Vegetation type	Floristic quadrats	Representative photograph	Other characteristic species	Area (ha) and extent (%)
Hill slopes	TLMSS	<p><i>Thryptomene</i> sp. Leinster (B.J. Lepschi & L.A. Craven 4362) mid sparse shrubland with <i>Acacia aptaneura</i> low scattered trees</p> <p>NVIS: U ^<i>Acacia aptaneura</i>\^tree\6\bi;M+ ^<i>Thryptomene</i> sp. Leinster (B.J. Lepschi & L.A. Craven 4362)\^shrub\3\r;</p>	HR2136 HR2184 HR2185		<i>Acacia pteraneura</i> <i>Acacia subcontorta</i> <i>Eremophila demissa</i> (P1) <i>Eremophila latrobei</i> <i>Eriachne helmsii</i> <i>Eriachne mucronata</i> <i>Mirbelia rhagodioides</i> <i>Ptilotus schwartzii</i>	1.57 ha 0.12%
Not native vegetation (cleared)						49.92 ha 3.79%
TOTAL EXTENT						1,317.73 ha 100%

4.2.2 VEGETATION SIGNIFICANCE

4.2.2.1 TECs and PECs

No vegetation recorded from the survey area was assessed as being representative of any currently described TEC. No TECs are known to occur within 50 km of the survey area.

Database searches (**Section 2.2.3**) identified the *Robinson Range* PEC has been mapped as intersecting the western portion of the Old Highway survey area. As the PEC is defined by a geographical feature, the PEC is therefore considered to occur within the survey area.

Broad comparisons with Robinson Range vegetation communities (Meissner, Owen & Bayliss 2009) are discussed in more detail in **Section 5.2.1**, however, most vegetation types occurring within the mapped extent of Old Highway are widespread and not likely to have specific significance in regard to the PEC. Vegetation types **AinTOS**, **AapAsuTOS** and **SMAprLSS** are the only vegetation types within the mapped PEC extent that do not occur elsewhere within the survey area and are of potential significance. Vegetation type **AinTOS** resembles the Robinson Range vegetation community 3 (Meissner, Owen & Bayliss 2009), however, the other vegetation types are less similar to any described type.

Vegetation type **SMAprLSS** is also likely to be significant in its own right due to it being a unique habitat (occurring on ironstone conglomerate) and occupying only a small extent within the survey area.

4.2.2.2 Other Significant Vegetation

According to the criteria outlined in the Flora and Vegetation Technical Guidance (EPA 2016), the following vegetation types are considered to be significant:

- **AapAsuAprLOF** and **CcAapMOF**, both of which represent sheet flow dependent (Mulga grove) vegetation that is historically impacted from threatening processes (grazing, weed invasion, changes to surface water flow), performs an important function to maintain ecological integrity and provides habitat and refuge for a range of species, including fauna
- **CcEvHIMW**, representing the Gascoyne River South riparian area that is also historically impacted by threatening processes (grazing), performs an important function to maintain ecological integrity and provides habitat and refuge for a range of species, including fauna. However, this vegetation type is unlikely to be groundwater dependent
- **TLMSS**, occurring on a calcrete hill that occupied a small extent and was unusual habitat for *Eremophila demissa* (P1) that was otherwise recorded on flats, as well as being characterised by a conservation listed species; *Thryptomene* sp. Leinster (B.J. Lepschi & L.A. Craven 4362) (P3).

4.2.3 FLORISTIC ANALYSIS

The floristic analysis dendrogram **Figure 6** in **Appendix Six** indicates that the floristic groups broadly reflect habitat types (e.g. riparian areas, stony flats, clay flats) and vegetation types as identified in the field.

Of particular note:

- vegetation types **AinTOS**, occurring within the mapped extent of the Robinson Range PEC and similar to the described Robinson Range vegetation community 3 (Meissner, Owen & Bayliss 2009), is floristically similar to vegetation type **AinLOW** that occurs near the northern terminus of the proposed haul route
- vegetation considered representative of sheet flow dependent (Mulga grove) vegetation (**AapAteAanLOF** and **CcAapMOF**) are floristically grouped with Mulga vegetation occurring in minor creeks or areas with dispersed drainage (**AapAteAanLOF**), creeks (**AapAsuPILW**) and the Gascoyne River South riparian area (**CcEvHIMW**).

4.2.4 VEGETATION CONDITION

The vegetation condition within the survey area ranged from Excellent to Completely Degraded condition (**Table 8, Map 5** series). The main factor affecting vegetation condition was weediness, primarily due to **Bidens subalternans* in Mulga groves and minor or dispersed drainage lines. Historical clearing for prospecting activities and cattle grazing, with the survey area currently appearing to be only lightly grazed, would also be a consideration for condition assessment in some areas.

Many areas were devoid of or deficient in annual herb cover, and shrubs, particularly smaller *Eremophila* species, were dead. However, in most cases this was attributed to poor seasonal conditions (low rainfall) over at least two of the previous 3 years (e.g. Meekatharra Airport; BoM 2021a) rather than to a specific human induced change or grazing.

Table 8: Vegetation condition

Vegetation condition	Extent (ha)	Proportion (%)
Excellent	135.45	10.28
Very Good	442.38	33.57
Good	355.69	26.99
Poor	275.32	20.89
Degraded	58.14	4.41
Completely Degraded	0.83	0.06
Not vegetated (cleared)	49.92	3.79

4.2.5 ADEQUACY OF SURVEY

Adequacy of survey can be demonstrated using a species accumulation curve; if the curve has reached (or almost reached) an asymptote it is considered that most species are likely to have been recorded from the survey area.

A species accumulation curve was generated using quadrat data (**Figure 3**). Opportunistic observations, which increase the number of species recorded, are not included in the analysis.

The species accumulation curve indicates that most species would have been recorded during the field survey. The Bootstrap estimate of species richness is 197.1 which, when taking opportunistic records into account, is similar to the number of species recorded (192, when including 2019 data).

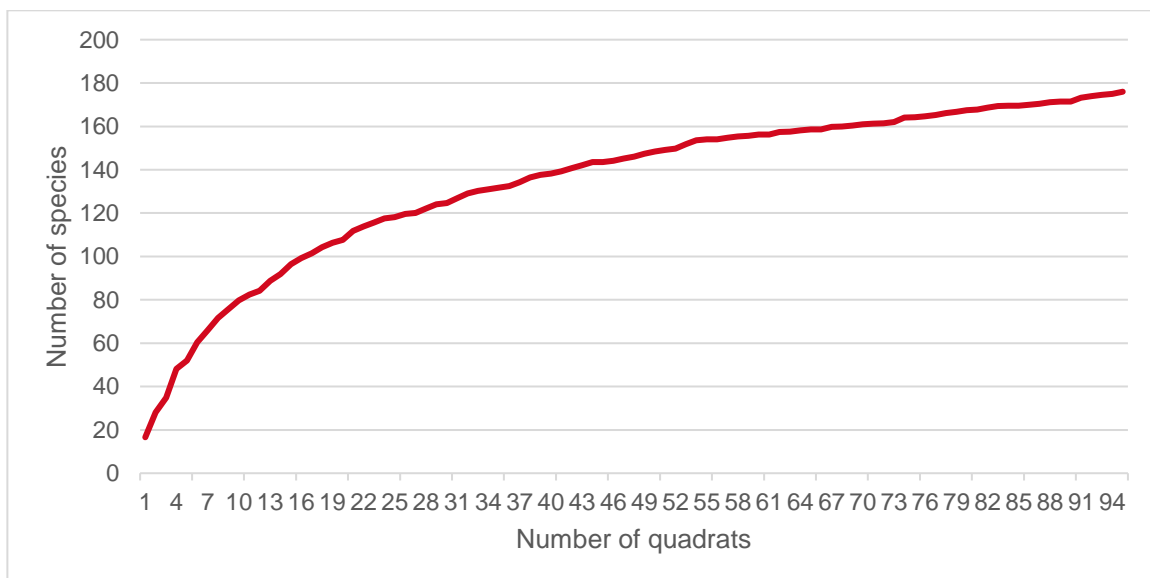


Figure 3: Species accumulation curve

4.3 BOTANICAL LIMITATIONS

Survey design: Single phase, quadrat-based flora and vegetation survey with extensive traverses searching for conservation significant flora. Results from previous surveys were considered as part of survey design and the desktop assessment.

Survey type: Detailed flora and vegetation survey with extensive searches for significant flora conducted over a single phase. All areas were adequately surveyed through the use of floristic quadrats to sample vegetation types, and targeted searches for conservation significant flora.

Type of vegetation classification system: Vegetation classified at NVIS Level V (NVIS Technical Working Group & DotEE 2017) using largely structural vegetation types defined using dominant and characteristic species and vegetation structure as recorded during the field surveys. Floristic analysis was used to identify major floristic groups and outlier groups of floristic interest.

A full summary of botanical limitations is presented in **Table 9**.

Table 9: Botanical limitations

Possible limitations	Constraints (yes/no): Significant, moderate or negligible	Comment
Availability of contextual information at a regional and local scale	No	Although there are few known surveys from the surrounding area, the entire survey area had been previously subject to a detailed assessment (Mattiske Consulting Pty Ltd 2010) and in part by an earlier Ecoscape assessment (Ecoscape 2019a).
Competence/experience of the team conducting the survey, including experience in the bioregion surveyed	No	The lead botanist conducting the field survey has over 30 years conducting flora and vegetation surveys over much of Western Australia.
Proportion of the flora recorded and/or collected, and any identification issues	Negligible	182 vascular flora taxa were recorded during the 2021 field survey of which 4.95% could not be identified with certainty to species level due to the lack of diagnostic reproductive material. This is considered a negligible constraint as none of the unidentified taxa are considered likely to represent any conservation-listed flora from the region.
Was the appropriate area fully surveyed (effort and extent)	No	<p>A total of 88 floristic quadrats were recorded during the 2021 field survey; previously an additional seven quadrats had been recorded in Old Highway in 2019.</p> <p>Four vegetation types did not have a minimum of three quadrats recorded from within them due to the following reasons:</p> <ul style="list-style-type: none"> • vegetation type AapAsuTOS had two quadrats only; this vegetation type occupied two small adjacent quartz knolls and footslopes; there was insufficient extent to record additional quadrats. • vegetation type AbuApyAmaTOS had only one quadrat; there was only one representative area, a calcrete plain adjacent to the Gascoyne River, of this vegetation type within the survey area and insufficient extent to record additional quadrats • vegetation type CcEvHIMW had only one quadrat; there was only one representative area (Gascoyne River riparian area) of this vegetation type within the survey area and insufficient extent to record additional quadrats • vegetation type SMAprLSS had only one quadrat; there was only one representative area of this vegetation type within the survey area and

Possible limitations	Constraints (yes/no): Significant, moderate or negligible	Comment
		<p>insufficient extent to record additional quadrats. This vegetation type occurred on a small area of black ironstone at the foot of the Robinson Range.</p> <p>Despite the significance of vegetation types AapAsuTOS and SMAprLSS that occur in areas within the mapped extent of the <i>Robinson Range</i> PEC, there are no constraints attributable to the recording of less than three quadrats per vegetation type, which was due to the small extent of the landform within which they occur.</p>
Access restrictions within the survey area	No	The entire area was accessible presenting no constraints.
Survey timing, rainfall, season of survey	<p>Timing: no</p> <p>Rainfall: moderate</p>	<p>The field survey was conducted during March-April that is considered for the primary season for survey in the Gascoyne bioregion.</p> <p>The rainfall in 6 months prior to the field survey was below average for this period (BoM 2021a), although the rainfall deciles indicate that the rainfall is considered 'average' (Figure 4). Over a longer period the rainfall has been below average for approximately the previous 3 years, based on Meekatharra data (BoM 2021a). Rainfall figures for DeGrussa (Ben McLernon, Sandfire Resources <i>pers. comm.</i>) indicates 2020 received approximately average rainfall with the previous 2 years being significantly below average (Figure 5).</p> <p>This represents a moderate constraint in regard to the presence of annual and ephemeral species and has likely led to the death of large numbers of small shrubs, particularly <i>Eremophila</i> species, and a negligible constraint to identification of some species due to paucity of flowering material.</p>
Disturbance that may have affected the results of the survey e.g. fire, flood, clearing	No	<p>There were no recent disturbances that would have affected the results of the survey.</p> <p>None of the survey area had been recently burnt.</p>

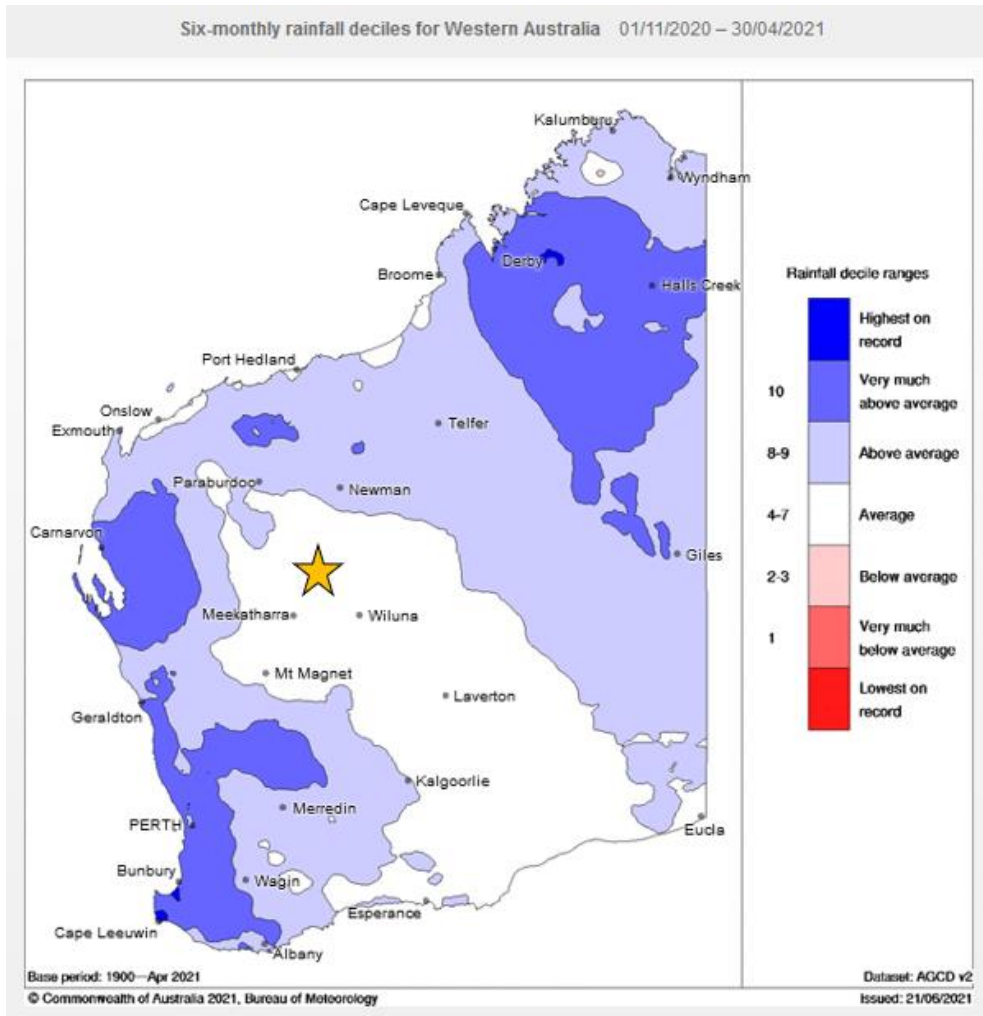


Figure 4: Rainfall deciles for the 6 months prior to the field survey (BoM 2021c)

The star in **Figure 4** indicates the approximate location of the field survey.

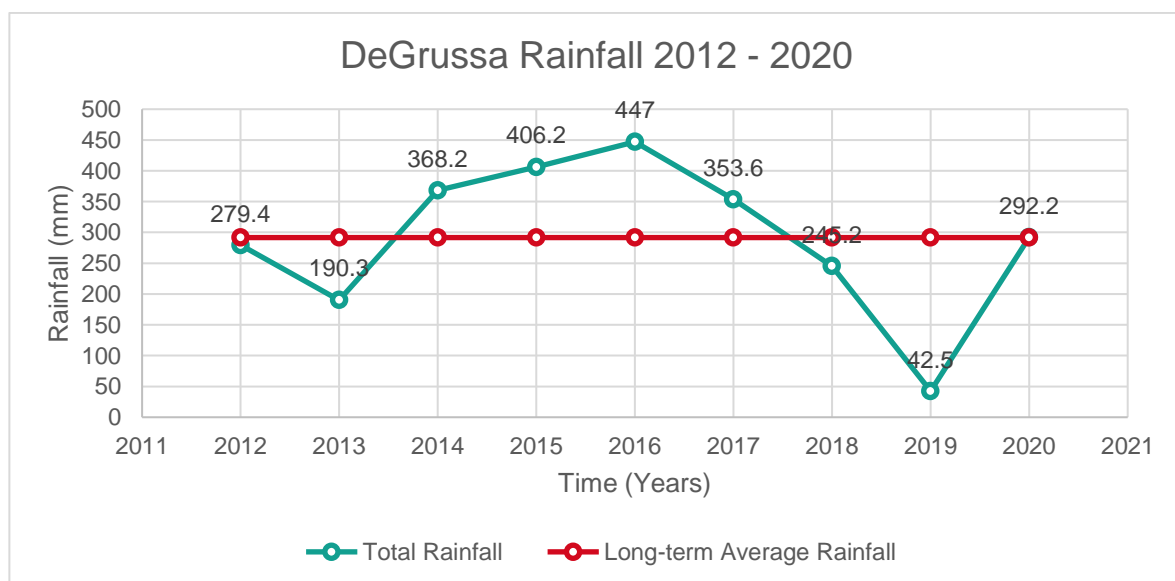


Figure 5: DeGrussa rainfall (Ben McLernon, Sandfire Resources *pers. comm.*)

5 DISCUSSION

5.1 FLORA SIGNIFICANCE

A total of 182 vascular flora species were recorded from 88 floristic quadrats and opportunistic observations, including during searches for conservation-listed flora. A further 10 species had been recorded during Ecoscape's (2019a) survey of part of Old Highway. Only two introduced species were recorded, representing 1.10% of the total 2021 flora inventory.

5.1.1 LOCAL AND REGIONAL ASSESSMENT OF FLORA SIGNIFICANCE

5.1.1.1 Conservation-listed Flora

Threatened Flora

No Threatened Flora species listed for protection under the Commonwealth EPBC Act or Western Australian BC Act were recorded. None of the unidentified taxa resemble any currently described TF.

Priority Flora

Seven Priority-listed flora were recorded

- *Eremophila demissa* (P1)
- *Ptilotus actinocladus* (P1)
- *Indigofera fractiflexa* subsp. *augustensis* (P2)
- *Homalocalyx echinulatus* (P3)
- *Sida picklesiana* (P3)
- *Thryptomene* sp. Leinster (B.J. Lepschi & L.A. Craven 4362) (P3)
- *Goodenia nuda* (P4).

Mattiske Consulting (2010) did not record any conservation-listed flora species within its survey area where it intersects the Old Highway and proposed haul route survey area.

Priority 1

P1 flora taxa are considered poorly known and are known from few locations which are potentially at risk (DBCA 2019b).

Eremophila demissa was subject to targeted searches in two additional areas of interest to Sandfire Resources (Ecoscape 2021a, 2021b), as well within the scope of this Detailed flora and vegetation survey. A total of 6,374 individuals were recorded during all of these surveys; approximately 173 in the Old Highway and proposed haul route survey area in vegetation types **AapAinEgTSS**, **AapAinGbTSS**, **AapAsuAprLOF**, **AptAapAsuTOS** and **AteAapAinTSS**, although this is likely to be an underestimation as there is a significant population immediately adjacent to the proposed haul route. According to ALA (2021) there are 20 records of this species from the Gascoyne and Murchison bioregions, with an overall distribution of approximately 150 km (north-south) by 85 km (east-west). Most records are from within 30 km and to the north of the survey area indicating the survey area is the core population area, and the species is locally common in the vicinity of the survey area.

The number of individuals recorded during the combined surveys indicate *Eremophila demissa* is locally common, at times the dominant species, on stony clay plains and occasionally clay plains with few stones, generally in areas with low shrubs and only sparse larger shrubs or trees. It was not observed in areas with a grassy understorey or significant cover of medium to tall shrubs or trees. The majority of observed plants were dead (estimated 80-90%), likely due to dry conditions over several years as no other obvious cause of death was observed.

Ptilotus actinocladus was recorded from within two quadrats, however, it was identified from collected voucher material after the survey thus no population estimate is available. It occurred in two vegetation types (**CcEvHIMW** and **AteAapAinTSS**), with the quadrats being located on either side of the Gascoyne River South and likely representing a single population. DBCA specimen records (DBCA database search results) indicate this species has been recorded previously in similar locations (three records), described as seasonally inundated clay plains with occasional Mulga, adjacent to the river, approximately 8-11 km south of these records. There is a further record approximately 9.5 km to the east of the DBCA locations. ALA (2021) indicates six records in total; the two additional records are approximately 150 km to the north-west and south-west of the survey area records. As most records are from the vicinity of the survey area it is likely that the survey area represents the largest population of this species.

Ptilotus actinocladus may occur elsewhere within the survey area, most likely where surface water runs off Great Northern Highway and pools adjacent to the road, forming damp clay areas, but is unlikely to be widespread. As an annual herb it is potentially more common in wetter years, and likely to be found over a wider range of habitats having high proportions of clay in the soil.

Priority 2

P2 species are considered poorly known and are known from few locations, however, some populations occur in lands reserved for conservation (DBCA 2019b).

Indigofera fractiflexa subsp. *augustensis* was recorded from five quadrats (and two opportunistic records) in two vegetation types on stony quartz knolls (vegetation type **AapAsuTOS**) and footslopes of the Robinson Range (vegetation type **AinTOS**) on banded ironstone. According to ALA (2021), there are 22 records of this species from the Gascoyne and Murchison bioregions, with an overall distribution of approximately 200 km (north-south) by 320 km (east-west), occurring in three foci (Mt Augustus, Robinson Range – this area, and Jack Hills).

Due to *Indigofera fractiflexa* subsp. *augustensis*' habitat being significantly rocky areas, it will be restricted to locations with suitable habitat (i.e. these vegetation types). Therefore, it is unlikely to occur elsewhere within Old Highway, and is unlikely to occur along the proposed haul route. The observed population is likely to represent only a small portion of the overall species' population.

Priority 3

P3 species are poorly known and likely require further survey, however, they may occur in several locations and aren't considered under imminent threat or are comparatively well known but there are threatening processes that could affect them (DBCA 2019b).

Homalocalyx echinulatus was recorded from three vegetation types (**AinLOW**, **AprLW** and **AptAapAsuTOS**), all in the northern part of the proposed haul route, potentially representing a single population when taking likely occurrences between the two areas (approximately 1 km apart) into consideration. It is unlikely to occur in other parts of the survey area, except in the vicinity of where it was recorded during this survey.

Overall *Homalocalyx echinulatus* has a wide extent of approximately 300 km (north-south) by 600 km (east-west) (ALA 2021). Therefore, the population identified during this survey is likely to only represent a small portion of the species overall population.

Sida picklesiana was recorded from six vegetation types (**AapAsuAprLOF**, **AapAsuTOS**, **AapAteAanLOF**, **AapLOW**, **AinLOW** and **AptAapAsuTOS**) and is likely to be present at various densities (sparsely to as a dominant substratum species) through much of the survey area. It was also recorded during the 2019 survey of Sandfire's Enigma area (Ecoscape 2019b), approximately 30 km north north-east.

Sida picklesiana has a wide distribution of approximately 200 km (north-south) by 240 km (east-west) in two bioregions (ALA 2021), thus the population identified during this survey is likely to only represent a small portion of the species overall population.

***Thryptomene* sp. Leinster (B.J. Lepschi & L.A. Craven 4362)** was recorded from stony hills and stony plain in vegetation types **AinLOW** and **AptAapAsuTOS**, along the proposed haul route. It was also recorded during the 2019 survey of Sandfire's Enigma area (Ecoscape 2019b), approximately 30 km north north-east.

Thryptomene sp. Leinster (B.J. Lepschi & L.A. Craven 4362) has overall distribution of approximately 400 km (north-south) by 270 km (east-west) in two bioregions (ALA 2021) thus the survey area is only likely to represent a small portion of its overall population.

Priority 4

P4 species are rare, near threatened or in need of monitoring (DBCA 2019b).

Goodenia nuda was recorded from five vegetation types (**AapAinEgTSS**, **AapGbAkeTSS**, **AinLOW**, **AptAapAsuTOS** and **AteAapAinTSS**) although it is likely to occur sparsely in other types, particularly in clay flats and adjacent to riparian areas. According to ALA (2021), *Goodenia nuda*'s overall distribution is approximately 500 km (north-south) by 670 km (east-west), largely to the north with the survey area being an outlier population. The population of *Goodenia nuda* within the survey area is only likely to represent a small portion of the species overall population.

5.1.1.2 Post-survey Likelihood Assessment

The likelihood of conservation significant flora occurring in the survey area was revised following the field survey. This revised likelihood, that took into account vegetation condition, grazing and other disturbances, actual habitat availability and search effort, is included in **Table 16** in **Appendix Three**.

Two species assessed as having a 'possible' likelihood were not recorded during the field survey (all other species with a 'possible' likelihood were recorded), and one species previously recorded from the survey area was not recorded (all other previous records were confirmed). Those not recorded are discussed below.

Eucalyptus semota (P1) was not recorded during the field survey. This species is a tree or mallee; within Sandfire's Thaduna and Enigma areas, approximately 30 km north north-east, it was a tree approximately 9 m high growing in association with hills (Ecoscape 2019b). Although there were some hills present within the Old Highway and proposed haul route survey area, they were of a smaller scale the hills in the surrounding area. As a result of the survey effort, visibility of the species and only marginally suitable habitat being present *Eucalyptus semota* has been re-evaluated as being unlikely to occur.

Rhodanthe sphaerocephala (P1) has been previously recorded (DBCA database search results) but was not observed during the field survey despite the area of the previous record being searched. *Rhodanthe sphaerocephala* is an erect annual herb with yellow flowers in October (WAH 1998-2021). It is unlikely to have been flowering during the field survey and as such may not have been readily visible. As the location of the record is amongst the most heavily grazed parts of the survey area, and due also to the poor seasonal conditions, this annual species may not always be present (except in the seed bank). Although previously recorded, Ecoscape could not confirm its presence and therefore it has been re-evaluated as having a 'possible' likelihood of occurring.

Dodonea amplisemina (P4) is a rigid, rounded shrub 0.3-1 m high by 1-2 m wide growing on rocky basalt, gabbro and banded ironstone (Shepherd *et al.* 2007). A small area of suitable habitat occurs in the western portion of Old Highway, in the area mapped as included in the Robinson Range PEC. Although this species was not observed, it is possible that few small specimens could occur, particularly in vegetation types **AinTOS** and **SMAprLSS**, thus it retains its 'possible' likelihood of occurring.

5.1.1.3 Other Significant Flora

No species having any other significance according to the Flora and Vegetation Technical Guidance (EPA 2016) was recorded, nor any flora of taxonomic interest.

5.1.1.4 Introduced Flora

Two introduced species were recorded during the field survey. Neither is listed as a Declared Pest plant or WoNS species, and both occur commonly throughout all mainland states of Australia (ALA 2021). They are not considered to be significant weeds requiring control or monitoring during exploration activities.

Bidens subalternans* (Beggartick) was recorded from 16 of the 88 recorded quadrats and was a contributor to overall vegetation condition assessment in Mulga groves (vegetation types **AapAsuPILW, **CcAapMOF**) and along minor drainage lines and areas of dispersed drainage (**AapAteAanLOF**) where it was at times a dominant ground stratum species.

Cenchrus ciliaris* (Buffel Grass) was recorded from one quadrat near the Gascoyne River South in vegetation type **AbuApyAmaTOS where it only occurred sparsely (<1% cover). It was not a significant contributor to vegetation condition assessment and, although likely to be more common than recorded due to the poor seasonal conditions, it is likely to be confined to riparian area.

5.2 VEGETATION SIGNIFICANCE

Twenty-two vegetation types were recorded from the survey area:

- **AapAinEgTSS**: *Acacia aptaneura*, *Acacia incurvaneura* and *Eremophila galeata* tall sparse shrubland
- **AapAinGbTSS**: *Acacia aptaneura*, *Acacia incurvaneura* and *Grevillea berryana* tall sparse shrubland
- **AapAptAcuLOW**: *Acacia aptaneura*, *Acacia pteraneura* and *Acacia cuspidifolia* low open woodland
- **AapAsuAprLOF**: *Acacia aptaneura*, *Acacia subcontorta* and *Acacia pruinocarpa* low open forest
- **AapAsuPILW**: *Acacia aptaneura*, *Acacia subcontorta* and *Psydrax latifolia* low woodland
- **AapAsuTOS**: *Acacia aptaneura* and *Acacia subcontorta* tall open shrubland
- **AapAteAanLOF**: *Acacia aptaneura*, *Acacia tetragonophylla* and *Acacia aneura* low open forest
- **AapGbAkeTSS**: *Acacia aptaneura*, *Grevillea berryana* and *Acacia kempeana* tall sparse shrubland
- **AapLOW**: *Acacia aptaneura* low open woodland
- **AbuApyAmaTOS**: *Acacia burkittii*, *Acacia pyrifolia* var. *pyrifolia* and *Acacia macraneura* tall open shrubland
- **AinAsuTSS**: *Acacia incurvaneura* and *Acacia subcontorta* tall sparse shrubland
- **AinLOW**: *Acacia incurvaneura* low open woodland
- **AinTOS**: *Acacia incurvaneura* tall open shrubland
- **AprLW**: *Acacia pruinocarpa* low woodland
- **AptAapAsuTOS**: *Acacia pteraneura*, *Acacia aptaneura* and *Acacia subcontorta* tall open shrubland
- **AptLOW**: *Acacia pteraneura* low open woodland
- **AteAapAinTSS**: *Acacia tetragonophylla*, *Acacia aptaneura* and *Acacia incurvaneura* tall sparse shrubland
- **CcAapMOF**: *Corymbia candida* and *Acacia aptaneura* mid open forest
- **CcEvHIMW**: *Corymbia candida*, *Eucalyptus victrix* and *Hakea lorea* subsp. *lorea* mid woodland
- **GbLOW**: *Grevillea berryana* low open woodland
- **SMAprLSS**: *Senna* sp. Meekatharra (E. Bailey 1-26) and *Acacia pruinocarpa* low sparse shrubland
- **TLMSS**: *Thryptomene* sp. Leinster (B.J. Lepschi & L.A. Craven 4362) mid sparse shrubland.

Broadly, these vegetation types are similar to as detailed in Ecoscape (2019a) that described, at Reconnaissance level, a subsection of the Old Highway survey area. Differences between the tallest stratum species dominance reflect the number of quadrats from each type that have varying dominant species (e.g. the 2019 **AiTOS** vegetation type was based on one quadrat, with this vegetation type now included in **AapAinGbTSS** from eight quadrats, with the initial characteristic species *Acacia incurvaneura* now relegated to sub-dominance). Mapping from 2019 has been refined as a result of the greater survey intensity.

Similarly, Mattiske Consulting (2010) mapping was also conducted at a broader scale due to the significantly larger survey area in 2010. The delineation of vegetation type boundaries in 2010 has been refined during this survey, with vegetation type descriptions reflective of a smaller survey area although the characteristic

species of both 2010 descriptions are similar to described herein, noting that Mulga taxonomy was revised after the survey (Maslin & Reid 2012).

Mattiske Consulting (2010) defined 21 vegetation types from its broader survey area; from these two were considered as significant although neither occurred within the Old Highway and proposed haul route survey area (one was characterised by *Eucalyptus semota* and the other a Chenopod shrubland).

5.2.1 PRIORITY ECOLOGICAL COMMUNITIES

The western portion of Old Highway intersects the mapped extent of the P1 Robinson Range PEC.

In 2007 the Robinson Range was considered a 'site requiring further investigation' following the Department of Environment and Conservation's strategic review (DEC 2007) that was based on a number of surveys by DEC that were published in the *Conservation Science Western Australia* journal, including for the Robinson Ranges (Meissner, Owen & Bayliss 2009). No floristic quadrats were recorded from within the Old Highway survey area (data available on *NatureMap*; DBCA 2007-2021), with the nearest quadrats (ROBI01, ROBI02, ROBI03) being approximately 2.25 km north-west of the most western point of Old Highway, although within the same range of hills that intersect the western side of the survey area.

In approximately 2013 the Robinson Range was listed as a PEC, known as the *Robinson Range vegetation assemblages (banded ironstone formation)*. Little information regarding this PEC is available and it is likely that the defining feature is inclusion in the landform rather than any specific vegetation (or other biological) attributes. Within Old Highway this would likely be inclusive of the entire mapped extent of the PEC as provided by DBCA (database search request), excluding the applied 500 m buffer, and incorporate the low hills and footslopes on the north-western edge of the survey area.

Meissner, Owen & Bayliss (2009) identified seven vegetation communities from the Robinson Range and Mt Gould (approximately 180 km to the west). The vegetation community listed for the three nearest DBCA quadrats is 'Robinson Range community group 3' described (noting that currently named Mulga species would have been combined as *Acacia aneura* as the DEC survey was prior to the 2012 taxonomic revision of this group (Maslin & Reid 2012)) as:

The community occurs on simple and lower slopes of Robinson range. It is described as sparse shrubland and woodlands of A. aneura and Acacia pruinocarpa over shrubland of A. aneura (juvenile), A. ramulosa var. linophylla, Eremophila fraseri, Eremophila spectabilis subsp. spectabilis and Senna glaucifolia over forbland and grassland of P. polystachyus, E. pulchella and Paspalidium basicladum. It is characterised by Species Group A, B and F. Indicator species are Hibiscus aff. burtonii, Senna artemisioides subsp. helmsii, E. spectabilis subsp. spectabilis, A. aneura var. aneura/intermedia morphotype, A. tetragonophylla and Senna sp. Meekatharra (E. Bailey 1–26). Mean species richness was 11 taxa per quadrat.

Visually, vegetation type **AinTOS** resembles the images for 'Robinson Range community group 3' available on *NatureMap*¹ (DBCA 2007-2021), including landform and overall vegetation structure. The typical taxa listed for this community in Meissner, Owen & Bayliss (2009) and on *NatureMap* were largely not included in the three representative quadrats (excluding *Hibiscus burtonii*), however, review of the DEC quadrat data indicates floristic similarity including the dominant Mulga species (*Acacia aneura* var. *microcarpa*, now *Acacia incurvaneura*) and ground stratum species (*Aluta maisonneuvei* subsp. *auriculata*) as well as a number of other species in common including *Aristida contorta*, *Brunonia australis*, *Eriachne pulchella* subsp. *dominii*, *Goodenia triodiophila*, *Grevillea berryana* and *Monachather paradoxus*. It is therefore concluded that vegetation type **AinTOS** from this survey is representative of 'Robinson Range community group 3' and therefore the PEC, based on both vegetation and landform.

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https://naturemap.dbca.wa.gov.au/resources/bif/24%20BIF%20Rgs/Robinson%20Range/Robinson%20Range%20Factsheets/Robinson_Range_Community_Group_3.htm

Vegetation type **AinTOS** is significant due to its association with, including being within the mapped extent of, the Robinson Range PEC, its small extent within the survey area (15.62 ha, occupying 1.19% of the survey area) and being a significant habitat for a P2 species; *Indigofera fractiflexa* subsp. *augustensis*.

No other vegetation type from this survey is broadly similar to any Robinson Range community type outlined in Meissner, Owen & Bayliss (2009) and *NatureMap* (DBCA 2007-2021), based on dominant or characteristic species, nor do any appear visually similar to representatives shown on *NatureMap* (*ibid.*; 'BIF Ranges Surveys' in 'Yilgarn Flora Surveys' theme). Except for **AinTOS** and two other vegetation types (**AapAsuTOS** and **MAprLSS**, discussed below), all vegetation types intersecting the mapped PEC extent occur over a wider area and are not considered as significant.

Vegetation type **AapAsuTOS** occurred only within the mapped Robinson Range PEC extent; it occupied two small quartzite knolls and adjacent footslope area. This vegetation type occupied only 1.61 ha (0.12% of the survey area). Only two quadrats were recorded due to its small extent and that the quadrats were centred on the quartz knolls that were pivotal to describing the vegetation. It was the only other vegetation type providing habitat for P2-listed *Indigofera fractiflexa* subsp. *augustensis*. This vegetation type is considered to be of significance due to its occurrence within the mapped extent of the Robinson Range PEC, its small extent, that it is confined to a habitat with only a small extent within the survey area and that it provides habitat for a P2-listed species.

Vegetation type **SMAprLSS** occurred only within the mapped Robinson Range PEC extent; it also occupied only a small extent (0.65 ha; 0.05% of the survey area) on conglomerated ironstone that was not found elsewhere in the survey area. Only one quadrat was recorded due to the small extent of the vegetation type and landform to which it was confined. No species within this vegetation type were of significance, nor was this vegetation type floristically distinctive from other types on stony plains. This vegetation type is considered to be of significance due to its occurrence within the mapped extent of the Robinson Range PEC, its small extent and that it is confined to a habitat with only a small extent within the survey area.

5.2.2 OTHER SIGNIFICANT VEGETATION

According to the criteria outlined in the Flora and Vegetation Technical Guidance (EPA 2016), four vegetation types are considered to be significant.

5.2.2.1 Sheetflow Dependent Vegetation

AapAsuAprLOF and **CcAapMOF** both represent sheet flow dependent (Mulga grove) vegetation that is significant as it is:

- historically impacted from threatening processes including grazing as it provides shelter and green forage in otherwise largely bare areas, weed invasion as a result of grazing and it being a more mesic area, and changes to surface water flow as a result of alteration to the soil surface including the intercepting of sheet flow by roads
- performs an important function to maintain ecological integrity, particularly through the interception of surface water flows that lead to accumulation of clay soil and organic matter, forming fertile soils in an otherwise dry and infertile area (Ludwig *et al.* 1997; Saco, Willgoose & Hancock 2007)
- provides habitat and refuge for a range of species, including fauna. Whilst no conservation-listed fauna were recorded, Mulga groves, particularly **CcAapMOF**, provide habitat for arboreal hollow-dwelling reptile species as well as a number of bird species, and potentially invertebrates.

The Mulga grove vegetation types are floristically similar to Mulga drainage vegetation types (**AapAsuPILW**, **AapAteAanLOF**). Patches of Mulga vegetation along the section of the proposed haul route immediately north of Old Highway have been assessed as being representative of **AapAteAanLOF** (dispersed drainage/minor creeks) as they contained clear drainage lines rather than the undulations in soil surface present in Mulga groves (vegetation type **AapAsuAprLOF**). Vegetation patterning suggests that these sections of Mulga should be a grove formation, however, continuous works on the Old Highway have lowered the ground surface, disrupting sheet flow and leading to a creekline forming within the vegetation.

Mulga groves with similar vegetation area widespread within the Gascoyne bioregion and beyond, over much of arid and semi-Australia (Saco, Willgoose & Hancock 2007). As such they are considered common, however, their significance lies in their ecological function rather than rarity.

5.2.2.2 Riparian Vegetation

CcEvHIMW, representing the Gascoyne River South riparian area, is also significant as it:

- is also historically impacted by threatening processes (grazing)
- performs an important function to maintain ecological integrity
- provides habitat and refuge for a range of species, including fauna. Its use as fauna habitat is similar to that of Mulga groves with *Corymbia candida* (vegetation type **CcAapMOF**).

No obligate phreatophytic species (see **Appendix One**) were recorded from within the survey area nor observed nearby. *Corymbia candida* is not considered to be groundwater dependent: no references were identified that considered it to be so although one reference speculated that dependence on groundwater could not be discounted (Astron Environmental Services 2016).

Eucalyptus victrix was a characteristic rather than dominant species in this part of the riparian area (and did not occur within the single quadrat recorded in this vegetation type). However, in many circumstances this species is not considered to be groundwater dependent (see **Appendix One**) including where groundwater is more than 10 m below the soil surface. There are no nearby bores to accurately determine depth to groundwater, with the nearest being 1.4 km to the north north-west but not within the riparian area (depth to groundwater here was 4.2 m; Ben McLernon, Sandfire Resources *pers. comm.*). The Groundwater Dependent Ecosystems Atlas (BoM 2021b) indicates that this part of the survey area has a moderate potential for terrestrial GDEs to occur with an IDE likelihood of 3. No pools correspond with the survey area nor were any observed nearby.

It is considered unlikely that this vegetation type is groundwater dependent although detailed investigations would be required for certainty. Its significance lies in its ecological function as a riparian area.

5.2.2.3 Restricted Distribution Vegetation

Vegetation type **TLMSS**, occurring on a calcrete hill that occupied a small extent and was unusual habitat for *Eremophila demissa* (P1) that was otherwise recorded on flats, as well as being characterised by a conservation-listed species; *Thryptomene* sp. Leinster (B.J. Lepschi & L.A. Craven 4362) (P3). For these reasons it is considered to have an element of significance.

5.2.3 LOCAL AND REGIONAL ASSESSMENT OF VEGETATION SIGNIFICANCE

Vegetation that is likely to be restricted to the survey area and vicinity may be considered as locally and potentially regionally significant, including vegetation types restricted to the Robinson Range and confined to within the mapped extent of the Robinson Range PEC:

- **AinTOS** (*Acacia incurvaneura* tall open shrubland) that is representative of the Robinson Range plant community 3 (Meissner, Owen & Bayliss 2009) and occupied 15.62 ha (1.19% of the survey area)
- **AapAsuTOS** (*Acacia aptaneura* and *Acacia subcontorta* tall open shrubland) was restricted to a small area with two quartzite knolls; no similar landforms were observed elsewhere in the survey area. This vegetation type occupied 1.61 ha (0.12% of the survey area).
- **SMAprLSS** (*Senna* sp. Meekatharra (E. Bailey 1-26) and *Acacia pruinocarpa* low sparse shrubland) was confined to a small area of ironstone conglomerate; no similar soil type was observed elsewhere in the survey area and the vegetation structure of low shrubs was also unique. This vegetation type occupied 0.65 ha; 0.05% of the survey area.

Vegetation type **TLMSS** (*Thryptomene* sp. Leinster (B.J. Lepschi & L.A. Craven 4362) mid sparse shrubland) occurred on a calcrete hill and occupied a small extent (1.57 ha; 0.12% of the survey area). It was unusual as

habitat for *Eremophila demissa* (P1) that was otherwise recorded on flats. For this reason it was considered as locally significant.

Vegetation performing important ecological functions are likely to be locally significant, although none were considered to be confined to the local area. Vegetation types **AapAsuAprLOF** (*Acacia aptaneura* and *Acacia subcontorta* tall open shrubland) and **CcAapMOF** (*Corymbia candida* and *Acacia aptaneura* mid open forest) represent Mulga groves; vegetation type **CcEvHIMW** (*Corymbia candida*, *Eucalyptus victrix* and *Hakea lorea* subsp. *lorea* mid woodland) represents riparian vegetation. These occupy 29.80 ha (2.26% of the survey area), 4.50 ha (0.34%) and 2.36 ha (0.18%) respectively.

The previous section provides more detail regarding these vegetation types' significance.

No other vegetation types are considered to have local or regional significance and, on the whole, those observed within the survey area are considered representative of the wider Gascoyne bioregion.

5.2.4 VEGETATION CONDITION

The vegetation condition of the survey area ranged from Excellent to Completely Degraded, with most being in Good to Very Good condition (60.57%). The main factor affecting vegetation condition was weediness, primarily in Mulga groves and drainage lines, although cattle grazing (the survey area was only considered to be lightly grazed at the moment) and previous clearing for prospecting activities were also a factor.

Many low shrubs were dead; this was considered likely a result of poor seasonal conditions (low rainfall) over at least two of the previous 3 years rather than any particular human-induced disturbance.

6 CONCLUSIONS

The Detailed flora and vegetation survey of 1,317.73 ha was conducted during March/April 2021.

A number of significant findings were identified by the Detailed flora and vegetation survey of the Old Highway and proposed haul route. The most significant aspects likely to be investigated by regulatory authorities are conservation-listed flora species and impacts on the Robinson Range PEC that is mapped as intersecting the western portion of Old Highway, although other significant vegetation types may also be taken into consideration.

Eighty-eight floristic quadrats were established during the field survey resulting in the identification of 182 vascular flora species, plus an additional 10 species from a previous survey conducted during 2019 (Ecoscape 2019a).

Seven PF were recorded during the field survey: *Eremophila demissa* (P1), *Ptilotus actinocladus* (P1), *Indigofera fractiflexa* subsp. *augustensis* (P2), *Homalocalyx echinulatus* (P3), *Sida picklesiana* (P3), *Thryptomene* sp. Leinster (B.J. Lepschi & L.A. Craven 4362) (P3) and *Goodenia nuda* (P4). Of the conservation-listed flora considered as possibly occurring but not recorded during the field survey, *Eucalyptus semota* was re-evaluated as unlikely to occur and *Dodonaea amplisemina* retained its possible likelihood. *Rhodanthe sphaerocephala* was not recorded but may occur as it is an annual species and may not always be present or identifiable.

The most significant of the recorded Priority-listed flora were those with the highest priority; the P1 and P2 species.

Eremophila demissa was recorded from six vegetation types over much of the survey area from the eastern side of Old Highway and intermittently along the proposed haul route. Although the number of plants recorded from the survey area is listed as 168, significantly more occur as this number represents only a sample of the population, particularly along the proposed haul route in the section indicated on **Map 4E**, with the population also extending outside the survey area and into the surrounding vegetation. Ecoscape also conducted targeted surveys of East Shed Well and Cow Hole Bore, as well as recording *Eremophila demissa* opportunistically during the survey period resulting in approximately 5,000 individual plants being recorded. Again, this is an underestimate due to the method of sampling. Based on the observed locally widespread extent of this species, clearing for a mine at Old Highway and widening the existing road along the proposed haul route, including some additional infrastructure developments along the route, is unlikely to significantly impact this species as a whole.

Ptilotus actinocladus was identified from within two floristic quadrats from collected material. No population estimate is available, however, the species is likely to be confined to areas close to the Gascoyne River South although it may also occur in run-on areas adjacent to the Highway elsewhere. As an annual species its population is likely to fluctuate naturally. Widening of the proposed haul route is unlikely to significantly impact on this species' population as a whole.

Indigofera fractiflexa subsp. *augustensis* was confined to two rocky vegetation types within the mapped extent of the Robinson Range PEC; it is unlikely to occur elsewhere within the survey area. However, it has been recorded in suitable habitat from within two bioregions and a potential range of over 50,000 km² thus it is unlikely that clearing of the populations within the survey area would have a significant impact on the species as a whole, although clearing should be avoided in vegetation type **AinTOS** if possible as this represented the majority of the plants recorded within the survey area.

Twenty-two vegetation types were recorded. Most occur commonly in the local area beyond the survey area, with similar vegetation being widespread within the bioregion.

Vegetation confined to the mapped extent of the Robinson Range PEC is likely to be the most significant. Seven vegetation types intersect the mapped extent, including buffers, although only three were confined to the PEC:

- vegetation type **AinTOS** floristically, structurally and visually resembles the ‘Robinson Range community group 3’ (Meissner, Owen & Bayliss 2009) and occurs on banded ironstone; it occupied 15.62 ha (1.19% of the survey area)
- **AapAsuTOS** was restricted to a small area with two quartzite knolls and occupied 1.61 ha (0.12%)
- **SMAprLSS** was confined to a small area of ironstone conglomerate, had unique vegetation structure of stunted plants and occupied 0.65 ha (0.05%).

These three vegetation types are likely to be the most significant within the survey area, although the following vegetation types also have some significance.

Sheetflow dependent (Mulga grove) vegetation (vegetation types **AapAsuAprLOF** occupying 29.80 ha; 2.26% and **CcAapMOF** occupying 4.50 ha; 0.34%) were also considered significant due to their historical impact from threats, ecological function and role as a refuge. Riparian vegetation type **CcEvHIMW** (2.36 ha; 0.18%), corresponding with the Gascoyne River South, was also considered significant for similar reasons.

Vegetation type **TLMSS** occupied a small extent (1.57 ha; 0.12%) and was confined to a calcrete hill that was a distinctive landform in the survey area. It was unusual as habitat for *Eremophila demissa* (P1) that was otherwise recorded on flats and was further characterised by a conservation-listed flora as a dominant species; this vegetation type was considered likely to be significant for these reasons.

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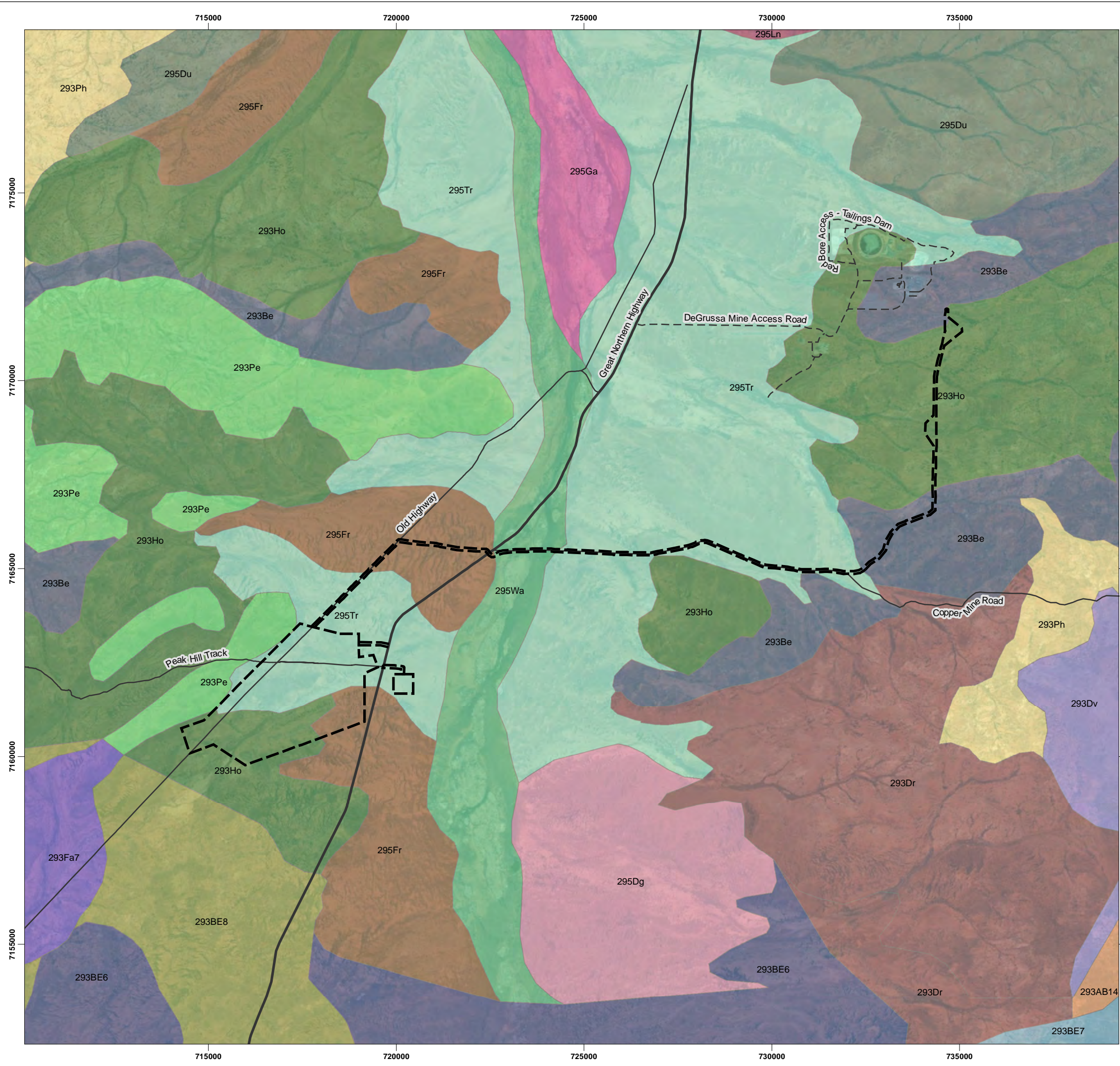
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LEGEND

Survey Area

Soil Landscapes that intersect with the Survey

- 293Be - Low ridges, hills and lateritised residuals above stony footslopes and broad, stony lower plains supporting scattered mulga and snakewood shrublands.
- 293Ho - Gently undulating stony plains and low rounded hills with partially saline drainage foci and alluvial tracts supporting acacia and eremophila tall shrublands, and chenopod low shrublands .
- 293Pe - Rugged, sinuous ranges and rounded hills of banded ironstone and hematitic shale, supporting stunted mulga and cottonbush shrublands.
- 295Fr - Hardpan wash plains with broad, reticulate mulga groves and wanderrie banks supporting acacia tall shrublands with grassy understorey.
- 295Tr - Hardpan plains and minor sandy banks supporting sparse mulga shrublands.
- 295Wa - Low calcrete platforms and plains supporting mulga and cassia shrublands and minor chenopod low shrublands.

DATASOURCES :
SOURCE DATA: SOIL LANDSCAPE MAPPING BEST AVAILABLE (DPIRD, 2018)
AERIAL: ESRI BASEMAP 2020
BASEMAP: GEOSCIENCE AUSTRALIA
SERVICE LAYERS: SOURCE: ESRI, MAXAR, GEOEYE, EARTHSTAR GEOGRAPHICS, CNES/AIRBUS DS, USDA, USGS, AEROGRIID, IGN, AND THE GIS USER COMMUNITY



PRE EUROPEAN VEGETATION ASSOCIATIONS

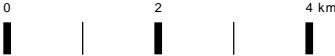
OLD HIGHWAY PROJECT FLORA & VEGETATION SURVEY



COORDINATE SYSTEM: GDA 1994 MGA ZONE 50
PROJECTION: TRANSVERSE MERCATOR
DATUM: GDA 1994
UNITS: METER

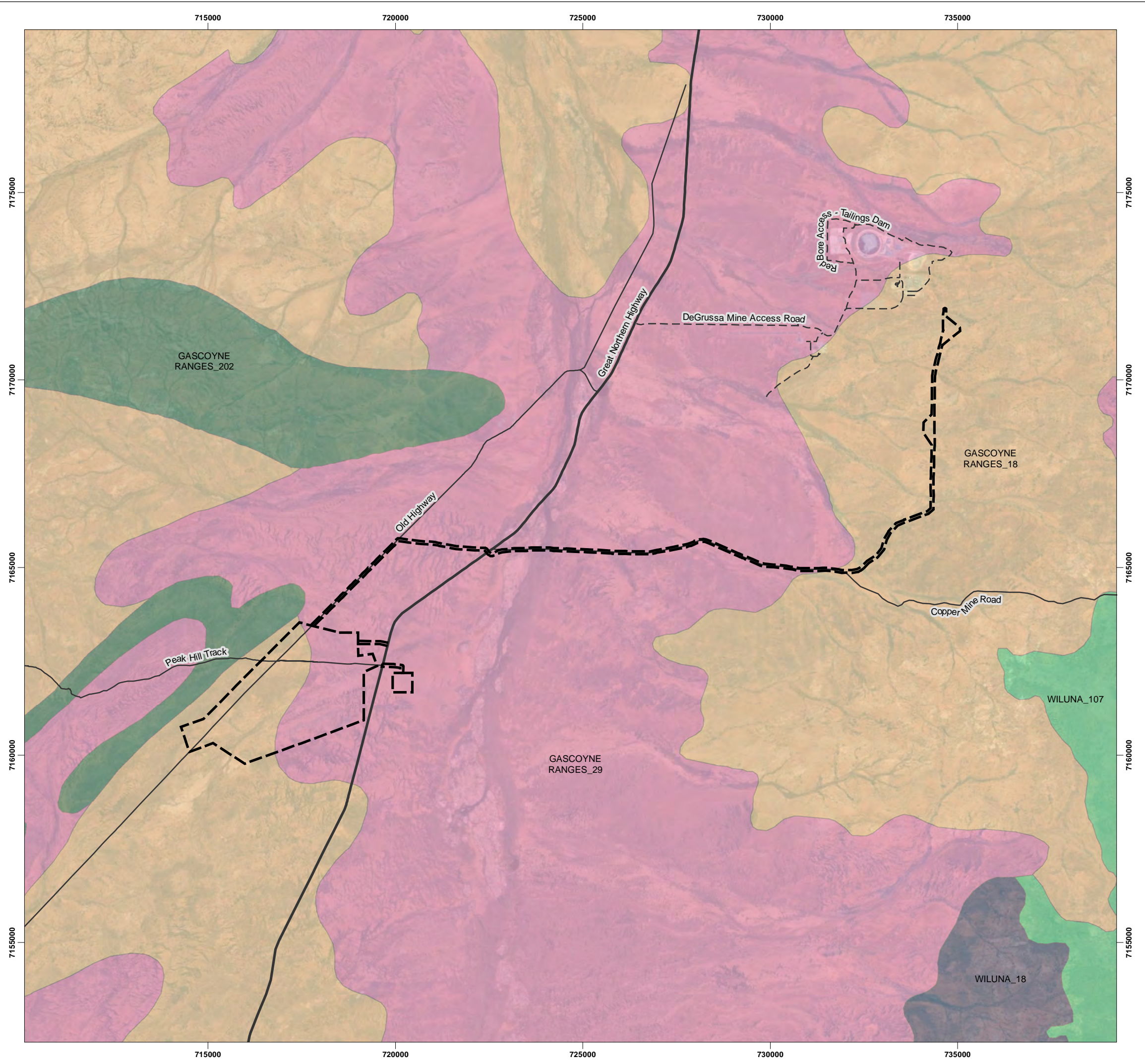


SCALE: 1:100,000 @ A3



PROJECT NO: 4622-21

REV	AUTHOR	APPROVED	DATE
0	SB	LA	30/06/2021



LEGEND

Survey Area

Pre-European Vegetation

GASCOYNE RANGES_18 - Low woodland; mulga (*Acacia aneura*)

GASCOYNE RANGES_202 - Shrublands; mulga and *Acacia quadrimarginea* scrub

GASCOYNE RANGES_29 - Sparse low woodland; mulga, discontinuous in scattered groups

WILUNA_107 - Hummock grasslands, shrub steppe; mulga and *Eucalyptus kingsmillii* over hard spinifex

WILUNA_18 - Low woodland; mulga (*Acacia aneura*)

DATASOURCES :
SOURCE DATA: PRE-EUROPEAN VEGETATION - WA NVIS COMPLIANT VERSION (DPIRD, 2019)
AERIAL: ESRI BASEMAP 2020
BASEMAP: GEOSCIENCE AUSTRALIA
SERVICE LAYERS: SOURCE: ESRI, MAXAR, GEOEYE, EARTHSTAR GEOGRAPHICS, CNES/AIRBUS DS, USDA, USGS, AEROGRIID, IGN, AND THE GIS USER COMMUNITY

PRE EUROPEAN VEGETATION ASSOCIATIONS

**OLD HIGHWAY PROJECT
FLORA & VEGETATION SURVEY**

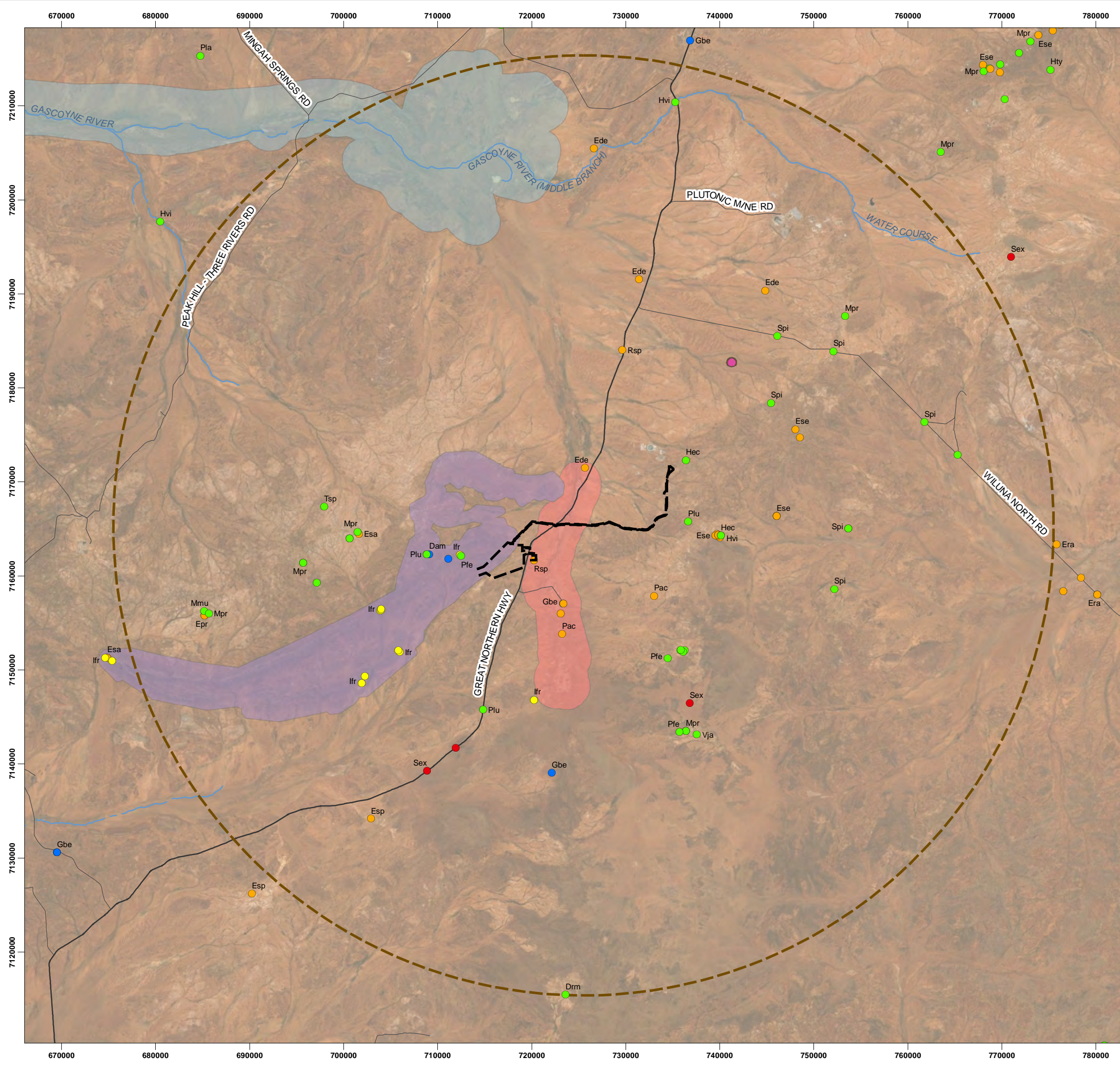
COORDINATE SYSTEM: GDA 1994 MGA ZONE 50
PROJECTION: TRANSVERSE MERCATOR
DATUM: GDA 1994
UNITS: METER

SCALE: 1:100,000 @ A3
0 2 4 km

PROJECT NO: 4622-21

REV	AUTHOR	APPROVED	DATE
0	SB	LA	30/06/2021

MAP
2



LEGEND

- Survey Area
- 50 km Buffer

Conservation Listed Flora

- Threatened
- Priority 1
- Priority 2
- Priority 3
- Priority 4

Threatened / Priority Ecological Communities

- Priority 1, Doolgunna Calcrete
- Priority 1, Robinson Range BIF
- Priority 1, Three Rivers Plutonic Calcrete
- Priority 3, Blech LS

Label	Taxon	Cons Status	Label	Taxon	Cons Status
Dm	<i>Dicrastylis mitchelli</i>	1	Fr	<i>Indigifera fraxifera</i> subsp. <i>augustensis</i>	2
Dam	<i>Dodonaea amplicarpa</i>	4	Ig	<i>Indigifera gilesii</i>	3
Dm	<i>Dumortiera maritima</i>	3	Mru	<i>Maireana murrayana</i>	3
Ean	<i>Eremophila anomala</i>	1	Mpr	<i>Maireana prostrata</i>	3
Ear	<i>Eremophila arachnoides</i> subsp. <i>arachnoides</i>	3	Mm	<i>Micromyrtus mucronulata</i>	1
Era	<i>Eremophila arguta</i>	1	Pp	<i>Phytolista iphithima</i>	1
Ede	<i>Eremophila demissa</i>	1	Pfe	<i>Prostanthera ferricola</i>	3
Egr	<i>Eremophila gracilima</i>	3	Pac	<i>Ptilotus actinocladus</i>	1
Ela	<i>Eremophila lanata</i>	3	Pla	<i>Ptilotus lazaridis</i>	3
Eob	<i>Eremophila obliquisepala</i>	3	Plu	<i>Ptilotus luteolus</i>	3
Epr	<i>Eremophila prolata</i>	1	Rsp	<i>Rhodanthe sphaeroccephala</i>	1
Eri	<i>Eremophila rigida</i>	3	Ssp	<i>Scaevola</i> sp. <i>Woolgong</i> (M. Officer s.n. 10/8/94)	3
Esh	<i>Eremophila shonae</i> subsp. <i>diffusa</i>	3	Sex	<i>Scaevola exaltata</i>	1
Esp	<i>Eremophila</i> sp. <i>Meekatharra</i> (D.J. Edinger 4430)	1	Spi	<i>Sida picklesiana</i>	3
Ese	<i>Eucalyptus semota</i>	1	Sio	<i>Solanum iodinum</i>	1
Esa	<i>Euphorbia sarcocottoides</i>	1	Sre	<i>Solanum reclusum</i>	1
Gbe	<i>Goodenia berringtonensis</i>	4	Tsp	<i>Thryptomena</i> sp. <i>Leinster</i> (B.J. Lepsch & L.A. Craven 4362)	3
Hty	<i>Hemigenia tysonii</i>	3	Tad	<i>Tribulus adalcanthus</i>	3
Hvi	<i>Hemigenia virescens</i>	3	Vja	<i>Verticordia jamiesonii</i>	3
Hec	<i>Homalocalyx echinulatus</i>	3	Wsp	<i>Wurmbea</i> sp. <i>Denham Pool</i> (F. Hort et al. 2216)	1

DATASOURCES :
SOURCE DATA: PRE-EUROPEAN VEGETATION - WA NVIS COMPLIANT VERSION (DPIRD, 2019)
AERIAL: ESRI BASEMAP 2020
BASEMAP: GEOSCIENCE AUSTRALIA
SERVICE LAYERS: SOURCE: ESRI, MAXAR, GEOEYE, EARTHSTAR GEOGRAPHICS, CNES/AIRBUS DS, USDA, USGS, AEROGRIID, IGN, AND THE GIS USER COMMUNITY



FLORA AND ECOLOGICAL
COMMUNITIES DBCA
DATABASE SEARCH RESULTS

OLD HIGHWAY PROJECT
FLORA & VEGETATION SURVEY



COORDINATE SYSTEM: GDA 1994 MGA ZONE 50
PROJECTION: TRANSVERSE MERCATOR
DATUM: GDA 1994
UNITS: METER

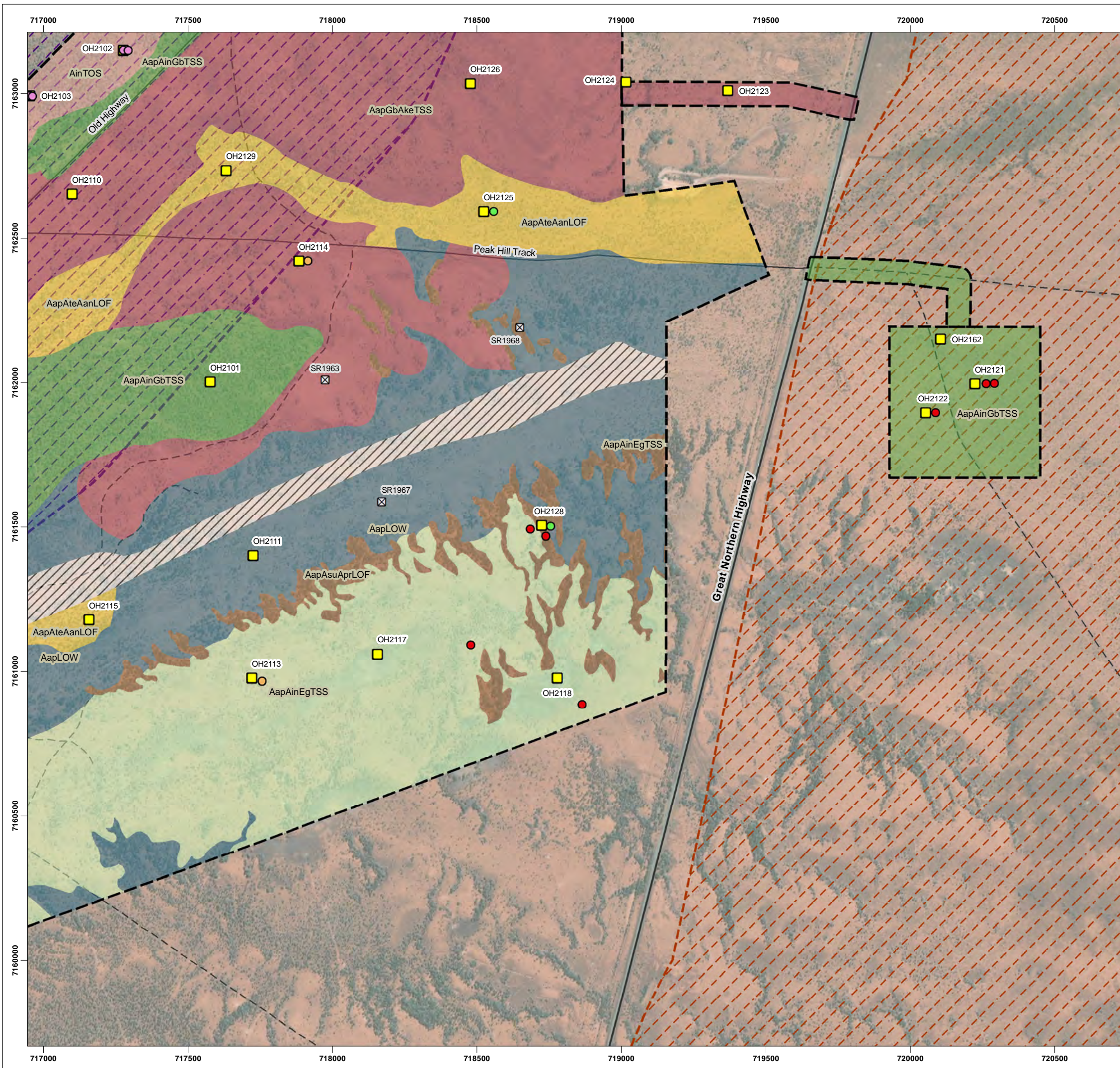


SCALE: 1:400,000 @ A3



PROJECT NO: 4622-21

REV	AUTHOR	APPROVED	DATE
0	SB	LA	30/06/2021



LEGEND

Survey Area

Quadrats (Ecoscope, 2021)

Quadrats (Ecoscope, 2019)

Conservation Listed Flora

Eremophila demissa (P1)

Goodenia nuda (P4)

Indigofera fractiflexa subsp. *augustensis* (P2)

Sida picklesiana (P3)

TEC/PEC (DBCA, 2021)

Doolgunna Calcrete

Robinson Range BIF

Vegetation Type

AapAinEgTSS - *Acacia aptaneura*, *Acacia incurvaneura* and *Eremophila galeata* tall sparse shrubland

AapAinGbTSS - *Acacia aptaneura*, *Acacia incurvaneura* and *Grevillea berryana* tall sparse shrubland

AapAsuAprLOF - *Acacia aptaneura*, *Acacia subcontorta* and *Acacia pruinocarpa* low open forest

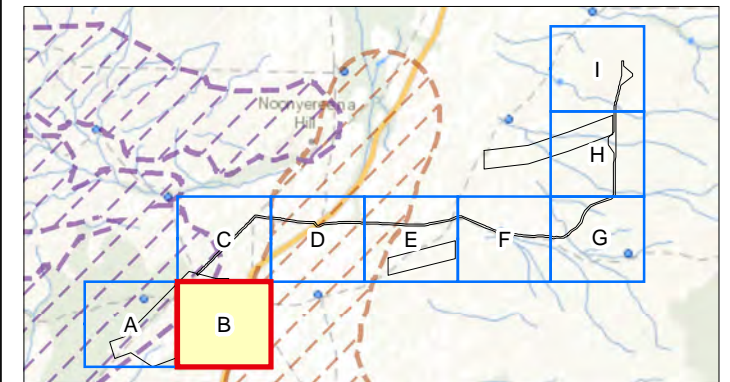
AapAteAanLOF - *Acacia aptaneura*, *Acacia tetragonophylla* and *Acacia aneura* low open forest

AapGbAkeTSS - *Acacia aptaneura*, *Grevillea berryana* and *Acacia kempeana* tall sparse shrubland

AapLOW - *Acacia aptaneura* low open woodland

AinTOS - *Acacia incurvaneura* tall open shrubland

- No vegetation



ecoscape

**VEGETATION TYPES,
QUADRATS AND
CONSERVATION LISTED FLORA**

**OLD HIGHWAY PROJECT
FLORA & VEGETATION SURVEY**

DATASOURCES:
SOURCE DATA: QUADRATS, CONSERVATION LISTED
FLORA AND VEGETATION (ECOSCAPE, 2021)
AERIAL: ESRI BASEMAP 2020
BASEMAP: GEOSCIENCE AUSTRALIA
SERVICE LAYERS: SOURCE: ESRI, MAXAR, GEOEYE,
EARTHSTAR, GEOGRAPHICS, CNES/AIRBUS DS, USDA,
USGS, AERGRID, IGN, AND THE GIS USER COMMUNITY

SANDFIRE RESOURCES

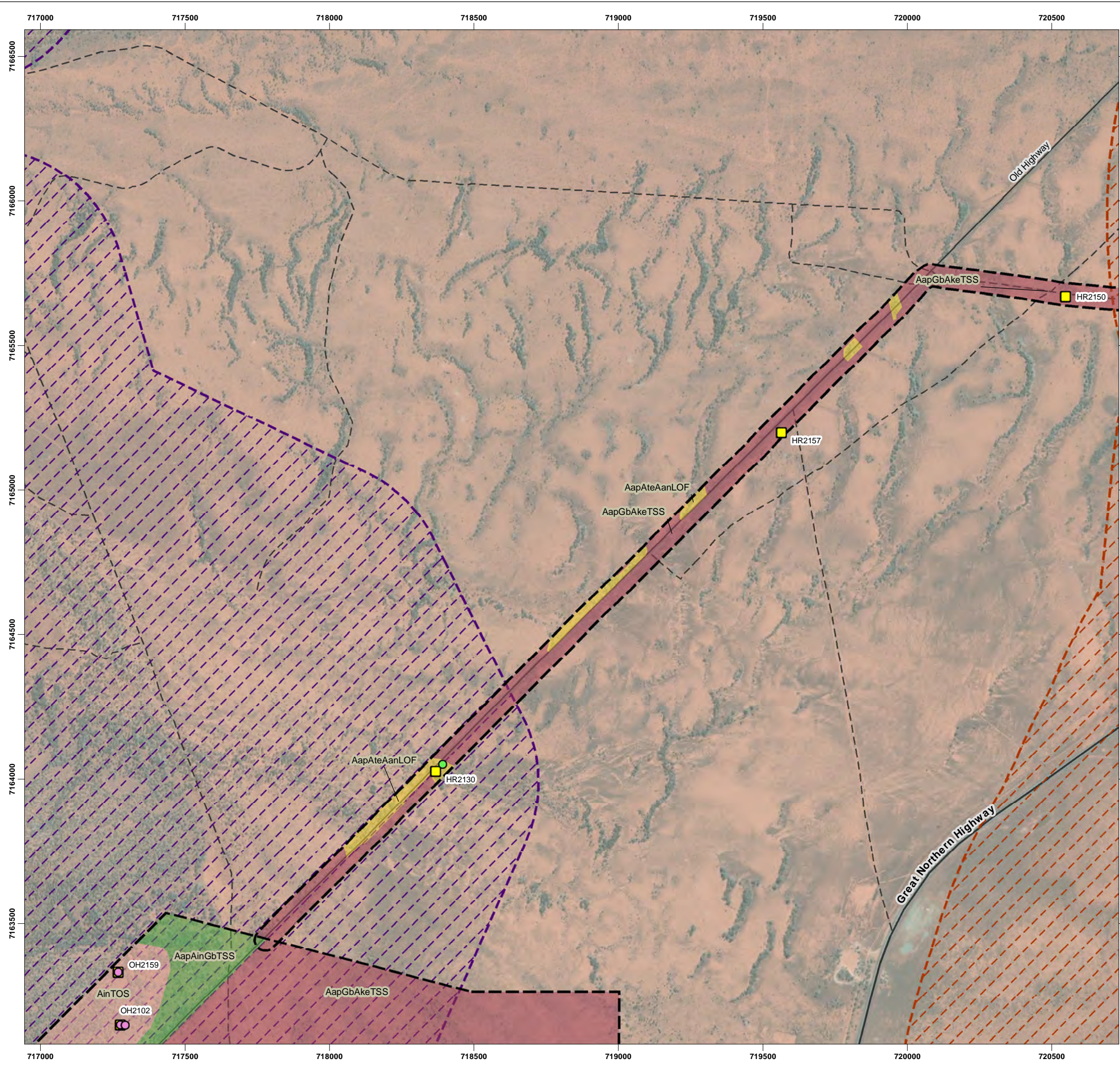
COORDINATE SYSTEM: GDA 1994 MGA ZONE 50
PROJECTION: TRANSVERSE MERCATOR
DATUM: GDA 1994
UNITS: METER

SCALE: 1:13,000 @ A3

PROJECT NO: 4622-21

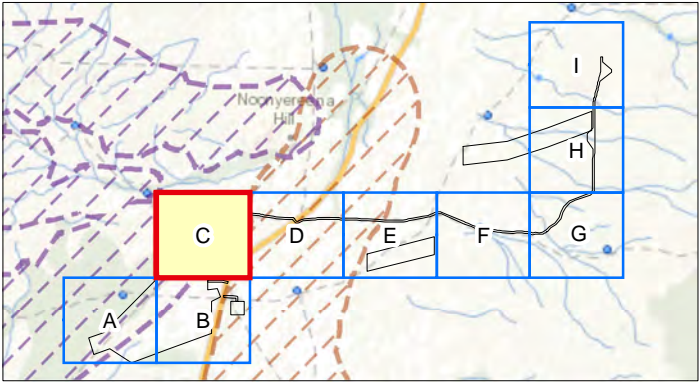
REV	AUTHOR	APPROVED	DATE
0	SB	LA	29/06/2021

**MAP
4B**



LEGEND

- Survey Area
- Quadrats (Ecoscape, 2021)
- Conservation Listed Flora**
- Indigofera fractiflexa* subsp. *augustensis* (P2)
- Sida picklesiana* (P3)
- TEC/PEC (DBCA, 2021)**
- Doolgunna Calcrete
- Robinson Range BIF
- Vegetation Type**
- AapAinGbTSS - *Acacia aptaneura*, *Acacia incurvaneura* and *Grevillea berryana* tall sparse shrubland
- AapAteAanLOF - *Acacia aptaneura*, *Acacia tetragonophylla* and *Acacia aneura* low open forest
- AapGbAkeTSS - *Acacia aptaneura*, *Grevillea berryana* and *Acacia kempeana* tall sparse shrubland
- AinTOS - *Acacia incurvaneura* tall open shrubland



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VEGETATION TYPES,
QUADRATS AND
CONSERVATION LISTED FLORA

OLD HIGHWAY PROJECT
FLORA & VEGETATION SURVEY

DATASOURCES:
SOURCE DATA: QUADRATS, CONSERVATION LISTED
FLORA AND VEGETATION (ECOSCAPE, 2021)
AERIAL: ESRI BASEMAP 2020
BASEMAP: GEOSCIENCE AUSTRALIA
SERVICE LAYERS: SOURCE: ESRI, MAXAR, GEOEYE,
EARTHSTAR, GEOGRAPHICS, CNES/AIRBUS DS, USDA,
USGS, AERGRID, IGN, AND THE GIS USER COMMUNITY



COORDINATE SYSTEM: GDA 1994 MGA ZONE 50
PROJECTION: TRANSVERSE MERCATOR
DATUM: GDA 1994
UNITS: METER



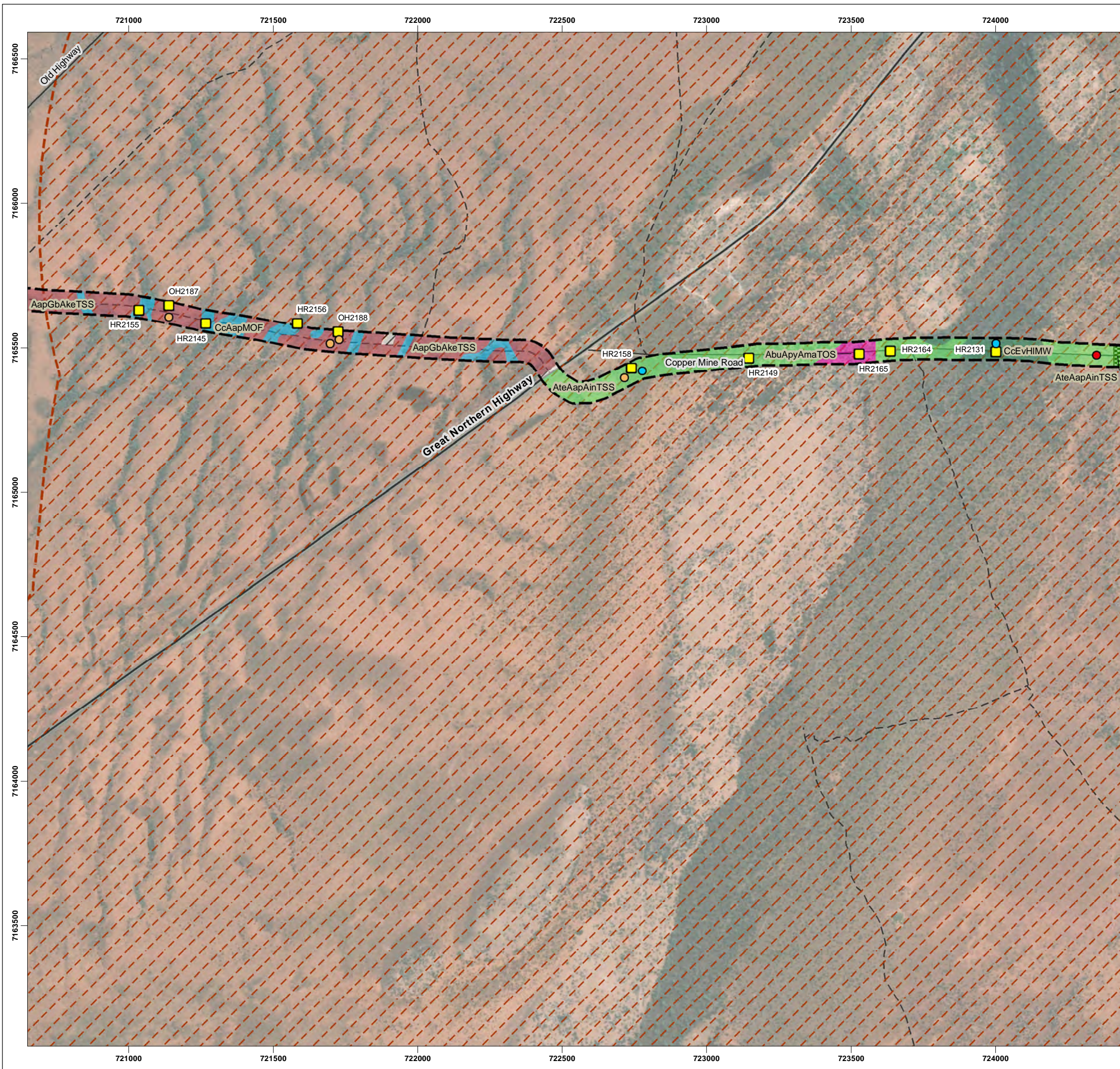
SCALE: 1:13,000 @ A3



PROJECT NO: 4622-21

REV	AUTHOR	APPROVED	DATE
0	SB	LA	29/06/2021

MAP
4C



LEGEND

Survey Area

Quadrats (Ecoscape, 2021)

Conservation Listed Flora

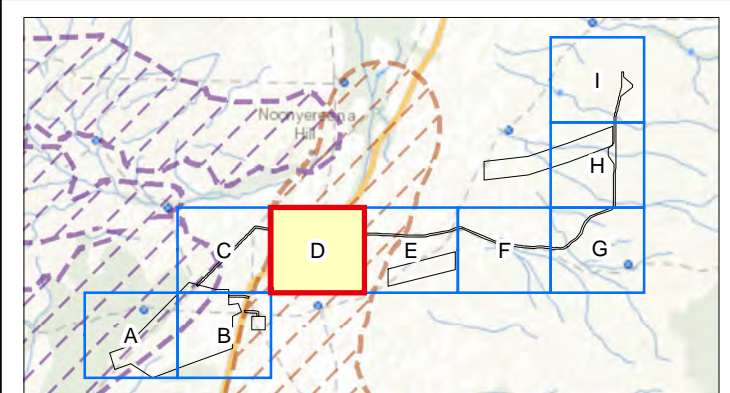
- Eremophila demissa* (P1)
- Goodenia nuda* (P4)
- Ptilotus actinocladus* (P1)
- Eremophila demissa* population

TEC/PEC (DBCA, 2021)

Doolgunna Calcrete

Vegetation Type

- AapGbAkeTSS - *Acacia aptaneura*, *Grevillea berryana* and *Acacia kempeana* tall sparse shrubland
- AbuApyAmaTOS - *Acacia burkittii*, *Acacia pyrifolia* var. *pyrifolia* and *Acacia macraneura* tall open shrubland
- AteAapAinTSS - *Acacia tetragonophylla*, *Acacia aptaneura* and *Acacia incurvaneura* tall sparse shrubland
- CcAapMOF - *Corymbia candida* and *Acacia aptaneura* mid open forest
- CcEvHIMW - *Corymbia candida*, *Eucalyptus victrix* and *Hakea lorea* subsp. *lorea* mid woodland
- No vegetation



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**VEGETATION TYPES,
QUADRATS AND
CONSERVATION LISTED FLORA**

**OLD HIGHWAY PROJECT
FLORA & VEGETATION SURVEY**

DATASOURCES:
SOURCE DATA: QUADRATS, CONSERVATION LISTED
FLORA AND VEGETATION (ECOSCAPE, 2021)
AERIAL: ESRI BASEMAP 2020
BASEMAP: GEOSCIENCE AUSTRALIA
SERVICE LAYERS: SOURCE: ESRI, MAXAR, GEOEYE,
EARTHSTAR, GEOGRAPHICS, CNES/AIRBUS DS, USDA,
USGS, AEROGRIID, IGN, AND THE GIS USER COMMUNITY

SANDFIRE RESOURCES

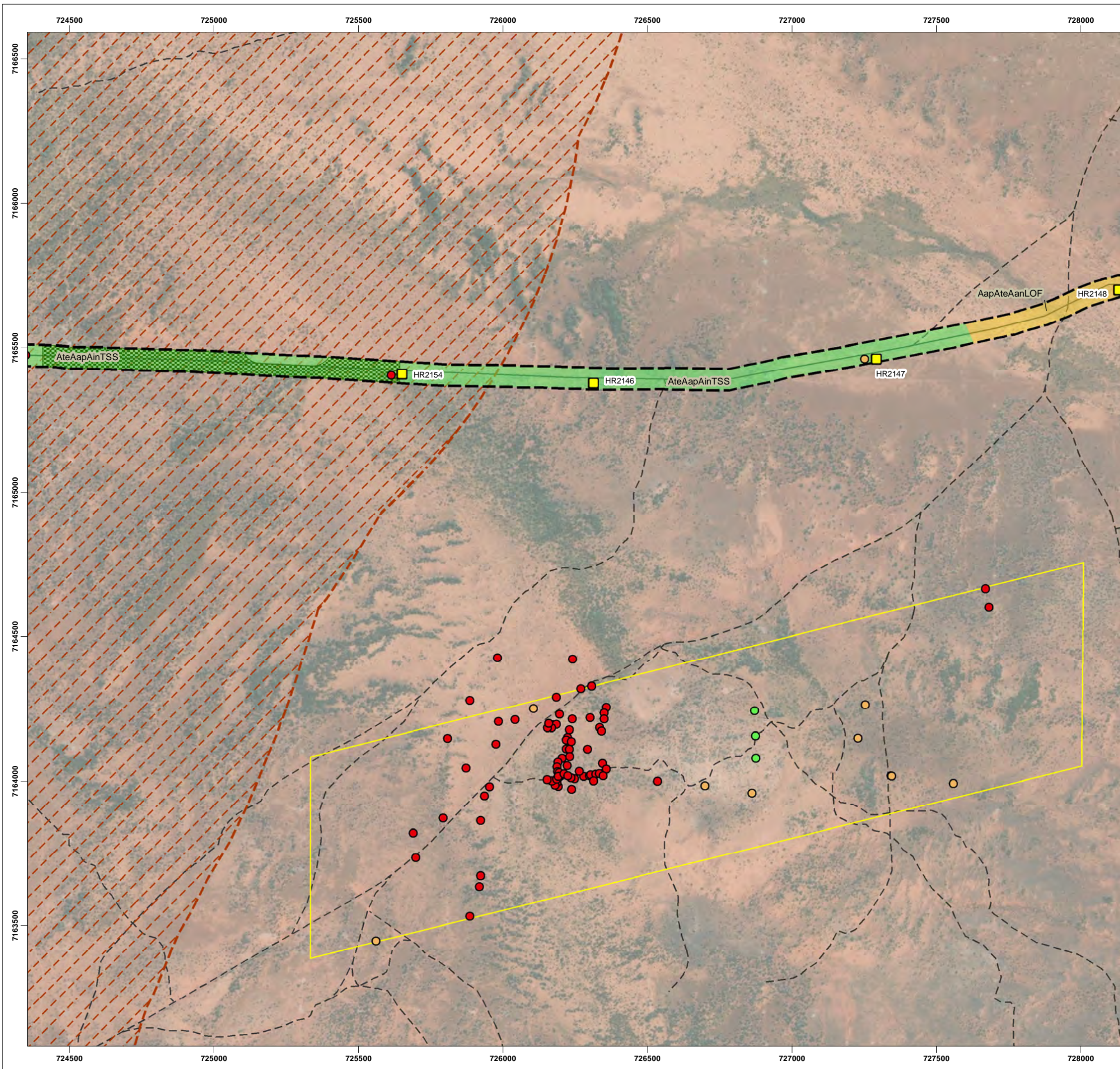
COORDINATE SYSTEM: GDA 1994 MGA ZONE 50
PROJECTION: TRANSVERSE MERCATOR
DATUM: GDA 1994
UNITS: METER

SCALE: 1:13,000 @ A3
0 200 400 m

PROJECT NO: 4622-21

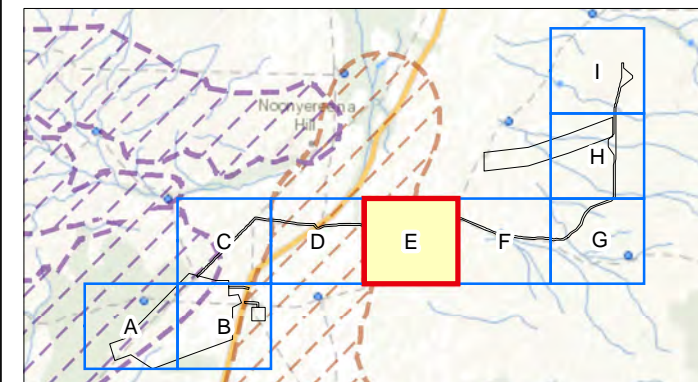
REV	AUTHOR	APPROVED	DATE
0	SB	LA	29/06/2021

**MAP
4D**



LEGEND

- Survey Area
- East Shed
- Quadrats (Ecoscape, 2021)
- Conservation Listed Flora**
 - Eremophila demissa* (P1)
 - Goodenia nuda* (P4)
 - Sida picklesiana* (P3)
 - Eremophila demissa* population
- TEC/PEC (DBCA, 2021)**
 - Doolgunna Calcrete
- Vegetation Type**
 - AapAteAanLOF - *Acacia aptaneura*, *Acacia tetragonophylla* and *Acacia aneura* low open forest
 - AteAapAinTSS - *Acacia tetragonophylla*, *Acacia aptaneura* and *Acacia incurvaneura* tall sparse shrubland



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VEGETATION TYPES, QUADRATS AND CONSERVATION LISTED FLORA

OLD HIGHWAY PROJECT FLORA & VEGETATION SURVEY

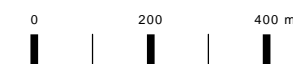
DATASOURCES:
SOURCE DATA: QUADRATS, CONSERVATION LISTED
FLORA AND VEGETATION (ECOSCAPE, 2021)
AERIAL: ESRI BASEMAP 2020
BASEMAP: GEOSCIENCE AUSTRALIA
SERVICE LAYERS: SOURCE: ESRI, MAXAR, GEOEYE,
EARTHSTAR, GEOGRAPHICS, CNES/AIRBUS DS, USDA,
USGS, AERGRID, IGN, AND THE GIS USER COMMUNITY



COORDINATE SYSTEM: GDA 1994 MGA ZONE 50
PROJECTION: TRANSVERSE MERCATOR
DATUM: GDA 1994
UNITS: METER



SCALE: 1:13,000 @ A3




PROJECT NO: 4622-21


REV	AUTHOR	APPROVED	DATE
0	SB	LA	29/06/2021

MAP
4E





LEGEND

 Survey Area


 Quadrats (Ecoscape, 2021)


Conservation Listed Flora

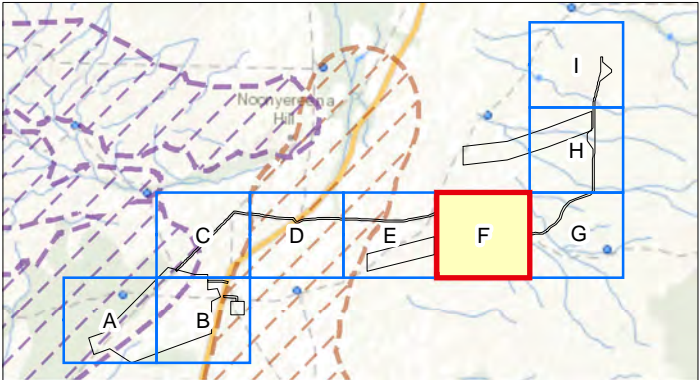
 *Goodenia nuda* (P4)

 *Thryptomene* sp. Leinster (B.J. Lepschi and L.A. Craven 4362) (P3)

Vegetation Type

 AapAteAanLOF - *Acacia aptaneura*, *Acacia tetragonophylla* and *Acacia aneura* low open forest

 GbLOW - *Grevillea berryana* low open woodland




VEGETATION TYPES,
QUADRATS AND
CONSERVATION LISTED FLORA

OLD HIGHWAY PROJECT
FLORA & VEGETATION SURVEY

DATASOURCES:
SOURCE DATA: QUADRATS, CONSERVATION LISTED
FLORA AND VEGETATION (ECOSCAPE, 2021)
AERIAL: ESRI BASEMAP 2020
BASEMAP: GEOSCIENCE AUSTRALIA
SERVICE LAYERS: SOURCE: ESRI, MAXAR, GEOEYE,
EARTHSTAR, GEOGRAPHICS, CNES/AIRBUS DS, USDA,
USGS, AEROGRIID, IGN, AND THE GIS USER COMMUNITY

 SANDFIRE RESOURCES

COORDINATE SYSTEM: GDA 1994 MGA ZONE 50
PROJECTION: TRANSVERSE MERCATOR
DATUM: GDA 1994
UNITS: METER

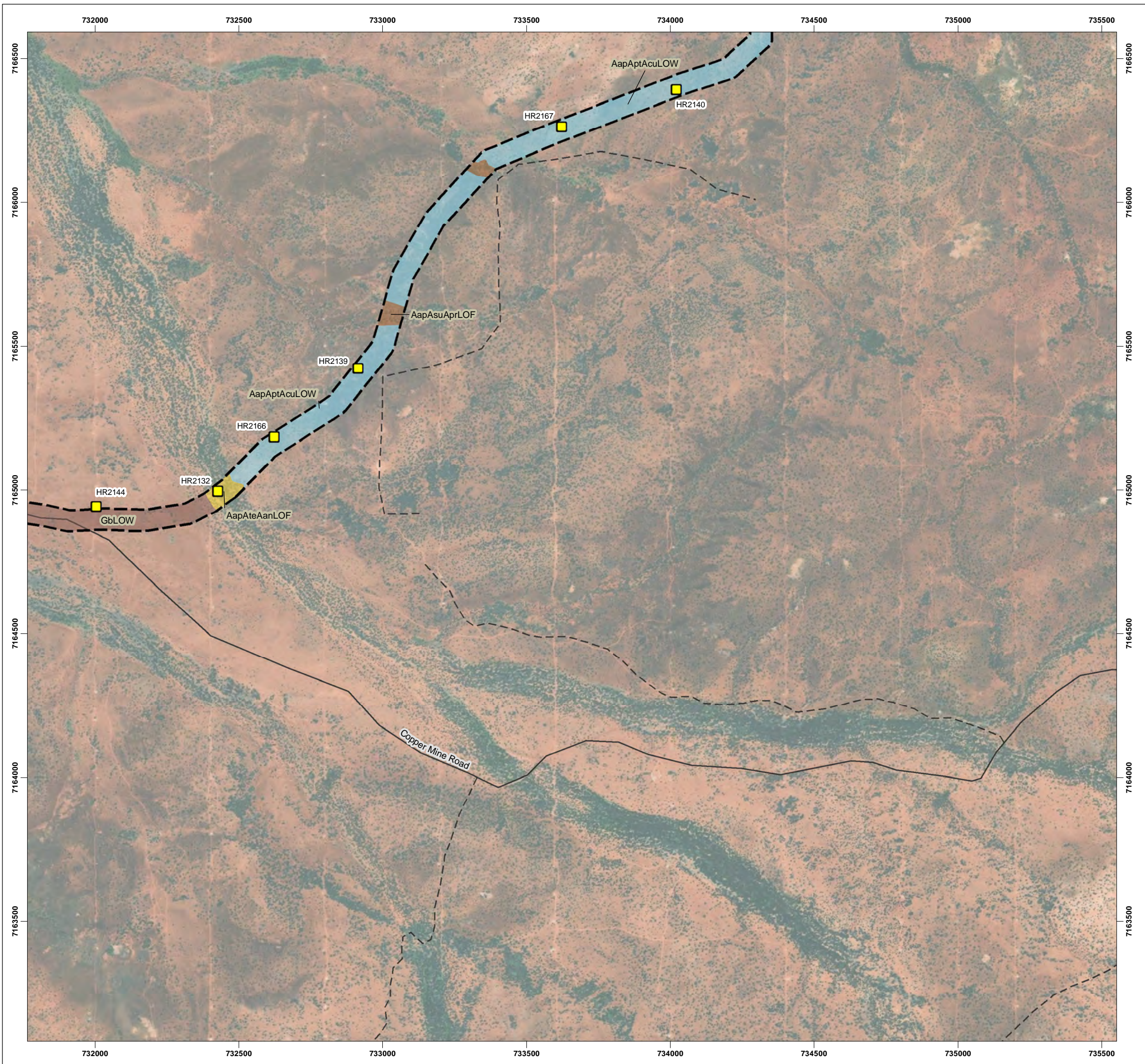


SCALE: 1:13,000 @ A3
0 200 400 m

PROJECT NO: 4622-21

REV	AUTHOR	APPROVED	DATE
0	SB	LA	29/06/2021

MAP
4F



LEGEND
 Survey Area
 Quadrats (Ecoscape, 2021)
Vegetation Type
 AapAptAcuLOW - *Acacia aptaneura*, *Acacia pteraneura* and *Acacia cuspidifolia* low open woodland
 AapAsuAprLOF - *Acacia aptaneura*, *Acacia subcontorta* and *Acacia pruinocarpa* low open forest
 AapAteAanLOF - *Acacia aptaneura*, *Acacia tetragonophylla* and *Acacia aneura* low open forest
 GbLOW - *Grevillea berryana* low open woodland

VEGETATION TYPES, QUADRATS AND CONSERVATION LISTED FLORA

OLD HIGHWAY PROJECT FLORA & VEGETATION SURVEY

DATASOURCES:
SOURCE DATA: QUADRATS, CONSERVATION LISTED
FLORA AND VEGETATION (ECOSCAPE, 2021)
AERIAL: ESRI BASEMAP 2020
BASEMAP: GEOSCIENCE AUSTRALIA
SERVICE LAYERS: SOURCE: ESRI, MAXAR, GEOEYE,
EARTHSTAR, GEOGRAPHICS, CNES/AIRBUS DS, USDA,
USGS, AERGRID, IGN, AND THE GIS USER COMMUNITY

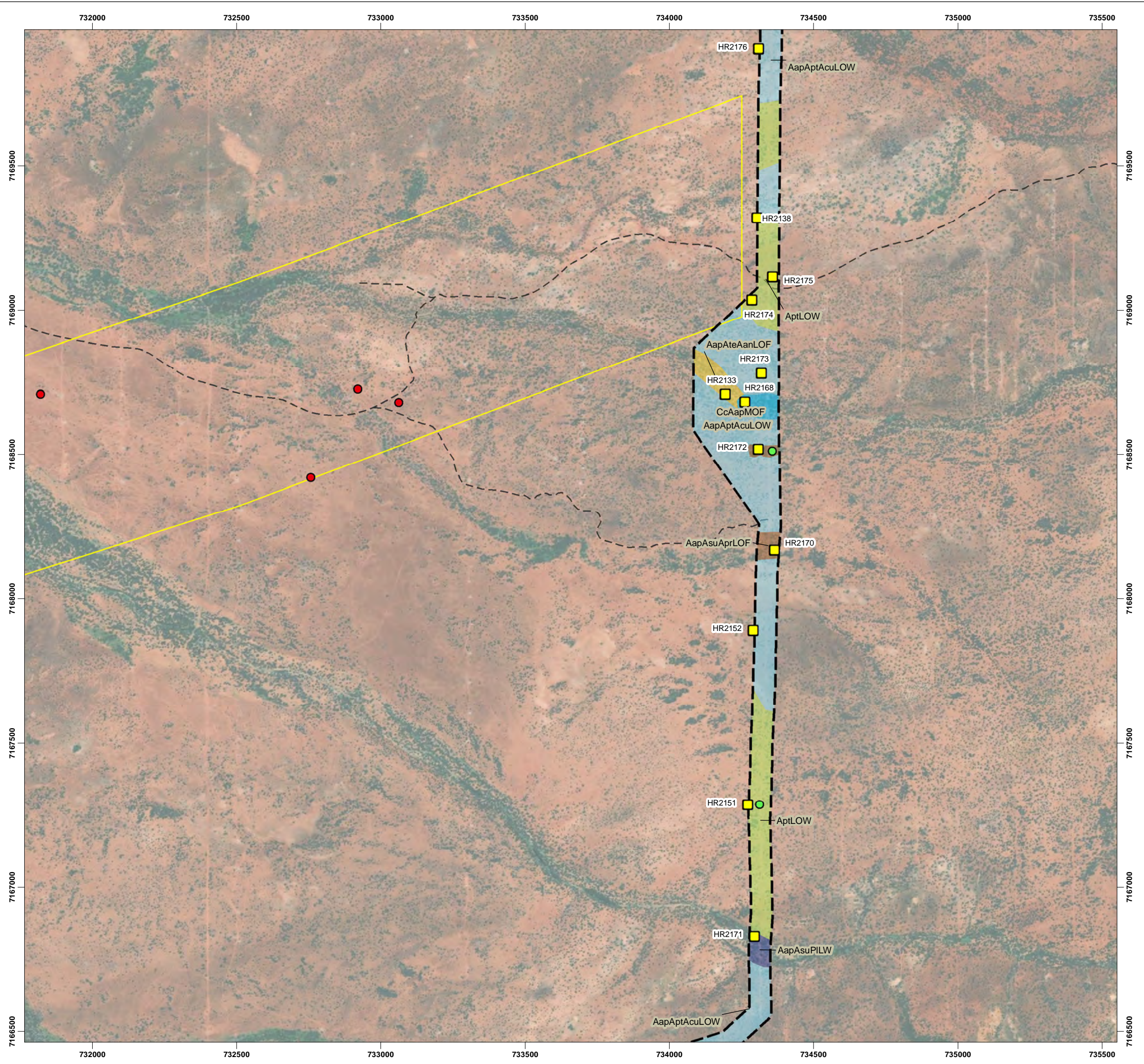
COORDINATE SYSTEM: GDA 1994 MGA ZONE 50
PROJECTION: TRANSVERSE MERCATOR
DATUM: GDA 1994
UNITS: METER

SCALE: 1:13,000 @ A3
0 200 400 m

PROJECT NO: 4622-21

REV	AUTHOR	APPROVED	DATE
0	SB	LA	29/06/2021

MAP
4G



LEGEND

Survey Area

Cow Hole

Quadrats (Ecoscape, 2021)

Conservation Listed Flora

Eremophila demissa (P1)

Sida picklesiana (P3)

Vegetation Type

AapAptAcuLOW - *Acacia aptaneura*, *Acacia pteraneura* and *Acacia cuspidifolia* low open woodland

AapAsuAprLOF - *Acacia aptaneura*, *Acacia subcontorta* and *Acacia pruinocarpa* low open forest

AapAsuPILW - *Acacia aptaneura*, *Acacia subcontorta* and *Psyrdrax latifolia* low woodland

AapAteAanLOF - *Acacia aptaneura*, *Acacia tetragonophylla* and *Acacia aneura* low open forest

AptLOW - *Acacia pteraneura* low open woodland

CcAapMOF - *Corymbia candida* and *Acacia aptaneura* mid open forest

VEGETATION TYPES, QUADRATS AND CONSERVATION LISTED FLORA

OLD HIGHWAY PROJECT FLORA & VEGETATION SURVEY

DATASOURCES:
SOURCE DATA: QUADRATS, CONSERVATION LISTED
FLORA AND VEGETATION (ECOSCAPE, 2021)
AERIAL: ESRI BASEMAP 2020
BASEMAP: GEOSCIENCE AUSTRALIA
SERVICE LAYERS: SOURCE: ESRI, MAXAR, GEOEYE,
EARTHSTAR, GEOGRAPHICS, CNES/AIRBUS DS, USDA,
USGS, AEROGRIID, IGN, AND THE GIS USER COMMUNITY

COORDINATE SYSTEM: GDA 1994 MGA ZONE 50
PROJECTION: TRANSVERSE MERCATOR
DATUM: GDA 1994
UNITS: METER

SCALE: 1:13,000 @ A3

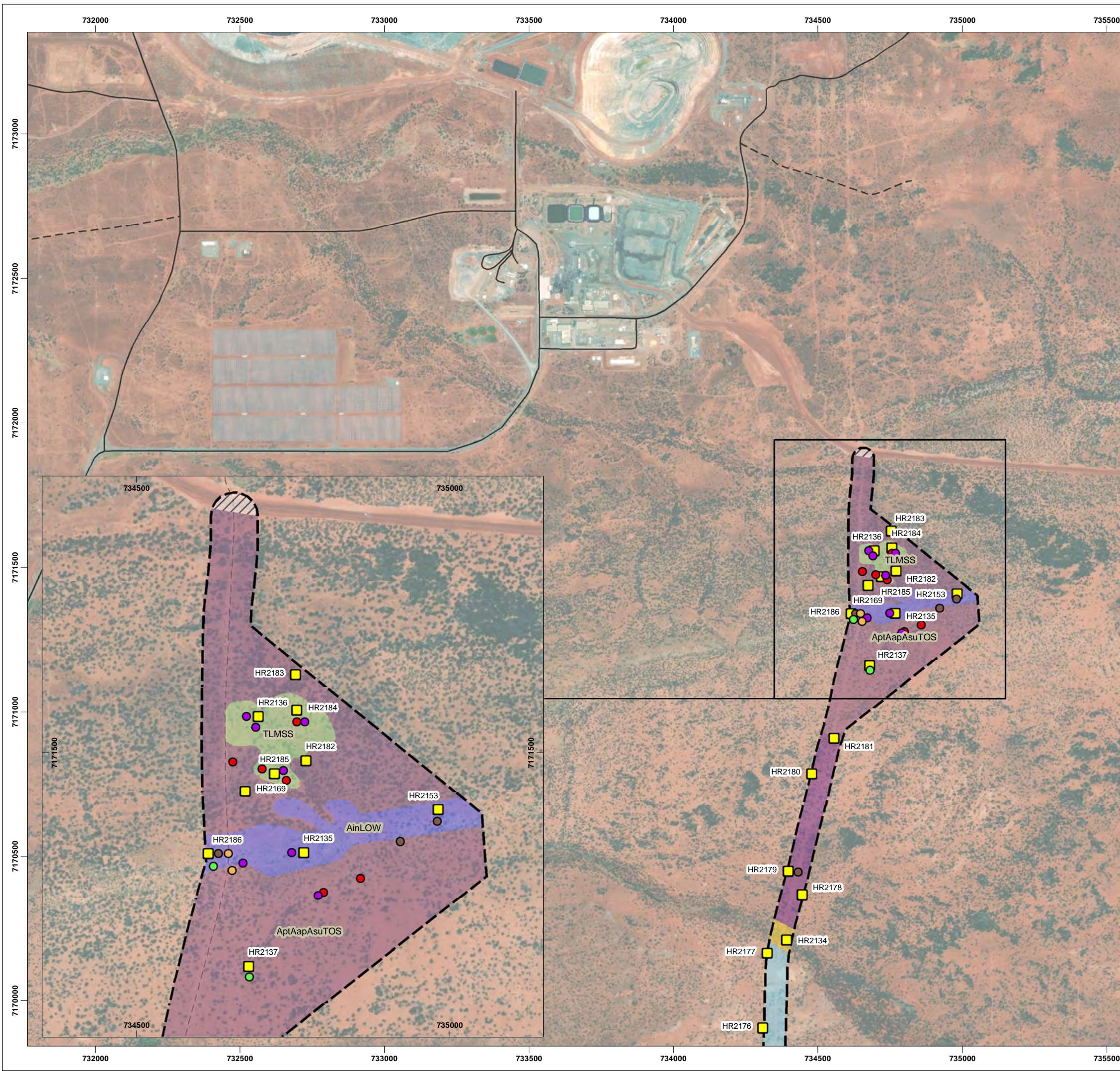
0 200 400 m

PROJECT NO: 4622-21

REV	AUTHOR	APPROVED	DATE
0	SB	LA	29/06/2021

MAP

4H



LEGEND

Survey Area

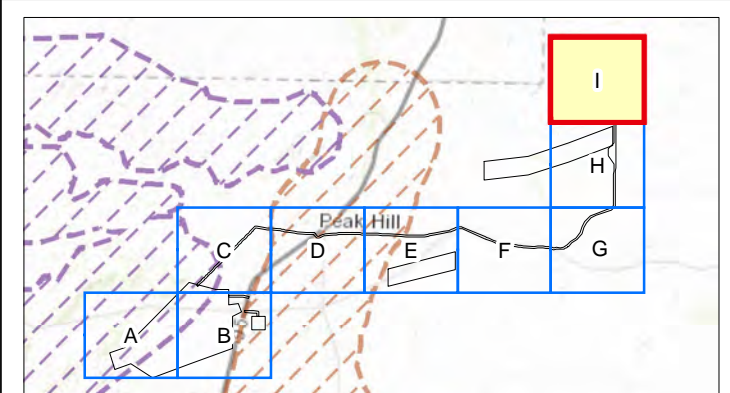
Quadrats (Ecoscape, 2021)

Conservation Listed Flora

- Eremophila demissa* (P1)
- Goodenia nuda* (P4)
- Homalocalyx echinulatus* (P3)
- Sida picklesiana* (P3)
- Thryptomene* sp. Leinster (B.J. Lepschi and L.A. Craven 4362) (P3)

Vegetation Type

- AapAptAcuLOW - *Acacia aptaneura*, *Acacia pteraneura* and *Acacia cuspidifolia* low open woodland
- AapAteAanLOF - *Acacia aptaneura*, *Acacia tetragonophylla* and *Acacia aneura* low open forest
- AinLOW - *Acacia incurvaneura* low open woodland
- AprLW - *Acacia pruinocarpa* low woodland
- AptAapAsuTOS - *Acacia pteraneura*, *Acacia aptaneura* and *Acacia subcontorta* tall open shrubland
- TLMSS - *Thryptomene* sp. Leinster (B.J. Lepschi and L.A. Craven 4362) mid sparse shrubland
- No vegetation



ecoscape

VEGETATION TYPES, QUADRATS AND CONSERVATION LISTED FLORA

OLD HIGHWAY PROJECT FLORA & VEGETATION SURVEY

SANDFIRE RESOURCES

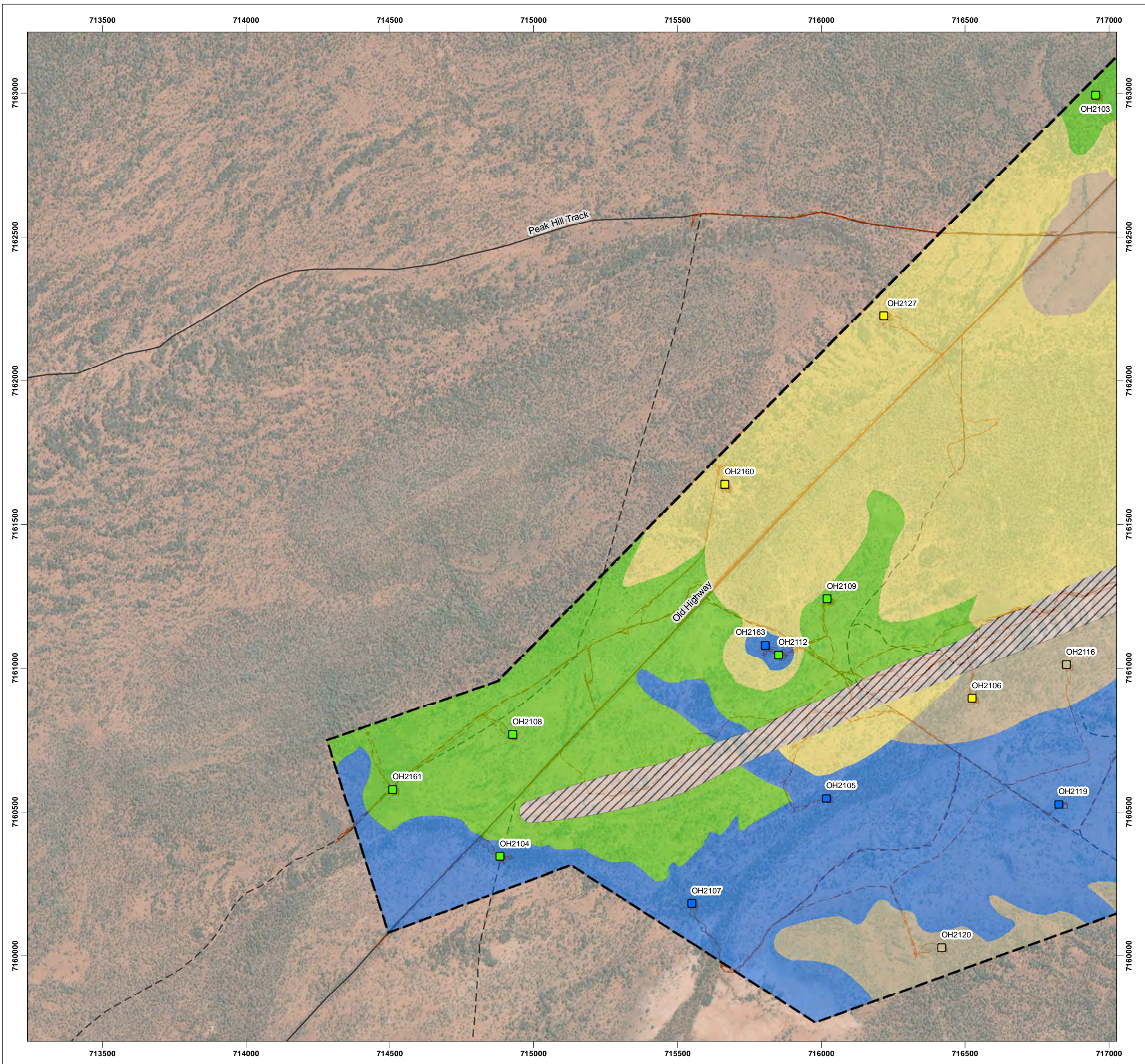
COORDINATE SYSTEM: GDA 1994 MGA ZONE 50
PROJECTION: TRANSVERSE MERCATOR
DATUM: GDA 1994
UNITS: METER

SCALE: 1:13,000 @ A3

MAP 41

PROJECT NO: 4622-21

REV	AUTHOR	APPROVED	DATE
0	SB	LA	29/06/2021



LEGEND
 Survey Area
 Survey Tracks
Quadrats - Vegetation Condition (Ecoscape, 2021)
 Excellent
 Very Good
 Good
 Poor
Vegetation Condition
 Excellent
 Very Good
 Good
 Poor
 No vegetation

VEGETATION CONDITION

**OLD HIGHWAY PROJECT
FLORA & VEGETATION SURVEY**

DATASOURCES:
SOURCE DATA: QUADRATS, CONSERVATION LISTED
FLORA AND VEGETATION (ECOSCAPE, 2021)
AERIAL: ESRI BASEMAP 2020
BASEMAP: GEOSCIENCE AUSTRALIA
SERVICE LAYERS: SOURCE: ESRI, MAXAR, GEOEYE,
EARTHSTAR, GEOGRAPHICS, CNES/AIRBUS DS, USDA,
USGS, AEROGRIID, IGN, AND THE GIS USER COMMUNITY

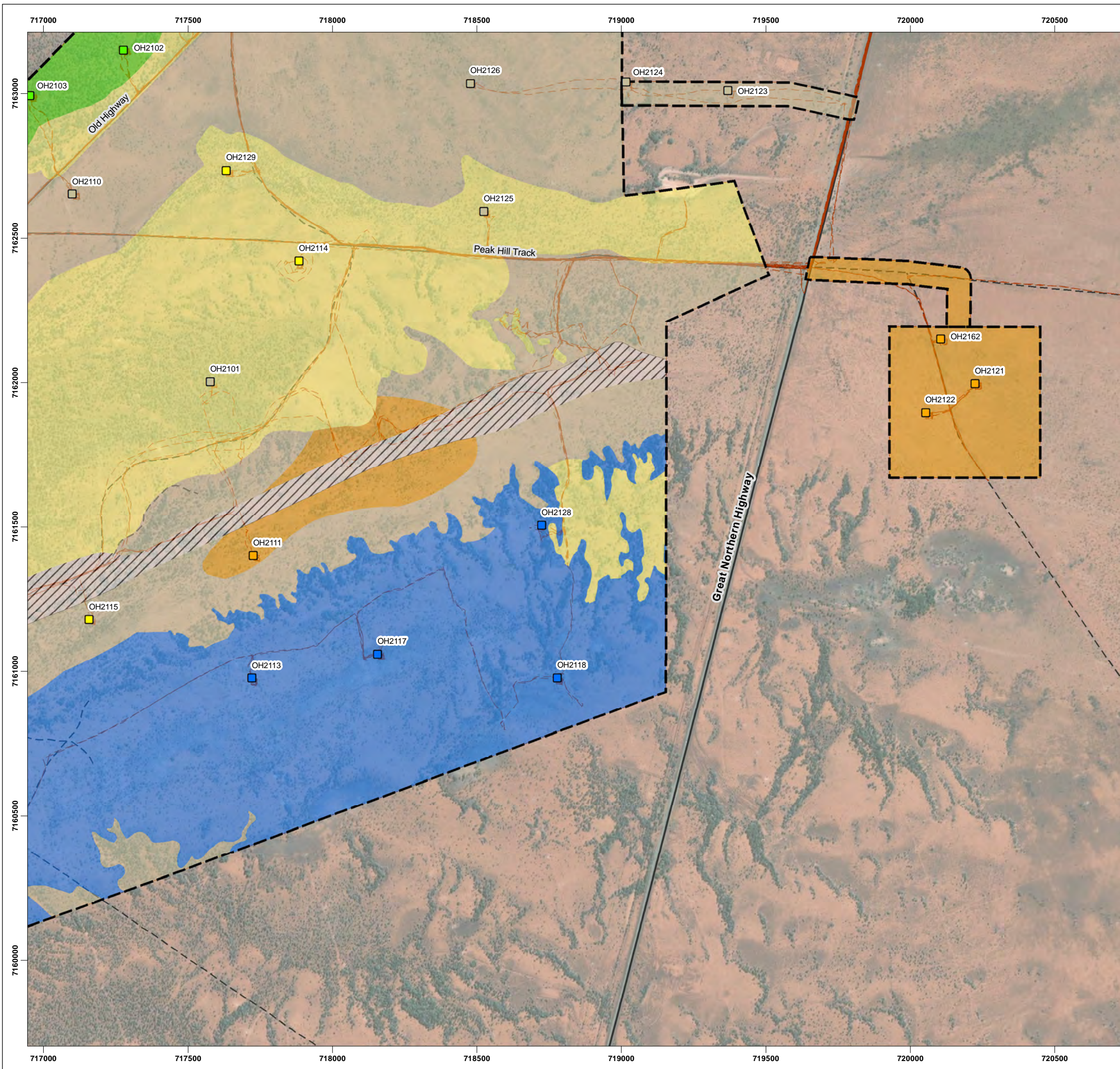
COORDINATE SYSTEM: GDA 1994 MGA ZONE 50
PROJECTION: TRANSVERSE MERCATOR
DATUM: GDA 1994
UNITS: METER

SCALE: 1:13,000 @ A3

PROJECT NO: 4622-21

REV	AUTHOR	APPROVED	DATE
0	SB	LA	29/06/2021

MAP
5A



LEGEND
 Survey Area
 Survey Tracks
Quadrats - Vegetation Condition (Ecoscape, 2021)
 Excellent
 Very Good
 Good
 Poor
 Degraded
Vegetation Condition
 Excellent
 Very Good
 Good
 Poor
 Degraded
 No vegetation

VEGETATION CONDITION

OLD HIGHWAY PROJECT FLORA & VEGETATION SURVEY

DATASOURCES:
SOURCE DATA: QUADRATS, CONSERVATION LISTED
FLORA AND VEGETATION (ECOSCAPE, 2021)
AERIAL: ESRI BASEMAP 2020
BASEMAP: GEOSCIENCE AUSTRALIA
SERVICE LAYERS: SOURCE: ESRI, MAXAR, GEOEYE,
EARTHSTAR, GEOGRAPHICS, CNES/AIRBUS DS, USDA,
USGS, AERGRID, IGN, AND THE GIS USER COMMUNITY

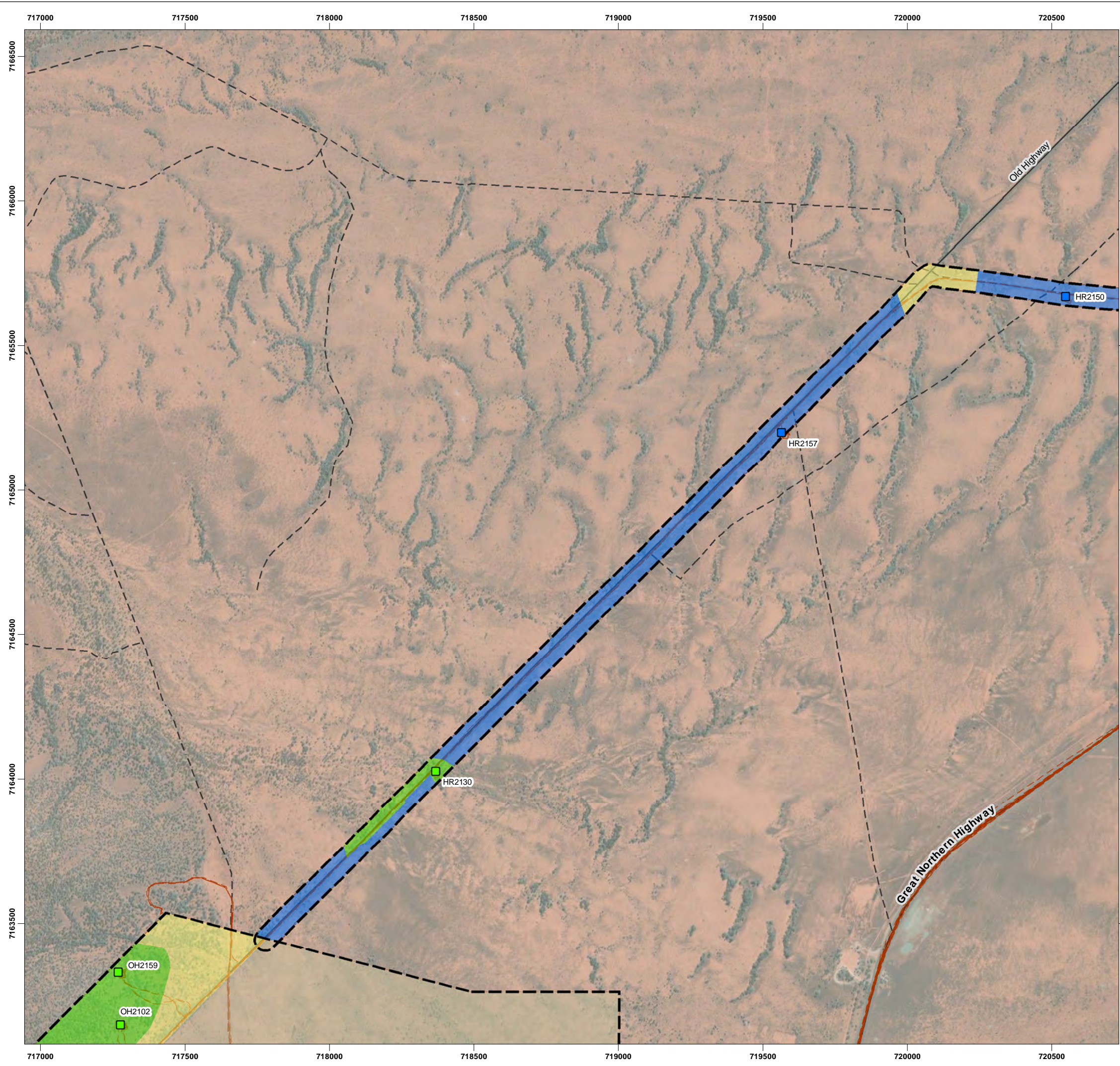
COORDINATE SYSTEM: GDA 1994 MGA ZONE 50
PROJECTION: TRANSVERSE MERCATOR
DATUM: GDA 1994
UNITS: METER

SCALE: 1:13,000 @ A3

PROJECT NO: 4622-21

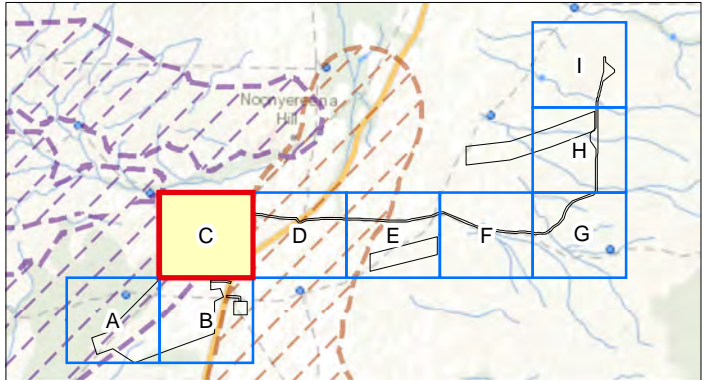
REV	AUTHOR	APPROVED	DATE
0	SB	LA	29/06/2021

MAP
5B



LEGEND

- Survey Area
- Survey Tracks
- Quadrats - Vegetation Condition (Ecoscape, 2021)
- Excellent
 - Very Good
- Vegetation Condition
- Excellent
 - Very Good
 - Good
 - Poor



ecoscape

VEGETATION CONDITION

OLD HIGHWAY PROJECT
FLORA & VEGETATION SURVEY

DATASOURCES:
SOURCE DATA: QUADRATS, CONSERVATION LISTED
FLORA AND VEGETATION (ECOSCAPE, 2021)
AERIAL: ESRI BASEMAP 2020
BASEMAP: GEOSCIENCE AUSTRALIA
SERVICE LAYERS: SOURCE: ESRI, MAXAR, GEOEYE,
EARTHSTAR, GEOGRAPHICS, CNES/AIRBUS DS, USDA,
USGS, AEROGRIID, IGN, AND THE GIS USER COMMUNITY



COORDINATE SYSTEM: GDA 1994 MGA ZONE 50
PROJECTION: TRANSVERSE MERCATOR
DATUM: GDA 1994
UNITS: METER



SCALE: 1:13,000 @ A3



PROJECT NO: 4622-21

REV	AUTHOR	APPROVED	DATE
0	SB	LA	29/06/2021

MAP
5C



LEGEND

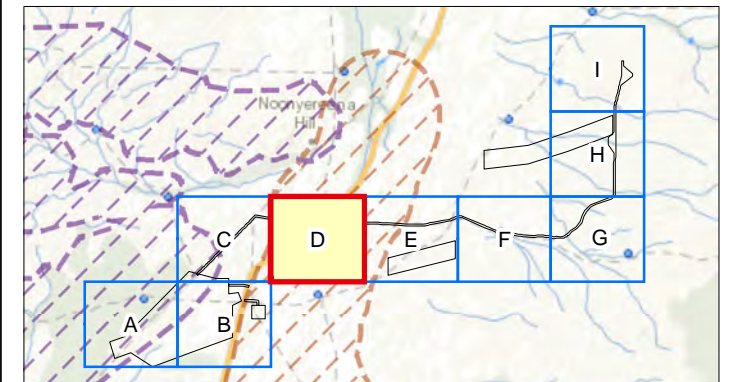
Survey Area
 Survey Tracks

Quadrats - Vegetation Condition (Ecoscape, 2021)

Very Good
 Poor
 Degraded

Vegetation Condition

Very Good
 Poor
 Degraded
 Completely Degraded
 No vegetation



ecoscape

VEGETATION CONDITION

**OLD HIGHWAY PROJECT
FLORA & VEGETATION SURVEY**

DATASOURCES:
SOURCE DATA: QUADRATS, CONSERVATION LISTED
FLORA AND VEGETATION (ECOSCAPE, 2021)
AERIAL: ESRI BASEMAP 2020
BASEMAP: GEOSCIENCE AUSTRALIA
SERVICE LAYERS: SOURCE: ESRI, MAXAR, GEOEYE,
EARTHSTAR, GEOGRAPHICS, CNES/AIRBUS DS, USDA,
USGS, AERGRID, IGN, AND THE GIS USER COMMUNITY

SANDFIRE RESOURCES

COORDINATE SYSTEM: GDA 1994 MGA ZONE 50
PROJECTION: TRANSVERSE MERCATOR
DATUM: GDA 1994
UNITS: METER

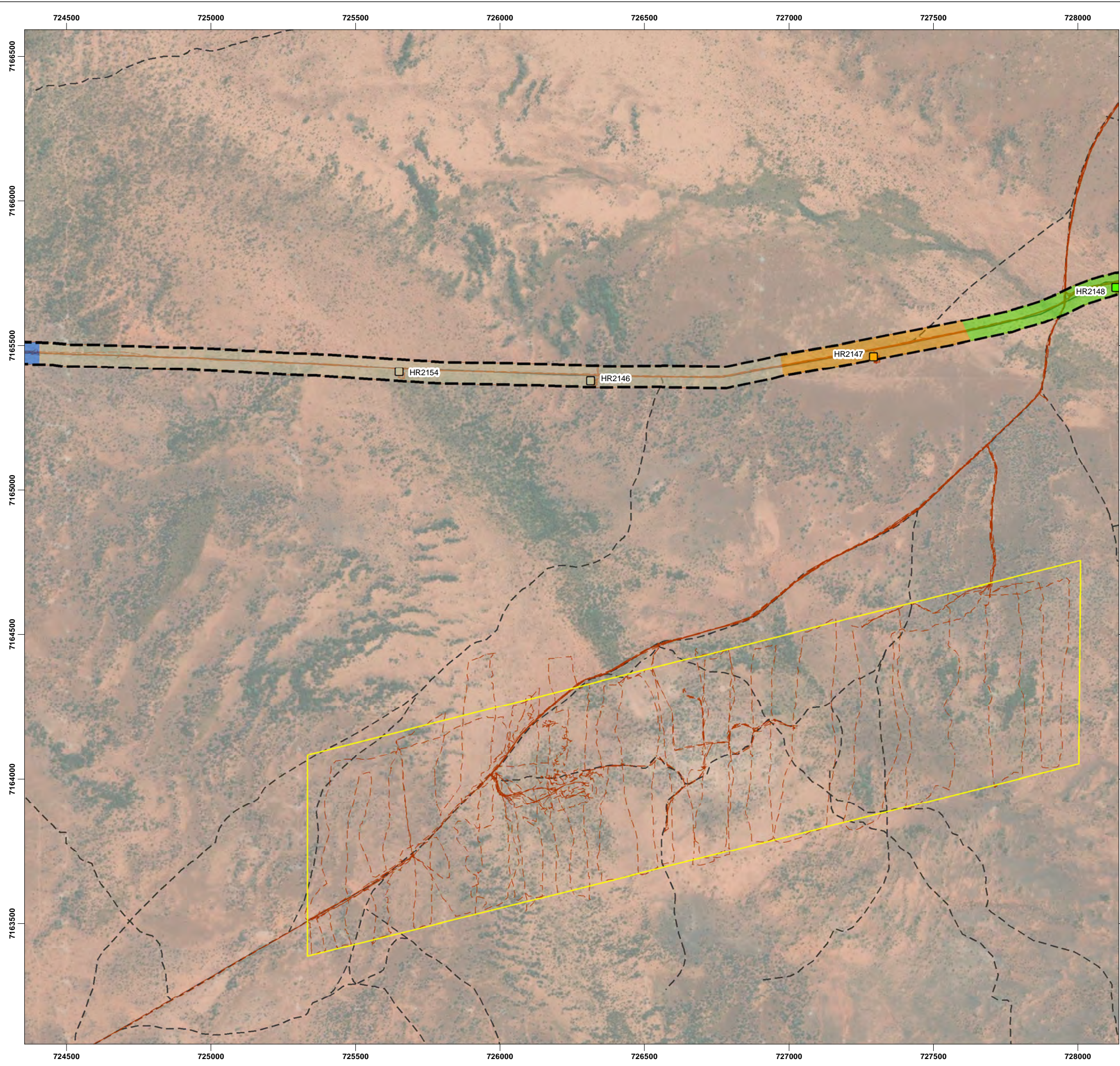
SCALE: 1:13,000 @ A3

0 200 400 m

PROJECT NO: 4622-21

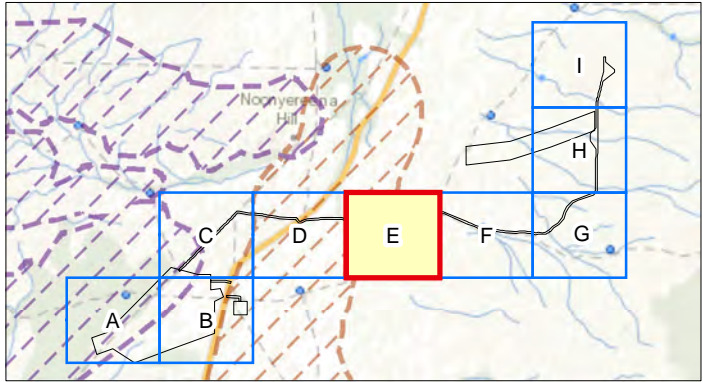
REV	AUTHOR	APPROVED	DATE
0	SB	LA	29/06/2021

**MAP
5D**



LEGEND

- Survey Area
- East Shed
- Survey Tracks
- Quadrats - Vegetation Condition (Ecoscape, 2021)
 - Excellent
 - Poor
 - Degraded
- Vegetation Condition
 - Excellent
 - Very Good
 - Poor
 - Degraded



ecoscape

VEGETATION CONDITION

OLD HIGHWAY PROJECT
FLORA & VEGETATION SURVEY

DATASOURCES:
SOURCE DATA: QUADRATS, CONSERVATION LISTED
FLORA AND VEGETATION (ECOSCAPE, 2021)
AERIAL: ESRI BASEMAP 2020
BASEMAP: GEOSCIENCE AUSTRALIA
SERVICE LAYERS: SOURCE: ESRI, MAXAR, GEOEYE,
EARTHSTAR, GEOGRAPHICS, CNES/AIRBUS DS, USDA,
USGS, AERGRID, IGN, AND THE GIS USER COMMUNITY



COORDINATE SYSTEM: GDA 1994 MGA ZONE 50
PROJECTION: TRANSVERSE MERCATOR
DATUM: GDA 1994
UNITS: METER



SCALE: 1:13,000 @ A3



PROJECT NO: 4622-21

REV	AUTHOR	APPROVED	DATE
0	SB	LA	29/06/2021

MAP
5E



LEGEND
 Survey Area
 Survey Tracks
Quadrats - Vegetation Condition (Ecoscape, 2021)
 Excellent
 Very Good
 Poor
Vegetation Condition
 Excellent
 Very Good

VEGETATION CONDITION

**OLD HIGHWAY PROJECT
FLORA & VEGETATION SURVEY**

DATASOURCES:
SOURCE DATA: QUADRATS, CONSERVATION LISTED
FLORA AND VEGETATION (ECOSCAPE, 2021)
AERIAL: ESRI BASEMAP 2020
BASEMAP: GEOSCIENCE AUSTRALIA
SERVICE LAYERS: SOURCE: ESRI, MAXAR, GEOEYE,
EARTHSTAR, GEOGRAPHICS, ONES/AIRBUS DS, USDA,
USGS, AERGRID, IGN, AND THE GIS USER COMMUNITY

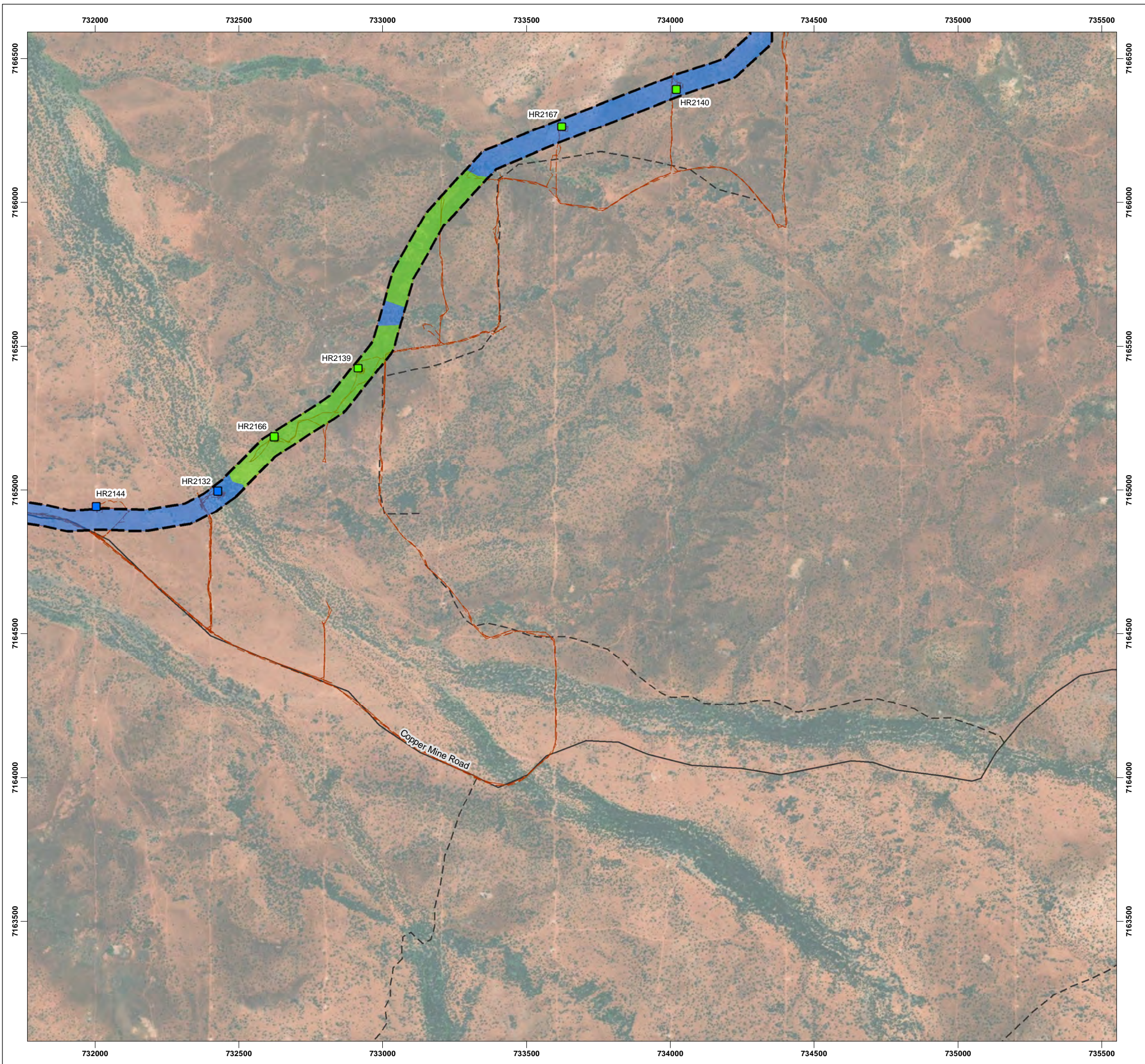
COORDINATE SYSTEM: GDA 1994 MGA ZONE 50
PROJECTION: TRANSVERSE MERCATOR
DATUM: GDA 1994
UNITS: METER

SCALE: 1:13,000 @ A3
0 200 400 m

PROJECT NO: 4622-21

REV	AUTHOR	APPROVED	DATE
0	SB	LA	29/06/2021

**MAP
5F**



LEGEND
 Survey Area
 Survey Tracks
Quadrats - Vegetation Condition (Ecoscape, 2021)
 Excellent
 Very Good
Vegetation Condition
 Excellent
 Very Good

VEGETATION CONDITION

**OLD HIGHWAY PROJECT
FLORA & VEGETATION SURVEY**

DATASOURCES:
SOURCE DATA: QUADRATS, CONSERVATION LISTED
FLORA AND VEGETATION (ECOSCAPE, 2021)
AERIAL: ESRI BASEMAP 2020
BASEMAP: GEOSCIENCE AUSTRALIA
SERVICE LAYERS: SOURCE: ESRI, MAXAR, GEOEYE,
EARTHSTAR, GEOGRAPHICS, CNES/AIRBUS DS, USDA,
USGS, AERGRID, IGN, AND THE GIS USER COMMUNITY

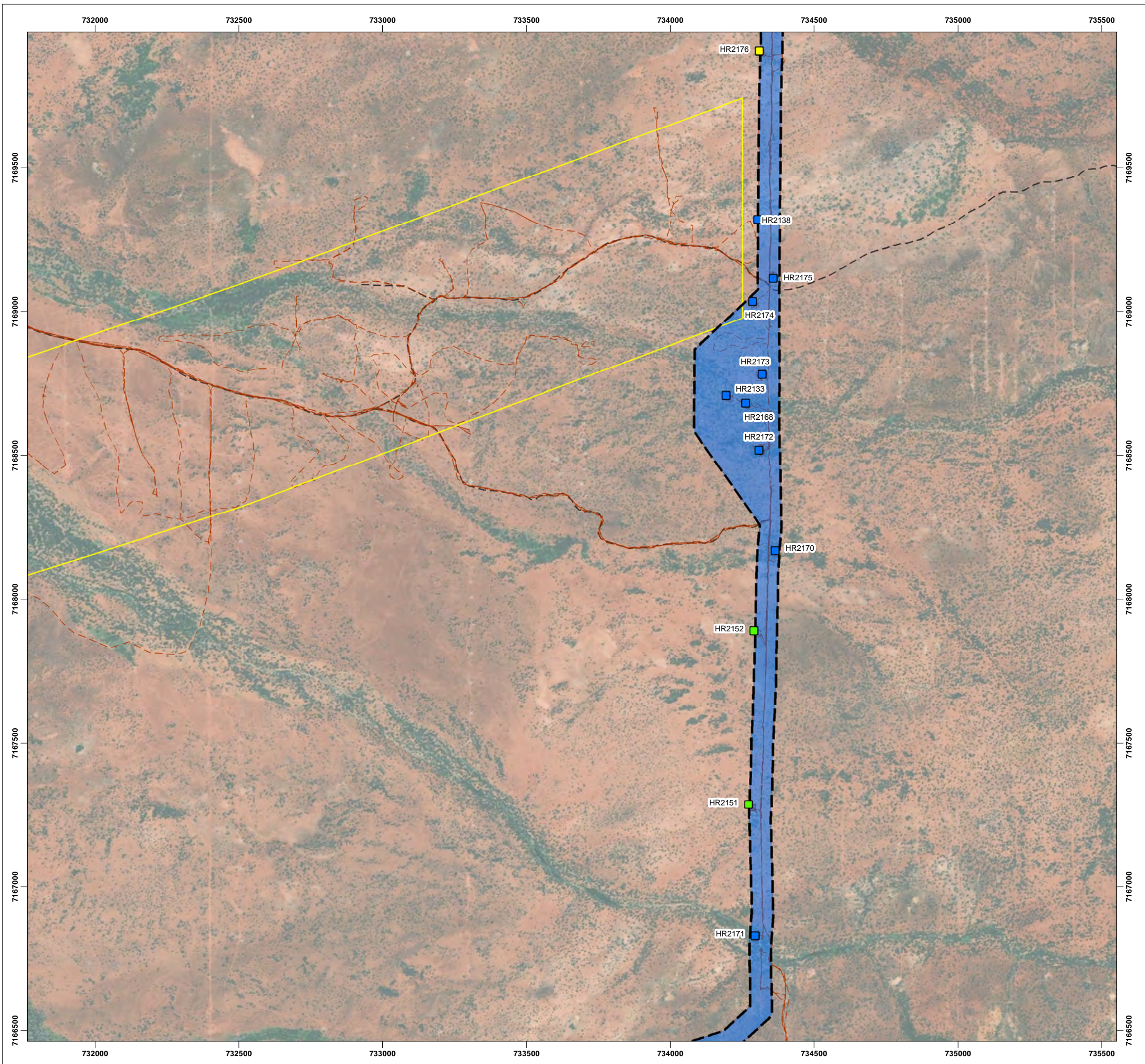
COORDINATE SYSTEM: GDA 1994 MGA ZONE 50
PROJECTION: TRANSVERSE MERCATOR
DATUM: GDA 1994
UNITS: METER

SCALE: 1:13,000 @ A3
0 200 400 m

PROJECT NO: 4622-21

REV	AUTHOR	APPROVED	DATE
0	SB	LA	29/06/2021

**MAP
5G**



LEGEND
 Survey Area
 Cow Hole
 Survey Tracks
Quadrats - Vegetation Condition (Ecoscape, 2021)
 Excellent
 Very Good
 Good
Vegetation Condition
 Very Good

VEGETATION CONDITION

**OLD HIGHWAY PROJECT
FLORA & VEGETATION SURVEY**

DATASOURCES:
SOURCE DATA: QUADRATS, CONSERVATION LISTED
FLORA AND VEGETATION (ECOSCAPE, 2021)
AERIAL: ESRI BASEMAP 2020
BASEMAP: GEOSCIENCE AUSTRALIA
SERVICE LAYERS: SOURCE: ESRI, MAXAR, GEOEYE,
EARTHSTAR, GEOGRAPHICS, ONES/AIRBUS DS, USDA,
USGS, AEROGRIID, IGN, AND THE GIS USER COMMUNITY

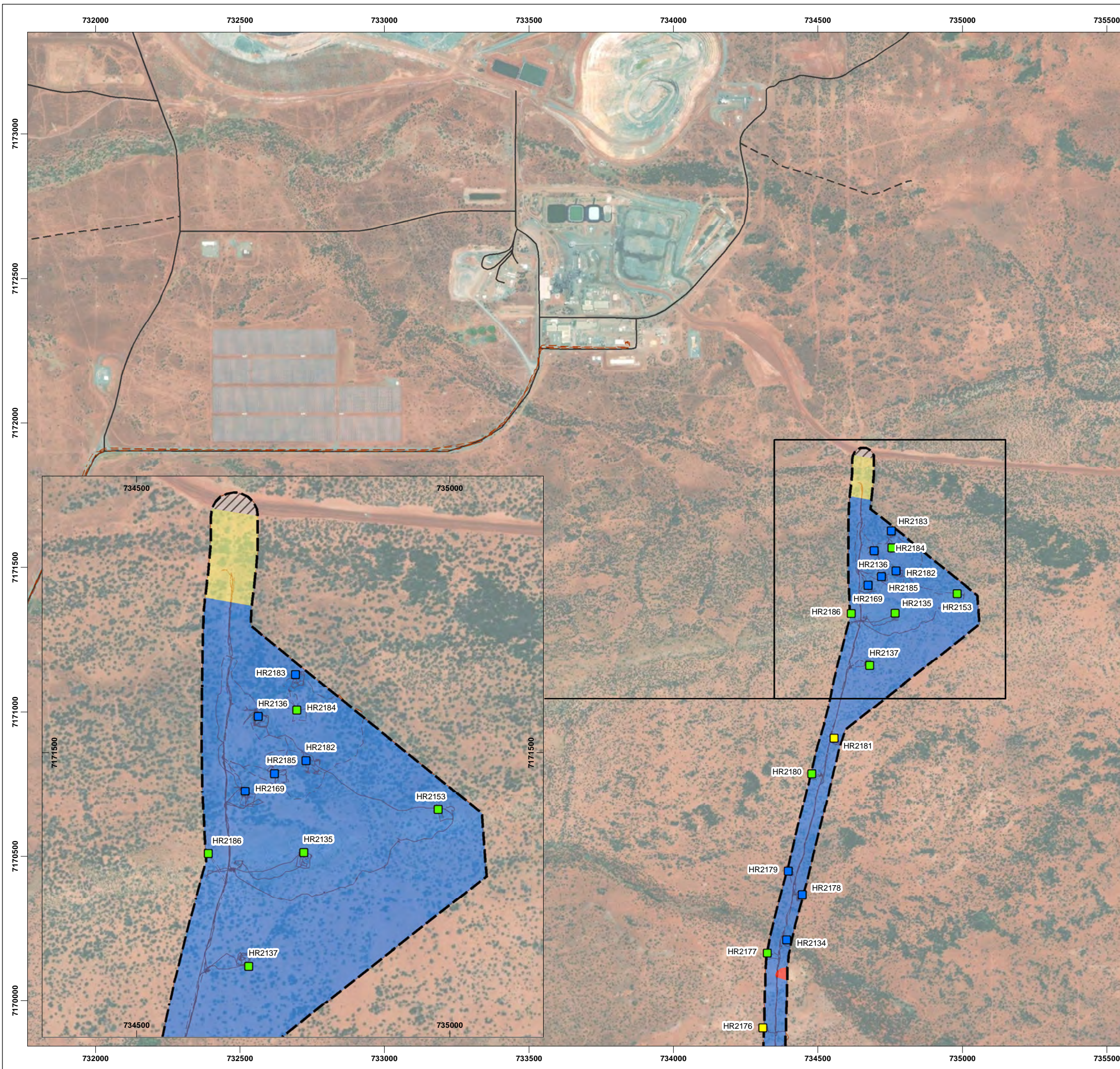
COORDINATE SYSTEM: GDA 1994 MGA ZONE 50
PROJECTION: TRANSVERSE MERCATOR
DATUM: GDA 1994
UNITS: METER

SCALE: 1:13,000 @ A3
0 200 400 m

PROJECT NO: 4622-21

REV	AUTHOR	APPROVED	DATE
0	SB	LA	29/06/2021

**MAP
5H**



LEGEND

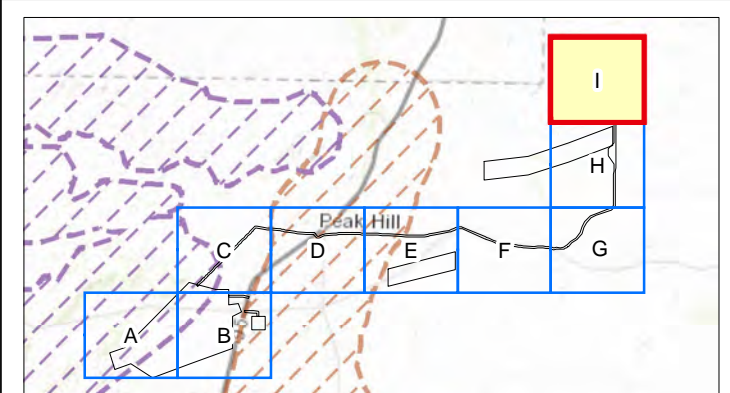
Survey Area
 Survey Tracks

Quadrats - Vegetation Condition (Ecoscape, 2021)

Excellent
 Very Good
 Good

Vegetation Condition

Very Good
 Good
 Completely Degraded
 No vegetation



ecoscape

VEGETATION CONDITION

**OLD HIGHWAY PROJECT
FLORA & VEGETATION SURVEY**

SANDFIRE RESOURCES

DATASOURCES:
SOURCE DATA: CONSERVATION LISTED FLORA AND VEGETATION (ECOSCAPE, 2021)
AERIAL: ESRI BASEMAP 2020
BASEMAP: GEOSCIENCE AUSTRALIA
SERVICE LAYERS: SOURCE: ESRI, MAXAR, GEOEYE, EARTHSTAR, GEOGRAPHICS, ONES/AIRBUS DS, USDA, USGS, AEROGRIID, IGN, AND THE GIS USER COMMUNITY
SOURCES: ESRI, HERE, GARMIN, INTERMAP, INCREMENT P CORP., GEBCO, USGS, FAD, NPS, NRCA, GEOBASE, IGN, KADASTER NL, ORDNANCE SURVEY, ESRI JAPAN, NITEL, ESRI CHINA (HONG KONG), (C) OPENSTREETMAP CONTRIBUTORS, AND THE GIS USER COMMUNITY

COORDINATE SYSTEM: GDA 1994 MGA ZONE 50
PROJECTION: TRANSVERSE MERCATOR
DATUM: GDA 1994
UNITS: METER

SCALE: 1:13,000 @ A3

0 200 400 m

PROJECT NO: 4622-21

REV	AUTHOR	APPROVED	DATE
0	SB	LA	29/06/2021

MAP 51

APPENDIX ONE LEGISLATIVE CONTEXT, DEFINITIONS AND CRITERIA

COMMONWEALTH ENVIRONMENT PROTECTION AND BIODIVERSITY CONSERVATION ACT 1999

The EPBC Act is a legal framework to protect and manage matters of national environmental significance (MNES) including important flora, fauna, ecological communities and heritage areas listed under the Act.

Threatened taxa (flora and fauna) are protected under the EPBC Act, which lists species and ecological communities that have been assessed as meeting the criteria to be listed as Critically Endangered, Endangered, Vulnerable, Conservation Dependant, Extinct, or Extinct in the Wild, as detailed in **Table 10**.

Threatened Ecological Communities protected under the EPBC Act are categorised as Critically Endangered, Endangered or Vulnerable, also detailed in this table.

Migratory species subject to international agreements are also protected under the EPBC Act. The definition of a migratory species under the Act follows that prescribed by the Convention on the Conservation of Migratory Species of Wild Animals (Bonn Convention) (Department of the Environment 2021):

Migratory species are the entire population or any geographically separate part of the population of any species or lower taxon of wild animals, a significant proportion of whose members cyclically and predictably cross one or more national jurisdictional boundaries.

Species listed by the following international agreements are currently protected under the EPBC Act:

- Convention on the Conservation of Migratory Species of Wild Animals (Bonn Convention)
- China-Australia Migratory Bird Agreement (CAMBA)
- Japan-Australia Migratory Bird Agreement (JAMBA)
- Republic of Korea-Australia Migratory Bird Agreement (ROKAMBA).

Table 10: EPBC Act categories for flora, fauna and ecological communities

Category	Threatened species	Threatened Ecological Communities
Extinct	A native species is eligible to be included in the extinct category at a particular time if, at that time, there is no reasonable doubt that the last member of the species has died.	n/a
Extinct in the wild	A native species is eligible to be included in the extinct in the wild category at a particular time if, at that time: (a) it is known only to survive in cultivation, in captivity or as a naturalised population well outside its past range; or (b) it has not been recorded in its known and/or expected habitat, at appropriate seasons, anywhere in its past range, despite exhaustive surveys over a time frame appropriate to its life cycle and form.	n/a
Critically Endangered (CE)	A native species is eligible to be included in the <i>critically endangered</i> category at a particular time if, at that time, it is facing an extremely high risk of extinction in the wild in the immediate future, as determined in accordance with the prescribed criteria.	An ecological community is eligible to be included in the <i>critically endangered</i> category at a particular time if, at that time, it is facing an extremely high risk of extinction in the wild in the immediate future, as determined in accordance with the prescribed criteria
Endangered (EN)	A native species is eligible to be included in the <i>endangered</i> category at a particular time if, at that time: (a) it is not critically endangered; and (b) it is facing a very high risk of extinction in the wild in the near future, as determined in accordance with the prescribed criteria.	An ecological community is eligible to be included in the <i>endangered</i> category at a particular time if, at that time: (a) it is not critically endangered; and (b) it is facing a very high risk of extinction in the wild in the near future, as determined in accordance with the prescribed criteria.

Category	Threatened species	Threatened Ecological Communities
Vulnerable (VU)	A native species is eligible to be included in the <i>vulnerable</i> category at a particular time if, at that time: (a) it is not critically endangered or endangered; and (b) it is facing a high risk of extinction in the wild in the medium term future, as determined in accordance with the prescribed criteria.	An ecological community is eligible to be included in the <i>vulnerable</i> category at a particular time if, at that time: (a) it is not critically endangered or endangered; and (b) it is facing a high risk of extinction in the wild in the medium term future, as determined in accordance with the prescribed criteria.
Conservation Dependent	A native species is eligible to be included in the conservation dependent category at a particular time if, at that time: (a) the species is the focus of a specific conservation program the cessation of which would result in the species becoming vulnerable, endangered or critically endangered; or (b) the following subparagraphs are satisfied: (i) the species is a species of fish; (ii) the species is the focus of a plan of management that provides for management actions necessary to stop the decline of, and support the recovery of, the species so that its chances of long-term survival in nature are maximised; (iii) the plan of management is in force under a law of the Commonwealth or of a State or Territory; (iv) cessation of the plan of management would adversely affect the conservation status of the species.	n/a

WESTERN AUSTRALIAN ENVIRONMENTAL PROTECTION ACT 1986

The Western Australian EP Act was created to provide for an Environmental Protection Authority (the EPA) that has the responsibility for:

- prevention, control and abatement of pollution and environmental harm
- conservation, preservation, protection, enhancement and management of the environment
- matters incidental to or connected with the above.

The EPA is responsible for providing the guidance and policy under which environmental assessments are conducted. It conducts environmental impact assessments (based on the information provided by the proponent), initiates measures to protect the environment and provides advice to the Minister responsible for environmental matters.

WESTERN AUSTRALIAN BIODIVERSITY CONSERVATION ACT 2016

The Western Australian BC Act provides for the conservation, protection and ecologically sustainable use of biodiversity and biodiversity components in Western Australia.

Threatened species (both flora and fauna) and ecological communities that meet the categories listed within the BC Act are protected under this legislation and require authorisation by the Minister to take or disturb. These are known as Threatened Flora, Threatened Fauna and Threatened Ecological Communities. The conservation categories of Critically Endangered, Endangered and Vulnerable are detailed in **Table 11**; these categories align with those of the EPBC Act. Some State-listed threatened species and ecological communities are provided with additional protection as they are also listed under the Commonwealth EPBC Act (see **Table 10** for conservation status category descriptions).

The most recent Western Australian flora and fauna listings were published in the Government Gazette on 11 September 2018 (Government of Western Australia 2018a).

PRIORITY-LISTED FLORA AND FAUNA

Flora are listed as PF where populations are geographically restricted or threatened by local processes, or where there is insufficient information to formally assign them to TF categories. Whilst PF are not specifically listed in the BC Act, some may qualify as being of special conservation interest and thereby have a greater level of protection than unlisted species.

There are three categories covering Western Australian-listed TF and four categories covering PF species which are outlined in **Table 11**. PF for Western Australia are regularly reviewed by the DBCA whenever new information becomes available, with species status altered or removed from the list when data indicates that they no longer meet these requirements.

Conservation significant fauna species are listed by the DBCA as Priority Fauna where populations are geographically restricted or threatened by local processes, or where there is insufficient information to formally assign them to threatened fauna categories. Whilst Priority Fauna are not specifically listed in the BC Act, these have a greater level of significance than other native species. The categories covering Priority Fauna species are outlined in **Table 11**.

Flora and fauna species may be listed as being of special conservation interest if they have a naturally low population, have a restricted natural range, are subject to or recovering from a significant population decline or reduction of range or are of special interest, and the Minister considers that taking may result in depletion of the species. Migratory species and those subject to international agreement are also listed under the Act. These are known as 'specially protected species' in the BC Act.

Table 11: Conservation codes for Western Australian flora and fauna (DBCA 2019b)

Conservation Codes for Western Australian Flora and Fauna	
Threatened, Extinct and Specially Protected fauna or flora ¹ are species ² which have been adequately searched for and are deemed to be, in the wild, threatened, extinct or in need of special protection, and have been gazetted as such.	
The Wildlife Conservation (Specially Protected Fauna) Notice 2018 and the Wildlife Conservation (Rare Flora) Notice 2018 have been transitioned under regulations 170, 171 and 172 of the Biodiversity Conservation Regulations 2018 to be the lists of Threatened, Extinct and Specially Protected species under Part 2 of the Biodiversity Conservation Act 2016.	
Categories of Threatened, Extinct and Specially Protected fauna and flora are:	
T	<p>Threatened species</p> <p>Listed by order of the Minister as Threatened in the category of critically endangered, endangered or vulnerable under section 19(1), or is a rediscovered species to be regarded as threatened species under section 26(2) of the <i>Biodiversity Conservation Act 2016</i> (BC Act).</p> <p>Threatened fauna is that subset of 'Specially Protected Fauna' listed under schedules 1 to 3 of the <i>Wildlife Conservation (Specially Protected Fauna) Notice 2018</i> for Threatened Fauna.</p> <p>Threatened flora is that subset of 'Rare Flora' listed under schedules 1 to 3 of the <i>Wildlife Conservation (Rare Flora) Notice 2018</i> for Threatened Flora.</p> <p>The assessment of the conservation status of these species is based on their national extent and ranked according to their level of threat using IUCN Red List categories and criteria as detailed below.</p>

Conservation Codes for Western Australian Flora and Fauna	
CR	<p>Critically endangered species</p> <p>Threatened species considered to be “facing an extremely high risk of extinction in the wild in the immediate future, as determined in accordance with criteria set out in the ministerial guidelines”.</p> <p>Listed as critically endangered under section 19(1)(a) of the BC Act in accordance with the criteria set out in section 20 and the ministerial guidelines. Published under schedule 1 of the <i>Wildlife Conservation (Specially Protected Fauna) Notice 2018</i> for critically endangered fauna or the <i>Wildlife Conservation (Rare Flora) Notice 2018</i> for critically endangered flora.</p>
EN	<p>Endangered species</p> <p>Threatened species considered to be “facing a very high risk of extinction in the wild in the near future, as determined in accordance with criteria set out in the ministerial guidelines”.</p> <p>Listed as endangered under section 19(1)(b) of the BC Act in accordance with the criteria set out in section 21 and the ministerial guidelines. Published under schedule 2 of the <i>Wildlife Conservation (Specially Protected Fauna) Notice 2018</i> for endangered fauna or the <i>Wildlife Conservation (Rare Flora) Notice 2018</i> for endangered flora.</p>
VU	<p>Vulnerable species</p> <p>Threatened species considered to be “facing a high risk of extinction in the wild in the medium-term future, as determined in accordance with criteria set out in the ministerial guidelines”.</p> <p>Listed as vulnerable under section 19(1)(c) of the BC Act in accordance with the criteria set out in section 22 and the ministerial guidelines. Published under schedule 3 of the <i>Wildlife Conservation (Specially Protected Fauna) Notice 2018</i> for vulnerable fauna or the <i>Wildlife Conservation (Rare Flora) Notice 2018</i> for vulnerable flora.</p>
<p>Extinct species</p> <p>Listed by order of the Minister as extinct under section 23(1) of the BC Act as extinct or extinct in the wild.</p>	
EX	<p>Extinct species</p> <p>Species where “there is no reasonable doubt that the last member of the species has died”, and listing is otherwise in accordance with the ministerial guidelines (section 24 of the BC Act).</p> <p>Published as presumed extinct under schedule 4 of the <i>Wildlife Conservation (Specially Protected Fauna) Notice 2018</i> for extinct fauna or the <i>Wildlife Conservation (Rare Flora) Notice 2018</i> for extinct flora.</p>
EW	<p>Extinct in the wild species</p> <p>Species that “is known only to survive in cultivation, in captivity or as a naturalised population well outside its past range; and it has not been recorded in its known habitat or expected habitat, at appropriate seasons, anywhere in its past range, despite surveys over a time frame appropriate to its life cycle and form”, and listing is otherwise in accordance with the ministerial guidelines (section 25 of the BC Act).</p> <p>Currently there are no threatened fauna or threatened flora species listed as extinct in the wild. If listing of a species as extinct in the wild occurs, then a schedule will be added to the applicable notice.</p>
<p>Specially protected species</p> <p>Listed by order of the Minister as specially protected under section 13(1) of the BC Act. Meeting one or more of the following categories: species of special conservation interest; migratory species; cetaceans; species subject to international agreement; or species otherwise in need of special protection.</p> <p>Species that are listed as threatened species (critically endangered, endangered or vulnerable) or extinct species under the BC Act cannot also be listed as Specially Protected species.</p>	
MI	<p>Migratory species</p> <p>Fauna that periodically or occasionally visit Australia or an external Territory or the exclusive economic zone; or the species is subject of an international agreement that relates to the protection of migratory species and that binds the Commonwealth; and listing is otherwise in accordance with the ministerial guidelines (section 15 of the BC Act).</p> <p>Includes birds that are subject to an agreement between the government of Australia and the governments of Japan (JAMBA), China (CAMBA) and The Republic of Korea (ROKAMBA), and fauna subject to the <i>Convention on the Conservation of Migratory Species of Wild Animals</i> (Bonn Convention), an environmental treaty under the United Nations Environment Program. Migratory species listed under the BC Act are a subset of the migratory animals that are known to visit Western Australia, protected under the international agreements or treaties, excluding species that are listed as Threatened species.</p> <p>Published as migratory birds protected under an international agreement under schedule 5 of the <i>Wildlife Conservation (Specially Protected Fauna) Notice 2018</i>.</p>
CD	<p>Species of special conservation interest (conservation dependent fauna)</p> <p>Fauna of special conservation need being species dependent on ongoing conservation intervention to prevent it becoming eligible for listing as threatened, and listing is otherwise in accordance with the ministerial guidelines (section 14 of the BC Act).</p> <p>Published as conservation dependent fauna under schedule 6 of the <i>Wildlife Conservation (Specially Protected Fauna) Notice 2018</i>.</p>
OS	<p>Other specially protected species</p> <p>Fauna otherwise in need of special protection to ensure their conservation, and listing is otherwise in accordance with the ministerial guidelines (section 18 of the BC Act).</p> <p>Published as other specially protected fauna under schedule 7 of the <i>Wildlife Conservation (Specially Protected Fauna) Notice 2018</i>.</p>

Conservation Codes for Western Australian Flora and Fauna	
P	<p>Priority species</p> <p>Possibly threatened species that do not meet survey criteria, or are otherwise data deficient, are added to the Priority Fauna or Priority Flora Lists under Priorities 1, 2 or 3. These three categories are ranked in order of priority for survey and evaluation of conservation status so that consideration can be given to their declaration as threatened fauna or flora.</p> <p>Species that are adequately known, are rare but not threatened, or meet criteria for near threatened, or that have been recently removed from the threatened species or other specially protected fauna lists for other than taxonomic reasons, are placed in Priority 4. These species require regular monitoring.</p> <p>Assessment of Priority codes is based on the Western Australian distribution of the species, unless the distribution in WA is part of a contiguous population extending into adjacent States, as defined by the known spread of locations.</p>
1	<p>Priority 1: Poorly-known species</p> <p>Species that are known from one or a few locations (generally five or less) which are potentially at risk. All occurrences are either: very small; or on lands not managed for conservation, e.g. agricultural or pastoral lands, urban areas, road and rail reserves, gravel reserves and active mineral leases; or otherwise under threat of habitat destruction or degradation. Species may be included if they are comparatively well known from one or more locations but do not meet adequacy of survey requirements and appear to be under immediate threat from known threatening processes. Such species are in urgent need of further survey.</p>
2	<p>Priority 2: Poorly-known species</p> <p>Species that are known from one or a few locations (generally five or less), some of which are on lands managed primarily for nature conservation, e.g. national parks, conservation parks, nature reserves and other lands with secure tenure being managed for conservation. Species may be included if they are comparatively well known from one or more locations but do not meet adequacy of survey requirements and appear to be under threat from known threatening processes. Such species are in urgent need of further survey.</p>
3	<p>Priority 3: Poorly-known species</p> <p>Species that are known from several locations, and the species does not appear to be under imminent threat, or from few but widespread locations with either large population size or significant remaining areas of apparently suitable habitat, much of it not under imminent threat. Species may be included if they are comparatively well known from several locations but do not meet adequacy of survey requirements and known threatening processes exist that could affect them. Such species are in need of further survey.</p>
4	<p>Priority 4: Rare, Near Threatened and other species in need of monitoring</p> <p>(a) Rare. Species that are considered to have been adequately surveyed, or for which sufficient knowledge is available, and that are considered not currently threatened or in need of special protection but could be if present circumstances change. These species are usually represented on conservation lands.</p> <p>(b) Near Threatened. Species that are considered to have been adequately surveyed and that are close to qualifying for vulnerable but are not listed as Conservation Dependent.</p> <p>(c) Species that have been removed from the list of threatened species during the past five years for reasons other than taxonomy.</p>
<p>¹ The definition of flora includes algae, fungi and lichens.</p> <p>² Species includes all taxa (plural of taxon - a classificatory group of any taxonomic rank, e.g. a family, genus, species or any infraspecific category i.e. subspecies or variety, or a distinct population).</p>	

THREATENED AND PRIORITY ECOLOGICAL COMMUNITIES

Western Australian TECs are protected under the BC Act and are categorised much like those of the EPBC Act. Western Australian definitions and criteria for TECs are shown in **Table 12**.

Currently described TECs are listed on the DBCA website, with the most recent list endorsed by the Minister for Environment in June 2018 (DBCA 2018).

DBCA also maintains a list of Priority Ecological Communities (PECs). PECs include potential TECs that do not meet survey criteria, or that are not adequately defined. They are not protected under legislation but are taken into consideration as part of the environmental approvals process.

Currently described PECs are listed on the DBCA website, with the most recent list dated 20 March 2021 (Species and Communities Program, DBCA 2021). Definitions and criteria for PECs are shown in **Table 12**.

Table 12: DBCA definitions and criteria for TECs and PECs (DEC 2013)

Criteria	Definition
Threatened Ecological Communities	
Presumed Totally Destroyed (PD)	<p>An ecological community that has been adequately searched for but for which no representative occurrences have been located. The community has been found to be totally destroyed or so extensively modified throughout its range that no occurrence of it is likely to recover its species composition and/or structure in the foreseeable future.</p> <p>An ecological community will be listed as presumed totally destroyed if there are no recent records of the community being extant and either of the following applies (A or B):</p> <ul style="list-style-type: none"> A. Records within the last 50 years have not been confirmed despite thorough searches of known or likely habitats or B. All occurrences recorded within the last 50 years have since been destroyed
Critically Endangered (CR)	<p>An ecological community that has been adequately surveyed and found to have been subject to a major contraction in area and/or that was originally of limited distribution and is facing severe modification or destruction throughout its range in the immediate future, or is already severely degraded throughout its range but capable of being substantially restored or rehabilitated.</p> <p>An ecological community will be listed as Critically Endangered when it has been adequately surveyed and is found to be facing an extremely high risk of total destruction in the immediate future. This will be determined on the basis of the best available information, by it meeting any one or more of the following criteria (A, B or C):</p> <ul style="list-style-type: none"> A. The estimated geographic range, and/or total area occupied, and/or number of discrete occurrences since European settlement have been reduced by at least 90% and either or both of the following apply (i or ii): <ul style="list-style-type: none"> i. geographic range, and/or total area occupied and/or number of discrete occurrences are continuing to decline such that total destruction of the community is imminent (within approximately 10 years); ii. modification throughout its range is continuing such that in the immediate future (within approximately 10 years) the community is unlikely to be capable of being substantially rehabilitated. B. Current distribution is limited, and one or more of the following apply (i, ii or iii): <ul style="list-style-type: none"> i. geographic range and/or number of discrete occurrences, and/or area occupied is highly restricted and the community is currently subject to known threatening processes which are likely to result in total destruction throughout its range in the immediate future (within approximately 10 years); ii. there are very few occurrences, each of which is small and/or isolated and extremely vulnerable to known threatening processes; iii. there may be many occurrences but total area is very small and each occurrence is small and/or isolated and extremely vulnerable to known threatening processes. C. The ecological community exists only as highly modified occurrences that may be capable of being rehabilitated if such work begins in the immediate future (within approximately 10 years).
Endangered (EN)	<p>An ecological community that has been adequately surveyed and found to have been subject to a major contraction in area and/or was originally of limited distribution and is in danger of significant modification throughout its range or severe modification or destruction over most of its range in the near future.</p> <p>An ecological community will be listed as Endangered when it has been adequately surveyed and is not Critically Endangered but is facing a very high risk of total destruction in the near future. This will be determined on the basis of the best available information by it meeting any one or more of the following criteria (A, B, or C):</p> <ul style="list-style-type: none"> A. The geographic range, and/or total area occupied, and/or number of discrete occurrences have been reduced by at least 70% since European settlement and either or both of the following apply (i or ii): <ul style="list-style-type: none"> i. the estimated geographic range, and/or total area occupied and/or number of discrete occurrences are continuing to decline such that total destruction of the community is likely in the short term future (within approximately 20 years); ii. modification throughout its range is continuing such that in the short term future (within approximately 20 years) the community is unlikely to be capable of being substantially restored or rehabilitated. B. Current distribution is limited, and one or more of the following apply (i, ii or iii): <ul style="list-style-type: none"> i. geographic range and/or number of discrete occurrences, and/or area occupied is highly restricted and the community is currently subject to known threatening processes which are likely to result in total destruction throughout its range in the short term future (within approximately 20 years); ii. there are few occurrences, each of which is small and/or isolated and all or most occurrences are very vulnerable to known threatening processes; iii. there may be many occurrences but total area is small and all or most occurrences are small and/or isolated and very vulnerable to known threatening processes. <p>The ecological community exists only as very modified occurrences that may be capable of being substantially restored or rehabilitated if such work begins in the short-term future (within approximately 20 years).</p>

Criteria	Definition
Vulnerable (VU)	<p>An ecological community that has been adequately surveyed and is found to be declining and/or has declined in distribution and/or condition and whose ultimate security has not yet been assured and/or a community that is still widespread but is believed likely to move into a category of higher threat in the near future if threatening processes continue or begin operating throughout its range.</p> <p>An ecological community will be listed as Vulnerable when it has been adequately surveyed and is not Critically Endangered or Endangered but is facing a high risk of total destruction or significant modification in the medium to long-term future. This will be determined on the basis of the best available information by it meeting any one or more of the following criteria (A, B or C):</p> <ul style="list-style-type: none"> A. The ecological community exists largely as modified occurrences that are likely to be capable of being substantially restored or rehabilitated. B. The ecological community may already be modified and would be vulnerable to threatening processes, is restricted in area and/or range and/or is only found at a few locations. C. The ecological community may be still widespread but is believed likely to move into a category of higher threat in the medium to long term future because of existing or impending threatening processes.
Priority ecological communities	
Priority One	<p><i>Poorly known ecological communities</i></p> <p>Ecological communities with apparently few, small occurrences, all or most not actively managed for conservation (e.g. within agricultural or pastoral lands, urban areas, active mineral leases) and for which current threats exist. Communities may be included if they are comparatively well-known from one or more localities but do not meet adequacy of survey requirements, and/or are not well defined, and appear to be under immediate threat from known threatening processes across their range.</p>
Priority Two	<p><i>Poorly known ecological communities</i></p> <p>Communities that are known from few small occurrences, all or most of which are actively managed for conservation (e.g. within national parks, conservation parks, nature reserves, state forest, unallocated Crown land, water reserves, etc.) and not under imminent threat of destruction or degradation. Communities may be included if they are comparatively well known from one or more localities, but do not meet adequacy of survey requirements, and / or are not well defined, and appear to be under threat from known threatening processes.</p>
Priority Three	<p><i>Poorly known ecological communities</i></p> <ul style="list-style-type: none"> i. Communities that are known from several to many occurrences, a significant number or area of which are not under threat of habitat destruction or degradation or; ii. Communities known from a few widespread occurrences, which are either large or within significant remaining areas of habitat in which other occurrences may occur, much of it not under imminent threat, or; iii. Communities made up of large, and/or widespread occurrences, that may or may not be represented in the reserve system, but are under threat of modification across much of their range from processes such as grazing by domestic and/or feral stock, and inappropriate fire regimes. <p>Communities may be included if they are comparatively well known from several localities, but do not meet adequacy of survey requirements and / or are not well defined, and known threatening processes exist that could affect them.</p>
Priority Four	<p>Ecological communities that are adequately known, rare but not threatened or meet criteria for Near Threatened, or that have been recently removed from the threatened list. These communities require regular monitoring.</p> <ul style="list-style-type: none"> i. Rare. Ecological communities known from few occurrences that are considered to have been adequately surveyed, and for which sufficient knowledge is available, and that are considered not currently threatened or in need of special protection, but could be if present circumstances change. These communities are usually represented on conservation lands. ii. Near Threatened. Ecological communities that are considered to have been adequately surveyed and that do not qualify for Conservation Dependent, but that are close to qualifying for Vulnerable. iii. Ecological communities that have been removed from the list of threatened communities during the past five years.
Priority Five	<p><i>Conservation Dependent Ecological Communities</i></p> <p>Ecological Communities that are not threatened but are subject to a specific conservation program, the cessation of which would result in the community becoming threatened within five years.</p>

FLORA CRITERIA

OTHER SIGNIFICANT FLORA

According to the Flora and Vegetation Technical Guidance (EPA 2016) other than being listed as Threatened or Priority Flora, a species can be considered as significant if it is considered to be:

- locally endemic or association with a restricted habitat type (e.g. Groundwater Dependent Ecosystems, Sheet Flow Dependent Vegetation)
- a new species or has anomalous features that indicate a potential new species
- at the extremes of range, recently discovered range extensions (generally considered greater than 100 km or in a different bioregion), or isolated outliers of the main range)
- unusual species, including restricted subspecies, varieties or naturally occurring hybrids
- relictual status, being representative of taxonomic groups that no longer occur widely in the broader landscape.

INTRODUCED FLORA

Introduced plant species, known as weeds, are plants that are not indigenous to an area and have been introduced either directly or indirectly (unintentionally) through human activity. Species are regarded as introduced if they are listed as 'alien' on *FloraBase* (Western Australian Herbarium [WAH] 1998-2021) and are designated with an asterisk (*) in this document.

Weeds of National Significance

At a national level there are 32 weed species listed as Weeds of National Significance (WoNS) (Weeds Australia & Centre for Invasive Species Solutions 2021). The Commonwealth *Australian Weeds Strategy 2017-2027* (Invasive Plants and Animals Committee 2016) describes broad goals and objectives to manage these species.

Declared Pest Plants

The Western Australian Organism List (WAOL) details organisms listed as Declared Pests under the *Biosecurity and Agriculture Management Act 2007* (BAM Act). Under the BAM Act, Declared Pests are listed as one of the three categories, or exempt:

- C1 (exclusion), that applies to pests not established in Western Australia; control measures are to be taken to prevent their entry and establishment
- C2 (eradication), that applies to pests that are present in Western Australia but in low numbers or in limited areas where eradication is still a possibility
- C3 (management), that applies to established pests where it is not feasible or desirable to manage them in order to limit their damage
- exempt (no category).

VEGETATION CRITERIA

OTHER SIGNIFICANT VEGETATION

According to the Flora and Vegetation Technical Guidance (EPA 2016) other than being listed as a TEC or PEC, vegetation can be considered as significant if it is considered to have:

- restricted distribution
- a degree of historical impact from threatening processes
- a role as a refuge
- provides an important function required to maintain ecological integrity of a significant ecosystem.

Groundwater Dependent Vegetation may be considered as significant and are described below.

Groundwater Dependent Vegetation

Groundwater Definition

Groundwater is water that is found in the saturated zone of the soil, where all soil pores are filled with water. The water table is the upper surface of the saturated zone in an unconfined aquifer. Groundwater may also occur as a perched aquifer located above unsaturated rock formations as a result of a discontinuous permeable layer or held under pressure in a confined aquifer (Goulburn-Murray Water 2010).

Groundwater Dependent Ecosystems Definition

Groundwater Dependent Ecosystems (GDEs) have been defined as ecosystems that are dependent on groundwater for their survival at some stage or stages of their lifecycle, however groundwater use cannot be equated with groundwater dependence (Eamus 2009). In some contexts (including that of a flora and vegetation assessment), GDEs are also known as Groundwater Dependent Vegetation (GDV).

Hatton and Evans (1998) identified four types of GDEs based on their geographic setting: terrestrial vegetation (vegetation communities and dependent fauna that have seasonal or episodic dependence on groundwater), river base flow systems (aquatic and riparian ecosystems that exist in or adjacent to streams that are fed by groundwater base flow), aquifer and cave ecosystems, and wetlands.

Eamus *et al.* (2006) identified three primary classes based on type of groundwater reliance:

1. Aquifer and cave ecosystems.
2. All ecosystems dependent on the surface expression of groundwater:
 - a) river base flows
 - b) wetlands, swamplands
 - c) seagrass beds in estuaries
 - d) floodplains
 - e) mound springs
 - f) riparian vegetation
 - g) saline discharge to lakes
 - h) low lying forests.
3. All ecosystems dependent on the subsurface presence of groundwater, often accessed via the capillary fringe (non-saturated zone above the water table) when roots penetrate this zone:
 - a) River Red Gum (*Eucalyptus camaldulensis*) forests
 - b) Banksia woodlands
 - c) Riparian vegetation in the wet/dry tropics.

GDEs in arid areas, including the Pilbara and Gascoyne regions, are generally determined to be vegetation associated with riparian areas. GDEs dependent on the surface expression of groundwater (Eamus *et al.* 2006 class 2) includes vegetation associated with wetlands (permanent or semi-permanent pools) within riparian areas, and generally includes *Melaleuca argentea* in association with other species described below.

GDEs associated with the subsurface presence of groundwater (Eamus *et al.* 2006 class 3) includes riparian vegetation characterised by the phreatophytic species described below.

Direct impacts on GDEs (clearing), and indirect impacts, including from dewatering and reinjection, frequently feature as being a significant environmental impact in mining approvals documents e.g. Office of the Appeals Convenor (2016a, 2016b), Rio Tinto (2016).

Phreatophytic Species

Phreatophytic species rely on groundwater sources for water intake (Maunsell Australia Pty Ltd 2006) essentially the water requirements of phreatophytes are greater than can be provided from the surface soil profile (e.g. riparian vegetation) or they are dependent on free water availability (e.g. wetland species). They frequently show low tolerance to extended water stress due to a lack of physiological and/or morphological adaptation to drought and respond to significant water deficit by a decline in health and eventual death (*ibid.*).

Obligate phreatophytes are dependent on free access to water (i.e. they are wetland species) whereas facultative phreatophytes can switch their water source between the soil surface profile in times of rain, to groundwater in times of drought when the soil surface profile (vadosphere) is depleted (Grierson 2010).

Phreatophytic species likely to occur include:

- *Eucalyptus camaldulensis sens. lat.*, which is regarded as a facultative phreatophyte that is dependent on groundwater for part of its lifecycle and/or in times of drought. This species has been reported to be tolerant of groundwater falls of up to 4 m per year (Maunsell Australia Pty Ltd 2006), has both lateral and sinker roots and is tolerant of waterlogging (Grierson 2010).
- *Eucalyptus victrix*, which may be regarded as a facultative phreatophyte. It is considered to be relatively drought tolerant and likely to be tolerant of gradual declines to the water table (to a degree) (Maunsell Australia Pty Ltd 2006). *Eucalyptus victrix* has lateral and sinker roots (i.e. a dimorphic root system) but is not tolerant of waterlogging (Grierson 2010). There is some conjecture that this species is actually a vadophyte (i.e. relies on water from within the soil surface profile, and is independent of groundwater) or, at best, weakly phreatophytic (Resource and Environmental Management Pty Ltd 2007). Depth to groundwater is likely to be an important indicator of groundwater dependence (Equinox Environmental 2017).
- wetland species such as *Melaleuca argentea*.

Vegetation containing *Eucalyptus camaldulensis sens. lat.* and *Melaleuca argentea* is generally considered to represent a GDE. Neither species occur within the Old Highway survey area.

However, there is supporting evidence that, in some circumstances, *Eucalyptus victrix* does not always depend on groundwater (Batini 2009; Eamus 2009; EPA 2010; Resource and Environmental Management Pty Ltd 2007). Depth to groundwater provides guidance to determining if the vegetation is likely to be groundwater dependent or not. Where the depth to groundwater is more than 10 m below the soil surface *Eucalyptus victrix* is unlikely to be able to access the resource (Barron *et al.* 2012); therefore *Eucalyptus victrix*-dominated vegetation is not likely to be groundwater dependent. However, where the depth to groundwater is less than 10 m, or where depth to groundwater is unknown but is potentially in this range, *Eucalyptus victrix*-dominated vegetation is considered to be potentially groundwater dependent (i.e. representative of a potential GDE).

Atlas of Groundwater Dependent Ecosystems

The Groundwater Dependent Ecosystems Atlas (BoM 2021b) indicates the presence of known GDEs and Inflow Dependent Ecosystems (IDEs) in Australia.

An Inflow Dependent Ecosystem is one in which the vegetation within the landscape is likely to be accessing water in addition to rainfall, from soil or surface water or groundwater, assessed using remotely sensed data. The likelihood of a landscape using additional water is rated from one to 10 (low to high), with a rating above six indicating that a landscape is likely to be inflow dependent (BoM 2021b).

ENVIRONMENTALLY SENSITIVE AREAS

There are a number of areas within Western Australia identified as being of environmental significance within which the exemptions to the Native Vegetation Clearing Regulations do not apply. These are referred to as Environmentally Sensitive Areas (ESAs), and are declared under section 51B of the EP Act and described in the *Environmental Protection (Environmentally Sensitive Areas) Notice*.

CONSERVATION ESTATE

The National Reserve System is a network of protected areas managed for conservation under international guidelines. The objective of placing areas of bushland into the Conservation Estate is to achieve and maintain a comprehensive, adequate and representative reserve system for Western Australia. The Conservation and Parks Commission is the vesting body for conservation lands, forest and marine reserves that are managed by DBCA (Government of Western Australia 2018b).

APPENDIX TWO

FIELD SURVEY CRITERIA

Table 13: NVIS structural formation terminology, terrestrial vegetation (NVIS Technical Working Group & DotEE 2017)

	Cover characteristics							
	Foliage cover *	70-100	30-70	10-30	<10	» 0 (scattered)	0-5 (clumped)	unknown
	Cover code	d	c	i	r	bi	bc	unknown
Growth Form	Height Ranges (m)	Structural Formation Classes						
tree, palm	<10,10-30,>30	closed forest	open forest	woodland	open woodland	isolated trees	isolated clumps of trees	tree, palm
tree mallee	<3, <10, 10-30	closed mallee forest	open mallee forest	mallee woodland	open mallee woodland	isolated mallee trees	isolated clumps of mallee trees	tree mallee
shrub, cycad, grass-tree, tree-fern	<1,1-2,>2	closed shrubland	shrubland	open shrubland	sparse shrubland	isolated shrubs	isolated clumps of shrubs	shrub, cycad, grass-tree, tree-fern
mallee shrub	<3, <10, 10-30	closed mallee shrubland	mallee shrubland	open mallee shrubland	sparse mallee shrubland	isolated mallee shrubs	isolated clumps of mallee shrubs	mallee shrub
heath shrub	<1,1-2,>2	closed heathland	heathland	open heathland	sparse heathland	isolated heath shrubs	isolated clumps of heath shrubs	heath shrub
chenopod shrub	<1,1-2,>2	closed chenopod shrubland	chenopod shrubland	open chenopod shrubland	sparse chenopod shrubland	isolated chenopod shrubs	isolated clumps of chenopod shrubs	chenopod shrub
samphire shrub	<0.5,>0.5	closed samphire shrubland	samphire shrubland	open samphire shrubland	sparse samphire shrubland	isolated samphire shrubs	isolated clumps of samphire shrubs	samphire shrub
hummock grass	<2,>2	closed hummock grassland	hummock grassland	open hummock grassland	sparse hummock grassland	isolated hummock grasses	isolated clumps of hummock grasses	hummock grass
tussock grass	<0.5,>0.5	closed tussock grassland	tussock grassland	open tussock grassland	sparse tussock grassland	isolated tussock grasses	isolated clumps of tussock grasses	tussock grass
other grass	<0.5,>0.5	closed grassland	grassland	open grassland	sparse grassland	isolated grasses	isolated clumps of grasses	other grass
sedge	<0.5,>0.5	closed sedgeland	sedgeland	open sedgeland	sparse sedgeland	isolated sedges	isolated clumps of sedges	sedge
rush	<0.5,>0.5	closed rushland	rushland	open rushland	sparse rushland	isolated rushes	isolated clumps of rushes	rush
herb	<0.5,>0.5	closed herbland	herbland	open herbland	sparse herbland	isolated herbs	isolated clumps of herbs	herb
fern	<1,1-2,>2	closed fernland	fernland	open fernland	sparse fernland	isolated ferns	isolated clumps of ferns	fern
bryophyte	<0.5	closed bryophyte-land	bryophyte-land	open bryophyteland	sparse bryophyteland	isolated bryophytes	isolated clumps of bryophytes	bryophyte
lichen	<0.5	closed lichenland	lichenland	open lichenland	sparse lichenland	isolated lichens	isolated clumps of lichens	lichen
vine	<10,10-30,>30	closed vineland	vineland	open vineland	sparse vineland	isolated vines	isolated clumps of vines	vine

Table 14: NVIS height classes (NVIS Technical Working Group & DotEE 2017)

Height		Growth form				
Height Class	Height Range (m)	Tree, vine (M & U), palm (single-stemmed)	Shrub, heath shrub, chenopod shrub, ferns, samphire shrub, cycad, tree-fern, grass-tree, palm (multi-stemmed)	Tree mallee, mallee shrub	Tussock grass, hummock grass, other grass, sedge, rush, forbs, vine (G)	Bryophyte, lichen, seagrass, aquatic
8	>30	tall	NA	NA	NA	NA
7	10-30	mid	NA	tall	NA	NA
6	<10	low	NA	mid	NA	NA
5	<3	NA	NA	low	NA	NA
4	>2	NA	tall	NA	tall	NA
3	1-2	NA	mid	NA	tall	NA
2	0.5-1	NA	low	NA	mid	tall
1	<0.5	NA	low	NA	low	low

Source: (based on Walker & Hopkins 1990)

Table 15: Vegetation condition scale for the Eremaean and Northern Botanical Provinces (EPA 2016)

Condition rating	Description
Excellent	Pristine or nearly so, no obvious signs of disturbance or damage caused by human activities since European settlement.
Very Good	Some relatively slight signs of damage caused by human activities since European settlement. For example, some signs of damage to tree trunks caused by repeated fire, the presence of some relatively non-aggressive weeds, or occasional vehicle tracks.
Good	More obvious signs of damage caused by human activity since European settlement, including some obvious impact on the vegetation structure such as that caused by low levels of grazing or slightly aggressive weeds.
Poor	Still retains basic vegetation structure or ability to regenerate it after very obvious impacts of human activities since European settlement, such as grazing, partial clearing, frequent fires or aggressive weeds.
Degraded	Severely impacted by grazing, very frequent fires, clearing or a combination of these activities. Scope for some regeneration but not to a state approaching good condition without intensive management. Usually with a number of weed species present including very aggressive species.
Completely Degraded	Areas that are completely or almost completely without native species in the structure of their vegetation; i.e. areas that are cleared or 'parkland cleared' with their flora comprising weed or crop species with isolated native trees or shrubs.

APPENDIX THREE DESKTOP ASSESSMENT RESULTS AND LIKELIHOOD ASSESSMENTS

Table 16: Flora database search results, habitat and likelihood assessment

Blue shading indicates high likelihood; dark blue indicates species is known (recorded) from the survey area

DBCA*	PMST**	Species name	Habitat from: <i>FloraBase</i> (WAH 1998-2021) unless otherwise listed	Flowering	Likelihood of occurrence	
					Desktop	Post-survey
		Threatened Flora				
	Likely	<i>Pityrodia augustensis</i>	Amongst rocks on slopes or in drainage lines.	Aug – Sep	Highly unlikely	Highly unlikely
WAH		<i>Seringia exastia</i>	Sandplains with red sand. Pindan plain. Sand dunes and gravel plains.	-	Unlikely	Unlikely
		DBCA Priority 1				
WAH		<i>Dicrastylis mitchellii</i>	Sandy or clay soils. Around dunes.	-	Highly unlikely	Highly unlikely
WAH/TP		<i>Eremophila anomala</i>	Basalt outcrop.	Aug – Sep	Highly unlikely	Highly unlikely
WAH/TP		<i>Eremophila arguta</i>	Seasonally damp areas along drainage lines/depressions near Mount Augustus Station.	Aug – Sep	Highly unlikely	Highly unlikely
WAH/TP		<i>Eremophila demissa</i>	Silcrete plain.	Mar	Recorded	Recorded
WAH		<i>Eremophila prolata</i>	Red stony clay. Flats & rises.	Aug – Sep	Unlikely	Unlikely
WAH		<i>Eremophila</i> sp. Meekatharra (D.J. Edinger 4430)	Laterite outcrop; rocky lower slope of mesa.	-	Unlikely	Unlikely
WAH/TP		<i>Eucalyptus semota</i>	Clay. Quartz outcrops.	-	Possible	Unlikely
WAH/TP		<i>Euphorbia sarcostemmoides</i>	Sandstone ridges, quartzite hills.	-	Unlikely	Unlikely
TP		<i>Micromyrtus mucronulata</i>	Brown loam on slopes or summits.	Aug	Highly unlikely	Highly unlikely
WAH/TP		<i>Pityrodia iphthima</i>	Skeletal red-brown sandy loam over banded ironstone. Upper hillslopes.	-	Highly unlikely	Highly unlikely
WAH		<i>Ptilotus actinocladius</i>	Sandy loam on plains.	-	Possible	Recorded
WAH		<i>Rhodanthe sphaerocephala</i>	Clayey loam on flats.	Oct	Recorded	Possible
WAH		<i>Solanum iodinum</i>	Brown/red clayey land.	Aug	Highly unlikely	Highly unlikely
WAH		<i>Solanum reclusum</i>	Red clay sand. On quartz hills.	Aug	Highly unlikely	Highly unlikely
WAH		<i>Wurmbea</i> sp. Denham Pool (F. Hort et al. 2216)	Red sandy clay. Edges of banks adjacent to river pools.	Apr	Highly unlikely	Highly unlikely
		DBCA Priority 2				
WAH		<i>Indigofera fractiflexa</i> subsp. <i>augustensis</i>	Orange/brown soil on rocky banded ironstone outcrops. On steep slopes, summits or near rocky watercourses.	Jul – Sep	Recorded	Recorded
		DBCA Priority 3				
WAH		<i>Drummondita miniata</i>	Laterite. Breakaways.	Jul – Aug or Nov	Highly unlikely	Highly unlikely
WAH		<i>Eremophila arachnoides</i> subsp. <i>arachnoides</i>	Shallow loam over limestone.	Sep	Highly unlikely	Unlikely
TP		<i>Eremophila gracillima</i>	Stony flats.	Sep	Highly unlikely	Unlikely
WAH		<i>Eremophila lanata</i>	Stony red clayey sand.	Aug	Highly unlikely	Highly unlikely
WAH		<i>Eremophila obliquisejala</i>	Sand. Open hardpan plains.	May	Highly unlikely	Highly unlikely
WAH		<i>Eremophila rigida</i>	Red sand alluvium. Hardpan plains, stony clay depressions.	Sep	Highly unlikely	Highly unlikely
WAH		<i>Eremophila shonae</i> subsp. <i>diffusa</i>	Stony yellow or red sandy soils.	Aug – Oct	Highly unlikely	Highly unlikely
WAH		<i>Hemigenia tysonii</i>	Red sand, sandy clay, lateritic sand. Flats, sand dunes, hills,	May or Jul – Dec	Highly unlikely	Unlikely

DESKTOP ASSESSMENT RESULTS AND LIKELIHOOD ASSESSMENTS

DBCA*	PMST**	Species name	Habitat from: <i>FloraBase</i> (WAH 1998-2021) unless otherwise listed	Flowering	Likelihood of occurrence	
					Desktop	Post-survey
WAH		<i>Hemigenia virescens</i>	Brown rocky/gravelly sandy loam.	Jul / Aug – Dec	Unlikely	Unlikely
WAH		<i>Homalocalyx echinulatus</i>	Laterite. Breakaways, sandstone hills.	Jun – Sep	Possible	Recorded
WAH		<i>Indigofera gilesii</i>	Pebbly loam. Amongst boulders & outcrops, hills.	May/Jun – Aug	Highly unlikely	Highly unlikely
WAH		<i>Maireana murrayana</i>	Red clayey sand, dissected sandstone.	-	Highly unlikely	Highly unlikely
WAH/TP		<i>Maireana prosthocochaeta</i>	Laterite. Hills, salty places.	-	Unlikely	Unlikely
WAH		<i>Prostanthera ferricola</i>	Shallow red-brown skeletal sandy loam on banded ironstone, laterite, basalt or quartz. Gently inclined mid to upper slopes of hills, rocky crests, outcrops.	Jul or Aug	Unlikely	Unlikely
WAH		<i>Ptilotus lazaridis</i>	Clay loam. Floodplains.	Jul or Oct	Highly unlikely	Highly unlikely
WAH/TP		<i>Ptilotus luteolus</i>	Brown, stony sand. Hills or near water courses.	Jun or Sep	Unlikely	Unlikely
WAH		<i>Sauropus</i> sp. Woolgorong (M. Officer s.n. 10/8/94)	Red sand. Plains.	Jun	Highly unlikely	Highly unlikely
WAH		<i>Sida picklesiana</i>	Red brown sand. On flats or upper slopes of breakaways.	Apr, Aug or Nov	Possible	Recorded
WAH		<i>Thryptomene</i> sp. Leinster (B.J. Lepschi & L.A. Craven 4362)	Red sandy loam. On flats or hills.	-	Possible	Recorded
WAH		<i>Tribulus adelacanthus</i>	Rocky soils. On flats or hills.	-	Highly unlikely	Highly unlikely
WAH		<i>Verticordia jamiesonii</i>	Sandy clay soils. Lateritic breakaways.	Sep – Oct	Unlikely	Unlikely
		DBCA Priority 4				
WAH		<i>Dodonaea amplisemina</i>	Red-brown sandy clay on basalt and gabbro and banded ironstone or dolerite and quartzite. Rocky hills.	-	Possible	Possible
WAH/TP		<i>Goodenia berringbinensis</i>	Red sandy loam. Along watercourses.	Oct	Unlikely	Unlikely
-		<i>Goodenia nuda</i>	Seasonally inundated clay soils and drainage lines	Apr-Aug	Recorded	Recorded

* WAH = herbarium record (vouchered specimen)

TP = Threatened and Priority Flora Report Form record; may be unconfirmed i.e. without vouchered specimen

** PMST likelihood of occurrence or likelihood of habitat occurring

FIELD SURVEY RESULTS

Table 17: Flora inventory (site x species matrix)

APPENDIX FIVE

FLORISTIC QUADRAT DATA

HR2130

Staff KCP **Date** 7/04/2021 **Season** P
Revisit
Type Q 20 m x 20 m
Location Old Highway Haul Route
MGA Zone 50 718368 mE 7164026 mN **Lat.** -25.6252 **Long.** 119.1748
Habitat Drainage
Aspect S **Slope** Very Gentle
Soil Type Orange brown clay
Rock Type Ironstone
Loose Rock <2 % cover; 6-20 mm in size **Litter** 1 % cover ; .05 cm in depth
Bare ground 80 % cover **Weeds** 0 % cover
Vegetation U+ ^*Acacia aptaneura*,^*Acacia subcontorta*^tree\6\c;M ^^*Eremophila forrestii*,*Eremophila galeata*,
Eremophila margarethae^shrub\3\r;
Veg. Condition Excellent
Disturbance
Fire Age >10 years

Notes



Species	WA Cons.	Height (m)	Cover (%)	Count
<i>Acacia aptaneura</i>		7	40	
<i>Acacia incurvaneura</i>		1	<1	
<i>Acacia kempeana</i>		1	<1	
<i>Acacia subcontorta</i>		7	10	
<i>Eremophila forrestii</i>		1	2	

<i>Eremophila galeata</i>		1.5	1
<i>Eremophila margarethae</i>		.5	<1
<i>Eriachne helmsii</i>		.4	<1
<i>Hibiscus burtonii</i>		.1	<1
<i>Psyrax latifolia</i>		2	<1
<i>Ptilotus obovatus</i>		.5	<1
<i>Sida picklesiana</i>	P 3	1	<1
<i>Sida</i> sp. Golden calyces glabrous (H.N. Foote 32)		.1	<1
<i>Vincetoxicum lineare</i>		.4	<1

HR2131

Staff LJA **Date** 6/04/2021 **Season** P
Revisit
Type Q 20 m x 20 m
Location Old Highway Haul Route
MGA Zone 50 724001 mE 7165487 mN **Lat.** -25.6112 **Long.** 119.2306
Habitat Flat
Aspect N/A **Slope** N/A
Soil Type Orange silty clay
Rock Type None
Loose Rock 0 % cover **Litter** 85 % cover ; 1-10 cm in depth
Bare ground 10 % cover **Weeds** <1 % cover
Vegetation U+ ^*Corymbia candida*, ^*Hakea lorea* subsp. *lorea* ^tree\7\i; M ^^*Acacia tetragonophylla*, *Acacia aneura*, *Acacia aptaneura* ^shrub\4\i; G ^^*Chrysopogon fallax*, *Themeda triandra* ^tussock grass\2\i
Veg. Condition Very Good
Disturbance Cattle grazing
Fire Age >10 years
Notes "River" but no obvious channel. Soil significantly drier away from track suggesting changed surface flow pattern.



Species	WA Cons.	Height (m)	Cover (%)	Count
<i>Abutilon cryptopetalum</i>		0,3	<1	
<i>Acacia aneura</i>		3	5	
<i>Acacia aptaneura</i>		3	2	
<i>Acacia pteraneura</i>		4	<1	

<i>Acacia tetragonophylla</i>		3	10
<i>Chrysopogon fallax</i>		0.8	20
<i>Corymbia candida</i>		12	20
<i>Duperreya commixta</i>		1	<1
<i>Eremophila galeata</i>		2	<1
<i>Eriachne flaccida</i>		0.2	2
<i>Hakea lorea</i> subsp. <i>lorea</i>		5	<1
<i>Isotropis iophyta</i>		0.4	2
<i>Marsilea hirsuta</i>		0.1	<1
<i>Paspalidium clementii</i>		0.1	<1
<i>Psyrdrax rigidula</i>		0.6	<1
<i>Ptilotus actinocladus</i>	P 1	0.2	<1
<i>Santalum lanceolatum</i>		2	<1
<i>Santalum spicatum</i>		3	<1
<i>Senna artemisioides</i> subsp. <i>x artemisioides</i>		0.6	<1
<i>Senna stricta</i>		0.7	<1
<i>Themeda triandra</i>		0.6	5

HR2132

Staff KCP **Date** 7/04/2021 **Season** P
Revisit
Type Q 20 m x 20 m
Location Old Highway Haul Route
MGA Zone 50 732427 mE 7164995 mN **Lat.** -25.6143 **Long.** 119.3146
Habitat Drainage
Aspect **Slope**
Soil Type Red sandy clay
Rock Type Ironstone
Loose Rock <2 % cover; 2-6 mm in size **Litter** 2 % cover ; <10 cm in depth
Bare ground 80 % cover **Weeds** <1 % cover
Vegetation U+ ^^*Acacia aptaneura*,*Acacia tetragonophylla*,*Acacia aneura*^tree\6\c;M ^*Acacia kempeana*^shrub\3\r;G ^^*Chrysopogon fallax*,*Aristida contorta*,*Evolvulus alsinoides* var. *villosicalyx*^tussock grass,forb\2\i
Veg. Condition Very Good
Disturbance Cattle tracks minor
Fire Age >10 years

Notes



Species	WA Cons.	Height (m)	Cover (%)	Count
<i>Abutilon cryptopetalum</i>		0.2	<1	
<i>Abutilon otocarpum</i>		0.3	<1	
<i>Acacia aneura</i>		6	2	
<i>Acacia aptaneura</i>		7	35	

<i>Acacia craspedocarpa</i>	0.5	<1
<i>Acacia kempeana</i>	1.5	2
<i>Acacia tetragonophylla</i>	4	8
<i>Aristida contorta</i>	0.1	1
* <i>Bidens subalternans</i>	0.1	<1
<i>Cheilanthes sieberi</i>	0.1	<1
<i>Chrysopogon fallax</i>	0.6	10
<i>Digitaria brownii</i>	0.2	<1
<i>Eragrostis cumingii</i>	.1	<1
<i>Eragrostis eriopoda</i>	0.4	<1
<i>Evolvulus alsinoides</i> var. <i>villosicalyx</i>	0.1	<1
<i>Heliotropium inexplicitum</i>	0.3	<1
<i>Hibiscus burtonii</i>	0.1	<1
<i>Iseilema membranaceum</i>	0.1	<1
<i>Isotropis iophyta</i>	0.2	<1
<i>Maireana</i> ? <i>planifolia</i>	0.2	<1
<i>Monachather paradoxus</i>		<1
<i>Psydrax latifolia</i>	0.7	<1
<i>Psydrax rigidula</i>	0.5	<1
<i>Ptilotus xerophilus</i>	0.3	<1
<i>Sclerolaena eriacantha</i>	0.1	<1
<i>Senna artemisioides</i> subsp. <i>helmsii</i>	0.5	<1
<i>Senna</i> sp. Meekatharra (E. Bailey 1-26)	1	<1
<i>Sida</i> sp. L (A.M. Ashby 4202)	0.2	<1
<i>Solanum lasiophyllum</i>	0.4	<1
<i>Vincetoxicum lineare</i>		<1

HR2133

Staff KCP **Date** 8/04/2021 **Season** P
Revisit
Type Q 20 m x 20 m
Location Old Highway Haul Route
MGA Zone 50 734194 mE 7168708 mN **Lat.** -25.5806 **Long.** 119.3315
Habitat Drainage
Aspect N/A **Slope** N/A
Soil Type Orange sandy clay loam
Rock Type Ironstone
Loose Rock 50-90 % cover; 2-6 mm in size **Litter** 1 % cover ; <5 cm in depth
Bare ground 80 % cover **Weeds** 0 % cover
Vegetation U+ ^^*Acacia aptaneura*,*Acacia pteraneura*,*Acacia subcontorta*\^tree\6\r;G ^*Eriachne pulchella* subsp. *pulchella*,^*Aristida contorta*\^tussock grass\1\i
Veg. Condition Very Good
Disturbance Minor cattle tracks
Fire Age >10 years

Notes



Species	WA Cons.	Height (m)	Cover (%)	Count
<i>Acacia aptaneura</i>		3	4	
<i>Acacia pteraneura</i>		3	1.5	
<i>Acacia subcontorta</i>		2.5	<1	
<i>Acacia tetragonophylla</i>		0.3	<1	
<i>Aristida contorta</i>		0.2	<1	

<i>Arivela viscosa</i>	0.1	<1
<i>Boerhavia coccinea</i>	0.1	<1
<i>Enneapogon caeruleus</i>	0.1	<1
<i>Eriachne pulchella</i> subsp. <i>pulchella</i>	0.1	20
<i>Evolvulus alsinoides</i> var. <i>villosicalyx</i>	0.1	<1
<i>Heliotropium inexplicitum</i>	0.2	<1
<i>Hibiscus</i> sp. <i>Gardneri</i> (A.L. Payne PRP 1435)	0.2	<1
<i>Indigofera monophylla</i>	0.1	<1
<i>Sida platycalyx</i>	0.2	<1
<i>Sida</i> sp. L (A.M. Ashby 4202)	0.1	<1

HR2134

Staff KCP **Date** 8/04/2021 **Season** P
Revisit
Type Q 20 m x 20 m
Location Old Highway Haul Route
MGA Zone 50 734392 mE 7170210 mN **Lat.** -25.5670 **Long.** 119.3332
Habitat River
Aspect **Slope** N/A
Soil Type Orange sand, clay
Rock Type Quartz, ironstone
Loose Rock <2 % cover **Litter** 1 % cover ; 1 cm in depth
Bare ground 80 % cover **Weeds** .5 % cover
Vegetation U+ ^*Acacia fuscaneura*, ^*Acacia aneura* \^tree\6\i; M ^*Acacia tetragonophylla*, ^*Psyrax latifolia* \^shrub\4\r; G ^^*Aristida contorta*, *Chrysopogon fallax*, *Eriachne pulchella* subsp. *pulchella* \^tussock grass\1\r
Veg. Condition Very Good
Disturbance
Fire Age >10 years
Notes



Species	WA Cons.	Height (m)	Cover (%)	Count
<i>Abutilon cryptopetalum</i>		.15	<1	
<i>Abutilon fraseri</i>		.3	<1	
<i>Acacia aneura</i>		5	1.5	
<i>Acacia fuscaneura</i>		5	15	

<i>Acacia tetragonophylla</i>	2.5	1.5
<i>Aristida contorta</i>	.2	2
* <i>Bidens subalternans</i>	.1	<1
<i>Chrysopogon fallax</i>	.5	1
<i>Digitaria brownii</i>	.3	<1
<i>Enneapogon caeruleus</i>	.3	<1
<i>Eremophila phyllopoda</i> subsp. <i>phyllopoda</i>	0.8	<1
<i>Eriachne pulchella</i> subsp. <i>pulchella</i>	.15	<1
<i>Heliotropium inexplicitum</i>	.1	<1
<i>Hibiscus</i> sp. <i>Gardneri</i> (A.L. Payne PRP 1435)	.2	<1
<i>Indigofera monophylla</i>		<1
<i>Isotropis iophyta</i>	.3	<1
<i>Marsdenia australis</i>	1	<1
<i>Portulaca oleracea</i>	.05	<1
<i>Psyrax latifolia</i>	1	1
<i>Ptilotus exaltatus</i>	.1	<1
<i>Ptilotus obovatus</i>	1	<1
<i>Senna artemisioides</i> subsp. <i>helmsii</i>	1	<1
<i>Senna</i> sp. <i>Meekatharra</i> (E. Bailey 1-26)	1.5	<1
<i>Sida platycalyx</i>	.15	<1
<i>Sida</i> sp. <i>L</i> (A.M. Ashby 4202)	.2	<1

HR2135

Staff KCP **Date** 8/04/2021 **Season** P
Revisit
Type Q 20 m x 20 m
Location Old Highway Haul Route
MGA Zone 50 734767 mE 7171341 mN **Lat.** -25.5567 **Long.** 119.3367
Habitat Crest
Aspect S **Slope** Gentle
Soil Type Orange clay loam
Rock Type
Loose Rock >90 % cover; 20-60 mm in size **Litter** 1 % cover ; 1 cm in depth
Bare ground 70 % cover **Weeds** 0 % cover
Vegetation U ^*Acacia subcontorta*^tree\6\r;M ^*Acacia incurvaneura*,^*Acacia aneura*^shrub\3\r;G+ ^*Aluta maisonneuvei* subsp. *auriculata*^shrub\1\i
Veg. Condition Excellent
Disturbance
Fire Age >10 years

Notes



Species	WA Cons.	Height (m)	Cover (%)	Count
<i>Acacia aneura</i>		2	1	
<i>Acacia incurvaneura</i>		2	1	
<i>Acacia rhodophloia</i>		1.2	<1	
<i>Acacia subcontorta</i>		5	2	
<i>Aluta maisonneuvei</i> subsp. <i>auriculata</i>		.4	25	

<i>Aristida contorta</i>		.3	<1
<i>Eremophila latrobei</i>		1	<1
<i>Eriachne pulchella</i> subsp. <i>dominii</i>		.08	<1
<i>Euphorbia tannensis</i> subsp. <i>eremophila</i>		.3	<1
<i>Goodenia triodiophila</i>		.3	<1
<i>Hibiscus burtonii</i>		.1	<1
Indeterminant spp.		.2	<1
<i>Psydrax latifolia</i>		1	<1
<i>Ptilotus obovatus</i>		.3	<1
<i>Sida</i> sp. Golden calyces glabrous (H.N. Foote 32)		.1	<1
<i>Thryptomene</i> sp. Leinster (B.J. Lepschi & L.A. Craven 4362)	P 3	2	<1

HR2136

Staff KCP **Date** 8/04/2021 **Season** P
Revisit
Type Q 20 m x 20 m
Location Old Highway Haul Route
MGA Zone 50 734695 mE 7171557 mN **Lat.** -25.5548 **Long.** 119.3360
Habitat Lower-Slope
Aspect N **Slope** Very Gentle
Soil Type Orange brown sandy clay loam
Rock Type Ironstone
Loose Rock 50-90 % cover; 6-20 mm in size **Litter** <1 % cover ; <5 cm in depth
Bare ground 90 % cover **Weeds** 0 % cover
Vegetation U+ ^*Acacia pteraneura*,^*Acacia subcontorta*^tree\6\r;M ^*Thryptomene* sp. Leinster (B.J. Lepschi & L.A. Craven 4362)\^shrub\3\r;G ^*Eriachne helmsii*^tussock grass\1\bi
Veg. Condition Very Good
Disturbance
Fire Age >10 years

Notes



Species	WA Cons.	Height (m)	Cover (%)	Count
<i>Acacia incurvaneura</i>		1	<1	
<i>Acacia pteraneura</i>		4	5	
<i>Acacia subcontorta</i>		5	2	
<i>Eremophila foliosissima</i>		0.5	<1	
<i>Eremophila latrobei</i>		1.5	<1	

<i>Eremophila punctata</i>		1	<1
<i>Eriachne helmsii</i>		0.2	1
<i>Eriachne mucronata</i>		0.1	<1
<i>Mirbelia rhagodioides</i>			<1
<i>Thryptomene</i> sp. Leinster (B.J. Lepschi & L.A. Craven 4362)	P 3	2	3

HR2137

Staff KCP **Date** 8/04/2021 **Season** P
Revisit
Type Q 20 m x 20 m
Location Old Highway Haul Route
MGA Zone 50 **734679 mE** **7171159 mN** **Lat.** -25.5584 **Long.** 119.3359
Habitat Lower-Slope
Aspect SE **Slope** Very Gentle
Soil Type Orange brown sandy clay
Rock Type Ironstone
Loose Rock 50-90 % cover; 2-6 mm in size **Litter** 1 % cover ; <1 cm in depth
Bare ground 90 % cover **Weeds** 0 % cover
Vegetation M+ ^*Acacia aptaneura*\^shrub\3\i;G ^*Ptilotus schwartzii*,^*Sida picklesiana*\^forb,shrub\1\bi
Veg. Condition Excellent
Disturbance
Fire Age >10 years

Notes



Species	WA Cons.	Height (m)	Cover (%)	Count
<i>Acacia aptaneura</i>		1.7	4	
<i>Acacia pteraneura</i>		1.5	<1	
<i>Aristida contorta</i>		0.1	<1	
<i>Eremophila latrobei</i>		0.3	<1	
<i>Eremophila latrobei</i> subsp. <i>latrobei</i>		0.1	<1	

<i>Ptilotus schwartzii</i>		0.25	1
<i>Sida picklesiana</i>	P 3	0.5	0.5
<i>Solanum lachnophyllum</i>		0.4	<1

HR2138

Staff LJA **Date** 8/04/2021 **Season** P
Revisit
Type Q 20 m x 20 m
Location Old Highway Haul Route
MGA Zone 50 734304 mE 7169320 mN **Lat.** -25.5750 **Long.** 119.3325
Habitat Flat
Aspect N/A **Slope** N/A
Soil Type Orange brown sandy clay
Rock Type Ironstone
Loose Rock >90 % cover; 6-20 mm in size **Litter** <1 % cover ; <5 cm in depth
Bare ground 95 % cover **Weeds** 0 % cover
Vegetation M+ ^*Acacia cuspidifolia*^shrub\4\r;G ^^*Senna* sp. Meekatharra (E. Bailey 1-26),*Rhagodia eremaea*,*Maireana ?georgei*^shrub,chenopod shrub\1\r
Veg. Condition Very Good
Disturbance Minor car tracks
Fire Age >10 years

Notes



Species	WA Cons.	Height (m)	Cover (%)	Count
<i>Acacia cuspidifolia</i>		2.8	3	
<i>Maireana ?georgei</i>		0.3	<1	
<i>Maireana triptera</i>		0.05	<1	
<i>Ptilotus exaltatus</i>		0.05	<1	
<i>Rhagodia eremaea</i>		0.4	<1	

<i>Salsola australis</i>	0.05	<1
<i>Sclerolaena cuneata</i>	0.1	<1
<i>Senna</i> sp. Meekatharra (E. Bailey 1-26)	0.6	1.5

HR2139

Staff KCP **Date** 7/04/2021 **Season** P
Revisit
Type Q 20 m x 20 m
Location Old Highway Haul Route
MGA Zone 50 732915 mE 7165422 mN **Lat.** -25.6104 **Long.** 119.3193
Habitat Flat
Aspect N/A **Slope** N/A
Soil Type Orange brown clay loam
Rock Type Ironstone, quartz
Loose Rock >90 % cover; 6-20 mm in size **Litter** 1 % cover ; 1 cm in depth
Bare ground 95 % cover **Weeds** 0 % cover
Vegetation U+ ^*Acacia cuspidifolia*\^tree\6\r;G ^^*Senna* sp. Meekatharra (E. Bailey 1-26),*Maireana triptera*,
Salsola australis\^shrub,forb\2\r
Veg. Condition Excellent
Disturbance
Fire Age >10 years

Notes



Species	WA Cons.	Height (m)	Cover (%)	Count
<i>Acacia cuspidifolia</i>		6	5	
<i>Maireana triptera</i>		.2	1	
<i>Ptilotus exaltatus</i>		.05	<1	
<i>Rhagodia eremaea</i>		.3	<1	
<i>Salsola australis</i>		.1	1	

Senna sp. Meekatharra (E. Bailey 1-26)

1

3

HR2140

Staff LJA **Date** 7/04/2021 **Season** P
Revisit
Type Q 20 m x 20 m
Location Old Highway Haul Route
MGA Zone 50 734021 mE 7166392 mN **Lat.** -25.6015 **Long.** 119.3302
Habitat Flat
Aspect N/A **Slope** N/A
Soil Type Orange sandy clay
Rock Type Ironstone
Loose Rock >90 % cover; 6-20 mm in size **Litter** <1 % cover ; 0.05 cm in depth
Bare ground 85 % cover **Weeds** 0 % cover
Vegetation U ^*Acacia aptaneura*,^*Acacia pteraneura*\^tree\6\r;+ G ^*Eremophila phyllopoda* subsp. *phyllopoda*\^shrub\2\bi
Veg. Condition Excellent
Disturbance
Fire Age >10 years

Notes



Species	WA Cons.	Height (m)	Cover (%)	Count
<i>Acacia aptaneura</i>		3	2	
<i>Acacia pteraneura</i>		2	1.5	
<i>Eremophila linearis</i>		1.5	<1	
<i>Eremophila phyllopoda</i> subsp. <i>phyllopoda</i>		0.6	<1	
<i>Senna artemisioides</i> subsp. <i>x artemisioides</i>		0.3	<1	

<i>Senna</i> sp. Meekatharra (E. Bailey 1-26)	0.4	<1
<i>Solanum lasiophyllum</i>	0.2	<1

HR2141

Staff LJA **Date** 6/04/2021 **Season** P
Revisit
Type Q 20 m x 20 m
Location Old Highway Haul Route
MGA Zone 50 728663 mE 7165591 mN **Lat.** -25.6095 **Long.** 119.2770
Habitat Flat
Aspect N/A **Slope** N/A
Soil Type Orange sandy clay
Rock Type Quartz
Loose Rock ; 20-60 mm in size **Litter**
Bare ground **Weeds**
Vegetation M+ ^*Acacia aptaneura*, ^*Grevillea berryana* ^shrub\4\r; G ^*Ptilotus schwartzii*, ^*Eriachne mucronata* ^forb, tussock grass\1\b
Veg. Condition Poor
Disturbance
Fire Age

Notes



Species	WA Cons.	Height (m)	Cover (%)	Count
<i>Acacia aneura</i>		2	<1	
<i>Acacia aptaneura</i>		2.5	1	
<i>Aristida contorta</i>		0.2	<1	
<i>Aristida inaequiglumis</i>		0.4	<1	
<i>Eremophila forrestii</i>		0.3	<1	

<i>Eremophila incisa</i>		0.3	<1	
<i>Eriachne mucronata</i>		0.1	<1	
<i>Goodenia nuda</i>	P 4	0.1	<1	
<i>Grevillea berryana</i>		3	1	
<i>Hibiscus burtonii</i>		0.1	<1	
<i>Hibiscus sturtii</i> var. <i>truncatus</i>		0.2	<1	
<i>Psyrax rigidula</i>		2	<1	
<i>Ptilotus schwartzii</i>		0.3	<1	
<i>Thryptomene</i> sp. Leinster (B.J. Lepschi & L.A. Craven 4362)	P 3	0.7	<1	2

HR2142

Staff KCP **Date** 7/04/2021 **Season** P
Revisit
Type Q 20 m x 20 m
Location Old Highway Haul Route
MGA Zone 50 730029 mE 7165027 mN **Lat.** -25.6144 **Long.** 119.2907
Habitat Flat
Aspect N/A **Slope** N/A
Soil Type Orange brown clay loam
Rock Type Ironestone, quartz
Loose Rock 2-10 % cover **Litter** <1 % cover ; .1 cm in depth
Bare ground 90 % cover **Weeds** 0 % cover
Vegetation M+ ^^*Acacia fuscaneura*,*Acacia aptaneura*,*Acacia subcontorta*\^shrub\3\r;G ^*Ptilotus schwartzii*,
^*Aristida contorta*\^forb,tussock grass\1\bi
Veg. Condition Very Good
Disturbance Tracks nearby
Fire Age >10 years

Notes



Species	WA Cons.	Height (m)	Cover (%)	Count
<i>Acacia aptaneura</i>		1	<1	
<i>Acacia fuscaneura</i>		2	1	
<i>Acacia subcontorta</i>		1	<1	
<i>Aristida contorta</i>		.15	<1	
<i>Eremophila incisa</i>		.03	<1	

<i>Eremophila latrobei</i> subsp. <i>latrobei</i>	.3	<1
<i>Heliotropium heteranthum</i>	.05	<1
<i>Ptilotus schwartzii</i>	.3	<1

HR2143

Staff KCP **Date** 7/04/2021 **Season** P
Revisit
Type Q 20 m x 20 m
Location Old Highway Haul Route
MGA Zone 50 731639 mE 7164895 mN **Lat.** -25.6154 **Long.** 119.3067
Habitat Flat
Aspect N/A **Slope** N/A
Soil Type Orange brown clay loam
Rock Type Ironstone
Loose Rock 2-10 % cover **Litter** <1 % cover ; 0.05 cm in depth
Bare ground 90 % cover **Weeds** 0 % cover
Vegetation U ^*Grevillea berryana*\^tree\6\bi;M+ ^*Eremophila forrestii*,^*Acacia incurvaneura*\^shrub\3\r;G
 ^^*Ptilotus schwartzii*,*Eragrostis eriopoda*,*Eriachne mucronata*\^forb,tussock grass\1\r
Veg. Condition Very Good
Disturbance Tracks nearby
Fire Age >10 years

Notes



Species	WA Cons.	Height (m)	Cover (%)	Count
<i>Acacia incurvaneura</i>		0.7	2	
<i>Aristida contorta</i>		0.1	<1	
<i>Eragrostis eriopoda</i>		0.1	1	
<i>Eremophila forrestii</i>		0.9	5	
<i>Eremophila incisa</i>		0.3	<1	

<i>Eriachne mucronata</i>	0.1	<1
<i>Euphorbia tannensis</i> subsp. <i>eremophila</i>	0.2	<1
<i>Grevillea berryana</i>	3	1
<i>Hibiscus burtonii</i>	0.1	<1
<i>Ptilotus obovatus</i>	0.2	<1
<i>Ptilotus schwartzii</i>	0.15	1
<i>Sclerolaena eriacantha</i>	0.2	<1

HR2144

Staff KCP **Date** 7/04/2021 **Season** P
Revisit
Type Q 20 m x 20 m
Location Old Highway Haul Route
MGA Zone 50 732004 mE 7164942 mN **Lat.** -25.6149 **Long.** 119.3104
Habitat Flat
Aspect N/A **Slope** N/A
Soil Type Orange brown clayey loam
Rock Type Ironstone, quartz
Loose Rock 10-20 % cover **Litter** <1 % cover ; 1 cm in depth
Bare ground 95 % cover **Weeds** 0 % cover
Vegetation U+ ^*Grevillea berryana*^tree\6\;M ^*Eremophila galeata*^shrub\3\bi;G ^*Ptilotus schwartzii*,
Eremophila incisa,*Aristida contorta*^forb,shrub,tussock grass\1\bi
Veg. Condition Very Good
Disturbance Vehicle track
Fire Age >10 years

Notes



Species	WA Cons.	Height (m)	Cover (%)	Count
<i>Acacia tetragonophylla</i>		1	<1	
<i>Aristida contorta</i>		.1	<1	
<i>Eremophila galeata</i>		1	1	
<i>Eremophila incisa</i>		.3	<1	
<i>Grevillea berryana</i>		3.5	<1	

<i>Hibiscus burtonii</i>	.1	<1
Indeterminant spp.	1	<1
<i>Psydrax latifolia</i>	1	<1
<i>Psydrax rigidula</i>	.5	<1
<i>Ptilotus aervoides</i>	.02	<1
<i>Ptilotus rotundifolius</i>	1	<1
<i>Ptilotus schwartzii</i>	.3	<1
<i>Rhagodia eremaea</i>	.5	<1
<i>Senna artemisioides</i> subsp. <i>helmsii</i>	1	<1
<i>Solanum lachnophyllum</i>	1	<1

HR2145

Staff LJA **Date** 5/04/2021 **Season** P
Revisit
Type Q 20 m x 20 m
Location Old Highway Haul Route
MGA Zone 50 721267 mE 7165584 mN **Lat.** -25.6107 **Long.** 119.2034
Habitat Flat
Aspect N/A **Slope** N/A
Soil Type Orange brown sandy clay
Rock Type Ironstone
Loose Rock <2 % cover; 2-6 mm in size **Litter** 25 % cover ; 1-2 cm in depth
Bare ground 45 % cover **Weeds** 1 % cover
Vegetation U+ ^*Acacia aptaneura*, ^*Corymbia candida* \^tree\6\i; M ^*Psyrax latifolia*, ^*Acacia kempeana* \^shrub\4\i; G ^*Eriachne helmsii* \^tussock grass\1\c
Veg. Condition Very Good
Disturbance Cattle grazing
Fire Age >10 years
Notes Mulga/Corymbia grove



Species	WA Cons.	Height (m)	Cover (%)	Count
<i>Abutilon cryptopetalum</i>		0.2	<1	
<i>Acacia aptaneura</i>		6	15	
<i>Acacia kempeana</i>		4	2	
* <i>Bidens subalternans</i>		0.1	1	
<i>Boerhavia coccinea</i>		0.1	<1	

<i>Brunonia australis</i>	0.3	<1
<i>Corymbia candida</i>	8	10
<i>Eragrostis eriopoda</i>	0.5	<1
<i>Eremophila forrestii</i>	1.5	<1
<i>Eremophila incisa</i>	0.3	<1
<i>Eremophila spectabilis</i>	0.5	<1
<i>Eriachne helmsii</i>	0.4	30
<i>Glycine canescens</i>	0.3	<1
<i>Hibiscus burtonii</i>	0.2	<1
<i>Monachather paradoxus</i>	0.3	<1
<i>Perotis rara</i>	0.1	<1
<i>Pluchea rubelliflora</i>	0.2	<1
<i>Psydrax latifolia</i>	5	5
<i>Psydrax rigidula</i>	0.5	<1
<i>Sida</i> sp. dark green fruits (S. van Leeuwen 2260)	0.3	<1
<i>Sida</i> sp. L (A.M. Ashby 4202)	0.1	<1
<i>Solanum lasiophyllum</i>	0.1	<1
<i>Thyridolepis multiculmis</i>	0.3	<1

HR2146

Staff LJA **Date** 6/04/2021 **Season** P
Revisit
Type Q 20 m x 20 m
Location Old Highway Haul Route
MGA Zone 50 726314 mE 7165377 mN **Lat.** -25.6118 **Long.** 119.2537
Habitat Flat
Aspect N/A **Slope** N/A
Soil Type Orange sandy clay
Rock Type Mixed
Loose Rock 0 % cover; 6-20 mm in size **Litter** 2 % cover ; <1 cm in depth
Bare ground 95 % cover **Weeds** 0 % cover
Vegetation M+ ^^*Acacia aptaneura*,*Acacia mulganeura*,*Eremophila galeata*\^shrub\4\r;G ^*Eremophila margarethae*,^*Eremophila forrestii*\^shrub\2\r
Veg. Condition Poor
Disturbance Cattle grazing
Fire Age >10 years

Notes



Species	WA Cons.	Height (m)	Cover (%)	Count
<i>Acacia aptaneura</i>		4	6	
<i>Acacia kempeana</i>		2	<1	
<i>Acacia mulganeura</i>		4	1	
<i>Eragrostis eriopoda</i>		0.2	<1	
<i>Eremophila forrestii</i>		0.6	<1	

<i>Eremophila galeata</i>	3	1
<i>Eremophila margarethae</i>	0.8	1
<i>Eremophila spectabilis</i>	0.4	<1
<i>Hibiscus burtonii</i>	0.1	<1
<i>Maireana ?planifolia</i>	0.3	<1
<i>Psyrax latifolia</i>	3	<1
<i>Ptilotus obovatus</i>	0.5	<1
<i>Ptilotus schwartzii</i>	0.3	<1
<i>Sida</i> sp. L (A.M. Ashby 4202)	0.1	<1

HR2147

Staff LJA **Date** 6/04/2021 **Season** P
Revisit
Type Q 20 m x 20 m
Location Old Highway Haul Route
MGA Zone 50 727292 mE 7165461 mN **Lat.** -25.6109 **Long.** 119.2634
Habitat Flat
Aspect N/A **Slope** N/A
Soil Type Orange clay loam
Rock Type Quartz, ironstone
Loose Rock ; 20-60 mm in size **Litter** 0 % cover ; na cm in depth
Bare ground 99 % cover **Weeds** 0 % cover
Vegetation M+ ^*Grevillea berryana*\^shrub\3\bi;G ^*Goodenia nuda*,^*Ptilotus schwartzii*\^forb\1\bi
Veg. Condition Degraded
Disturbance Cattle grazing
Fire Age >10 years

Notes



Species	WA Cons.	Height (m)	Cover (%)	Count
<i>Acacia aptaneura</i>		0.5	<1	
<i>Aristida contorta</i>		0.1	<1	
<i>Goodenia nuda</i>	P 4	0.1	<1	
<i>Grevillea berryana</i>		1,2	<1	
<i>Ptilotus schwartzii</i>		0.3	<1	

Sclerolaena eriacantha

0.2

<1

HR2148

Staff LJA **Date** 1/04/2021 **Season** P
Revisit
Type Q 20 m x 20 m
Location Old Highway Haul Route
MGA Zone 50 728130 mE 7165699 mN **Lat.** **Long.**
Habitat Flat
Aspect N/A **Slope** N/A
Soil Type Orange clay
Rock Type Mixed
Loose Rock <2 % cover; 6-20 mm in size **Litter** 1 % cover ; <1 cm in depth
Bare ground 98 % cover **Weeds** 0 % cover
Vegetation M+ ^^Acacia aptaneura,Acacia caesaneura,Acacia aneura\^shrub\3\r;G ^Acacia mulganeura\^shrub\2\bi
Veg. Condition Excellent
Disturbance None obvious
Fire Age >10 years
Notes Lots of dead shrubs; tree dead



Species	WA Cons.	Height (m)	Cover (%)	Count
<i>Acacia aneura</i>		1.5	1	
<i>Acacia aptaneura</i>		2	1	
<i>Acacia caesaneura</i>		2	1	
<i>Acacia mulganeura</i>		0.6	<1	
<i>Aristida contorta</i>		0.2	<1	

<i>Eremophila galeata</i>	0.6	<1
<i>Maireana ?planifolia</i>	0.2	<1
<i>Ptilotus obovatus</i>	0.3	<1

HR2149

Staff LJA **Date** 6/04/2021 **Season** P
Revisit
Type Q 20 m x 20 m
Location Old Highway Haul Route
MGA Zone 50 723146 mE 7165464 mN **Lat.** -25.6115 **Long.** 119.2221
Habitat Flat
Aspect N/A **Slope** N/A
Soil Type Orange loamy clay
Rock Type Calcrete, quartz
Loose Rock <2 % cover; 20-60 mm in size **Litter** 15 % cover ; 1 cm in depth
Bare ground 75 % cover **Weeds** 2 % cover
Vegetation M+ ^^Acacia tetragonophylla,Acacia incurvaneura,Acacia aptaneura\^shrub\4\i;G ^Bidens subalternans,^Sida sp. dark green fruits (S. van Leeuwen 2260)\^forb,shrub\1\i
Veg. Condition Poor
Disturbance Cattle grazing
Fire Age >10 years
Notes Lots of large shrubs dead, particularly Acacia tetragonophylla



Species	WA Cons.	Height (m)	Cover (%)	Count
<i>Abutilon cryptopetalum</i>		0.2	<1	
<i>Abutilon fraseri</i>		0.3	<1	
<i>Acacia aptaneura</i>		3	2	
<i>Acacia incurvaneura</i>		3	2	
<i>Acacia minyura</i>		1	<1	

<i>Acacia pyrifolia</i> var. <i>pyrifolia</i>	0.6	<1
<i>Acacia tetragonophylla</i>	4	10
<i>Aristida contorta</i>	0.2	<1
* <i>Bidens subalternans</i>	0.1	2
<i>Chrysocephalum gilesii</i>	0.2	<1
<i>Digitaria brownii</i>	0.1	<1
<i>Duperreya commixta</i>	2	<1
<i>Enneapogon caeruleus</i>	0.1	<1
<i>Evolvulus alsinoides</i> var. <i>villosicalyx</i>	0.1	<1
<i>Glycine canescens</i>	1.5	<1
<i>Heliotropium cunninghamii</i>	0.2	<1
Indeterminant spp.	0.1	<1
<i>Iseilema membranaceum</i>	0.1	<1
<i>Perotis rara</i>	0.1	<1
<i>Ptilotus obovatus</i>	0.8	1
<i>Sida</i> sp. dark green fruits (S. van Leeuwen 2260)	0.1	2
<i>Sida</i> sp. L (A.M. Ashby 4202)	0.2	<1
<i>Solanum lasiophyllum</i>	0.2	<1
<i>Thysanotus manglesianus</i>	1.5	<1

HR2150

Staff LJA **Date** 7/04/2021 **Season** P
Revisit
Type Q 20 m x 20 m
Location Old Highway Haul Route
MGA Zone 50 720546 mE 7165669 mN **Lat.** -25.6101 **Long.** 119.1962
Habitat Flat
Aspect N/A **Slope** N/A
Soil Type Orange broan clay
Rock Type Ironstone, quartz
Loose Rock 20-50 % cover; 2-6 mm in size **Litter** 0 % cover ; 0 cm in depth
Bare ground 95 % cover **Weeds** 0 % cover
Vegetation M+ ^*Acacia pteraneura*, ^*Grevillea berryana* \shrub\3r; G ^*Ptilotus schwartzii* \forb\1bi
Veg. Condition Very Good
Disturbance Vehicle tracks nearby
Fire Age >10 years

Notes



Species	WA Cons.	Height (m)	Cover (%)	Count
<i>Acacia pteraneura</i>		1.5	2	
<i>Aristida contorta</i>		.1	<1	
<i>Eremophila incisa</i>		.3	<1	
<i>Grevillea berryana</i>		2	<1	
<i>Marsdenia australis</i>		1	<1	

<i>Paspalidium clementii</i>	.15	<1
<i>Ptilotus schwartzii</i>	.3	<1

HR2151

Staff KCP **Date** 7/04/2021 **Season** P
Revisit
Type Q 20 m x 20 m
Location Old Highway Haul Route
MGA Zone 50 734272 mE 7167285 mN **Lat.** -25.5934 **Long.** 119.3325
Habitat Flat
Aspect N/A **Slope** N/A
Soil Type Orange brown sandy clay
Rock Type Ironstone
Loose Rock 50-90 % cover; 6-20 mm in size **Litter** <1 % cover ; 0.05 cm in depth
Bare ground 95 % cover **Weeds** 0 % cover
Vegetation U+ ^*Acacia pteraneura*\^tree\6\r;G ^*Sida picklesiana*,^*Ptilotus schwartzii*\^shrub,forb\1\r
Veg. Condition Excellent
Disturbance
Fire Age >10 years

Notes



Species	WA Cons.	Height (m)	Cover (%)	Count
<i>Acacia pteraneura</i>		4	3	
<i>Eremophila galeata</i>		0.3	<1	
<i>Eremophila spathulata</i>		0.4	<1	
<i>Psyrax latifolia</i>		0.8	<1	
<i>Ptilotus schwartzii</i>		0.2	1	

<i>Sclerolaena eriacantha</i>		0.05	<1
<i>Sida picklesiana</i>	P 3	0.7	<1

HR2152

Staff KCP **Date** 8/04/2021 **Season** P
Revisit
Type Q 20 m x 20 m
Location Old Highway Haul Route
MGA Zone 50 **734291 mE** **7167890 mN** **Lat.** -25.5879 **Long.** 119.3326
Habitat Flat
Aspect N/A **Slope** N/A
Soil Type Orange brown clay loam
Rock Type Ironstone, quartz
Loose Rock >90 % cover; 6-20 mm in size **Litter** <1 % cover ; 1 cm in depth
Bare ground 95 % cover **Weeds** 0 % cover
Vegetation U+ ^*Acacia cuspidifolia*^tree\6\;M ^*Acacia pteraneura*,^*Rhagodia eremaea*^shrub,chenopod shrub\3\bi;G ^*Maireana georgei*,^*Senna* sp. Meekatharra (E. Bailey 1-26)\^chenopod shrub, shrub\1\bi
Veg. Condition Excellent
Disturbance
Fire Age >10 years
Notes



Species	WA Cons.	Height (m)	Cover (%)	Count
<i>Acacia cuspidifolia</i>		4	5	
<i>Acacia pteraneura</i>		1.5	1	
<i>Atriplex codonocarpa</i>		.1	<1	
Indeterminant spp.		.04	<1	

<i>Lawrencia densiflora</i>	.06	<1
<i>Maireana georgei</i>	.3	.5
<i>Ptilotus exaltatus</i>	.05	<1
<i>Ptilotus obovatus</i>	.3	<1
<i>Rhagodia eremaea</i>	1	1
<i>Senna</i> sp. Meekatharra (E. Bailey 1-26)	.4	<1

HR2153

Staff KCP **Date** 8/04/2021 **Season** P
Revisit
Type Q 20 m x 20 m
Location Old Highway Haul Route
MGA Zone 50 734981 mE 7171409 mN **Lat.** -25.5561 **Long.** 119.3389
Habitat Crest
Aspect NW **Slope** Gentle
Soil Type Brown loam
Rock Type
Loose Rock 20-50 % cover; 20-60 mm in size **Litter** 2 % cover ; 1 cm in depth
Bare ground 90 % cover **Weeds** 0 % cover
Vegetation U+ ^*Acacia incurvaneura*^tree\6\r;G ^*Homalocalyx echinulatus*,^*Aluta maisonneuvei* subsp. *auriculata*^shrub\1\r
Veg. Condition Excellent
Disturbance
Fire Age >10 years
Notes Many dead plants around.



Species	WA Cons.	Height (m)	Cover (%)	Count
<i>Acacia incurvaneura</i>		5	4	
<i>Acacia pruinocarpa</i>		.2	<1	
<i>Aluta maisonneuvei</i> subsp. <i>auriculata</i>		.4	1	
<i>Aristida contorta</i>		.2	<1	
<i>Brunonia australis</i>		.3	<1	

<i>Eragrostis eriopoda</i>		.3	<1
<i>Eremophila latrobei</i> subsp. <i>latrobei</i>		.2	<1
<i>Eriachne pulchella</i> subsp. <i>pulchella</i>		.1	<1
<i>Hibiscus burtonii</i>		.3	<1
<i>Homalocalyx echinulatus</i>	P 3	.4	2
Indeterminant spp.		.2	<1
<i>Ptilotus schwartzii</i>		.4	<1
<i>Sida</i> sp. Golden calyces glabrous (H.N. Foote 32)		.3	<1

HR2154

Staff LJA **Date** 6/04/2021 **Season** P
Revisit
Type Q 20 m x 20 m
Location Old Highway Haul Route
MGA Zone 50 725651 mE 7165408 mN **Lat.** -25.6117 **Long.** 119.2471
Habitat Flat
Aspect N/A **Slope** N/A
Soil Type Orange sandy clay loam
Rock Type Quartz
Loose Rock 2-10 % cover; 6-20 mm in size **Litter** 20 % cover ; <1 cm in depth
Bare ground 75 % cover **Weeds** 0 % cover
Vegetation M+ ^*Acacia tetragonophylla*,^*Acacia aptaneura*\^shrub\4\r;G ^*Isilema membranaceum*\^other grass\1\bi
Veg. Condition Poor
Disturbance Fence (old); cattle grazing
Fire Age >10 years
Notes Most of litter dead grass (unknown species)



Species	WA Cons.	Height (m)	Cover (%)	Count
<i>Abutilon cryptopetalum</i>		0.1	<1	
<i>Abutilon otocarpum</i>		0.2	<1	
<i>Acacia aneura</i>		1.5	<1	
<i>Acacia aptaneura</i>		3	1	
<i>Acacia subcontorta</i>		1	<1	

<i>Acacia tetragonophylla</i>		3	2
<i>Boerhavia coccinea</i>		0.1	<1
<i>Eremophila demissa</i>	P 1	0.3	<1
<i>Eremophila galeata</i>		1.7	<1
<i>Euphorbia coghlanii</i>		0.1	<1
<i>Evolvulus alsinoides</i> var. <i>villosicalyx</i>		0.1	<1
<i>Goodenia prostrata</i>		0.1	<1
<i>Hibiscus burtonii</i>		0.1	<1
<i>Iseilema membranaceum</i>		0.1	<1
<i>Maireana ?planifolia</i>		0.3	<1
<i>Psyrdrax latifolia</i>		0.6	<1
<i>Senna artemisioides</i> subsp. <i>helmsii</i>		0.3	<1
<i>Senna</i> sp. Meekatharra (E. Bailey 1-26)		1.2	<1

HR2155

Staff LJA **Date** 5/04/2021 **Season** P
Revisit
Type Q 20 m x 20 m
Location Old Highway Haul Route
MGA Zone 50 721036 mE 7165631 mN **Lat.** -25.6103 **Long.** 119.2011
Habitat Flat
Aspect N/A **Slope** N/A
Soil Type Orange sandy clay
Rock Type Ironstone
Loose Rock <2 % cover; 2-6 mm in size **Litter** 75 % cover ; 1-2 cm in depth
Bare ground 20 % cover **Weeds** 5 % cover
Vegetation U+ ^*Corymbia candida*,^*Acacia aptaneura*\^tree\6\c;M ^^*Psyrdrax latifolia*,*Acacia kempeana*,
Eremophila forrestii\^shrub\4\c;G ^*Eriachne helmsii*\^tussock grass\1\i
Veg. Condition Very Good
Disturbance Cattle grazing
Fire Age >10 years
Notes Mulga/Corymbia grove



Species	WA Cons.	Height (m)	Cover (%)	Count
<i>Abutilon cryptopetalum</i>		0.1	<1	
<i>Acacia aptaneura</i>		7	15	
<i>Acacia kempeana</i>		2.5	15	
<i>Acacia tetragonophylla</i>		3	2	
<i>Arivela viscosa</i>		0.3	<1	

<i>*Bidens subalternans</i>	0.1	<1
<i>Boerhavia coccinea</i>	0.1	<1
<i>Corymbia candida</i>	8	20
<i>Eremophila forrestii</i>	1.5	5
<i>Eriachne helmsii</i>	0.5	15
<i>Glycine canescens</i>	0.3	<1
<i>Hibiscus burtonii</i>	0.1	<1
<i>Marsdenia australis</i>	0.1	<1
<i>Monachather paradoxus</i>		<1
<i>Paspalidium clementii</i>	0.2	<1
<i>Perotis rara</i>	0.1	<1
<i>Psydrax latifolia</i>	4	20
<i>Psydrax rigidula</i>	0.2	<1
<i>Ptilotus obovatus</i>	0.6	<1
<i>Ptilotus schwartzii</i>	0.3	<1
<i>Sclerolaena eriacantha</i>	0.3	<1
<i>Sida</i> sp. L (A.M. Ashby 4202)	0.1	<1
<i>Teucrium teucriiflorum</i>	0.6	<1

HR2156

Staff LJA **Date** 5/04/2021 **Season** P
Revisit
Type Q 20 m x 20 m
Location Old Highway Haul Route
MGA Zone 50 721583 mE 7165584 mN **Lat.** -25.6107 **Long.** 119.2065
Habitat Flat
Aspect N/A **Slope** N/A
Soil Type Orange brown sandy clay
Rock Type Ironstone
Loose Rock <2 % cover; 2-6 mm in size **Litter** 80 % cover ; 1-5 cm in depth
Bare ground 10 % cover **Weeds** 30 % cover
Vegetation U+ ^*Corymbia candida*,^*Acacia aptaneura*^tree\7\c;M ^*Psyrax latifolia*,^*Acacia kempeana*^shrub\4\i;G ^^*Bidens subalternans*,*Isotropis iophyta*,*Eriachne helmsii*^forb,tussock grass\1\c
Veg. Condition Very Good
Disturbance Cattle grazing
Fire Age >10 years
Notes Mulga/Corymbia grove



Species	WA Cons.	Height (m)	Cover (%)	Count
<i>Acacia aptaneura</i>		7	15	
<i>Acacia ayersiana</i>		3	1	
<i>Acacia kempeana</i>		3	5	
<i>Acacia tetragonophylla</i>		3	<1	

<i>Areocleome oxalidea</i>	0.1	<1
<i>*Bidens subalternans</i>	0.2	30
<i>Boerhavia coccinea</i>	0.1	<1
<i>Corymbia candida</i>	12	20
<i>Eragrostis eriopoda</i>	0.3	<1
<i>Eremophila forrestii</i>	1.5	<1
<i>Eriachne helmsii</i>	0.4	2
<i>Eriachne pulchella</i> subsp. <i>dominii</i>	0.1	<1
<i>Euphorbia</i> sp.	0.1	<1
<i>Fimbristylis dichotoma</i>	0.2	<1
<i>Hibiscus burtonii</i>	0.1	<1
Indeterminant spp.	0.5	<1
<i>Isotropis iophyta</i>	0.4	5
<i>Monachather paradoxus</i>	0.3	<1
<i>Paspalidium clementii</i>	0.1	<1
<i>Perotis rara</i>	2	<1
<i>Portulaca oleracea</i>	0.1	<1
<i>Psydrax latifolia</i>	5	20
<i>Sida</i> sp. dark green fruits (S. van Leeuwen 2260)	0.3	<1

HR2157

Staff KCP **Date** 7/04/2021 **Season** P
Revisit
Type Q 20 m x 20 m
Location Old Highway Haul Route
MGA Zone 50 719563 mE 7165198 mN **Lat.** -25.6145 **Long.** 119.1865
Habitat Flat
Aspect N/A **Slope** N/A
Soil Type Orange brown clay
Rock Type Ironstone, quartz
Loose Rock 50-90 % cover; 2-6 mm in size **Litter** 0 % cover ; 0 cm in depth
Bare ground 95 % cover **Weeds** 0 % cover
Vegetation M ^*Acacia* sp.\^shrub\3\bi;G+ ^*Ptilotus schwartzii*,^*Eremophila incisa*\^forb,shrub\1\bi
Veg. Condition Very Good
Disturbance Vehicle tracks nearby
Fire Age >10 years

Notes



Species	WA Cons.	Height (m)	Cover (%)	Count
<i>Acacia kempeana</i>		.4	<1	
<i>Acacia</i> sp.		1	<1	
<i>Eremophila incisa</i>		.3	<1	
<i>Eremophila margarethae</i>		.3	<1	
<i>Ptilotus schwartzii</i>		.3	1	

HR2158

Staff LJA **Date** 6/04/2021 **Season** P
Revisit
Type Q 20 m x 20 m
Location Old Highway Haul Route
MGA Zone 50 **722739 mE** **7165429 mN** **Lat.** -25.6119 **Long.** 119.2181
Habitat Flat
Aspect N/A **Slope** N/A
Soil Type Orange brown loamy clay
Rock Type Quartz, ironstone
Loose Rock 2-10 % cover; 6-20 mm in size **Litter** 2 % cover ; <1 cm in depth
Bare ground 95 % cover **Weeds** <1 % cover
Vegetation M+ ^*Acacia tetragonophylla*,^*Acacia incurvaneura*\^shrub\4\r;G ^^*Paspalidium clementii*,
Eragrostis pergracilis,*Alternanthera angustifolia*\^other grass,forb\1\r
Veg. Condition Degraded
Disturbance Grazing
Fire Age >10 years
Notes Heavily grazed



Species	WA Cons.	Height (m)	Cover (%)	Count
<i>Abutilon cryptopetalum</i>		0.2	<1	
<i>Acacia incurvaneura</i>		3	1	
<i>Acacia tetragonophylla</i>		3	2	
<i>Alternanthera angustifolia</i>		0.1	1	
<i>Areocleome oxalidea</i>		0.1	<1	

<i>Aristida contorta</i>		0.2	<1
<i>Enneapogon caerulescens</i>		0.1	<1
<i>Eragrostis pergracilis</i>		0.1	2
<i>Eremophila galeata</i>		0.8	<1
<i>Eriachne pulchella</i> subsp. <i>dominii</i>		0.1	<1
<i>Euphorbia coghlanii</i>		0.2	<1
<i>Fimbristylis dichotoma</i>		0.1	<1
<i>Goodenia nuda</i>	P 4	0.1	<1
<i>Goodenia prostrata</i>		0.1	<1
<i>Heliotropium cunninghamii</i>		0.1	<1
<i>Iseilema membranaceum</i>		0.1	<1
<i>Marsdenia australis</i>		0.3	<1
<i>Paspalidium clementii</i>		0.1	2
<i>Portulaca oleracea</i>		0.1	<1
<i>Psyrdrax latifolia</i>		0.6	<1
<i>Ptilotus actinocladus</i>	P 1	0.1	<1
<i>Sida</i> sp. dark green fruits (S. van Leeuwen 2260)		0.2	<1
<i>Sida</i> sp. L (A.M. Ashby 4202)		0.1	<1
<i>Solanum lasiophyllum</i>		0.2	<1
<i>Tribulus astrocarpus</i>		0.1	<1

HR2164

Staff LJA **Date** 6/04/2021 **Season** P
Revisit
Type Q 20 m x 20 m
Location Old Highway Haul Route
MGA Zone 50 723636 mE 7165488 mN **Lat.** -25.6112 **Long.** 119.2270
Habitat Flat
Aspect N/A **Slope** N/A
Soil Type Orange brown sandy clay
Rock Type Quartz
Loose Rock <2 % cover; 6-20 mm in size **Litter** 20 % cover ; <1 cm in depth
Bare ground 80 % cover **Weeds** 0 % cover
Vegetation U ^*Hakea lorea* subsp. *lorea*, ^*Grevillea striata* ^tree\6\bi; M+ ^*Acacia tetragonophylla*, ^*Eremophila galeata* ^shrub\4\r; G ^*Ptilotus obovatus*, ^*Digitaria brownii* ^shrub, tussock grass\1\bi
Veg. Condition Poor
Disturbance Cattle grazing
Fire Age >10 years
Notes Litter cover is largely dead grasses



Species	WA Cons.	Height (m)	Cover (%)	Count
<i>Acacia tetragonophylla</i>		2	3	
<i>Aristida contorta</i>		0.2	<1	
<i>Boerhavia coccinea</i>		0.1	<1	
<i>Chrysocephalum gilesii</i>		0.2	<1	
<i>Digitaria brownii</i>		0.3	<1	

<i>Duperreya commixta</i>	0.4	<1
<i>Eremophila galeata</i>	2	1
<i>Eriachne flaccida</i>	0.2	<1
<i>Grevillea striata</i>	4	<1
<i>Hakea lorea</i> subsp. <i>lorea</i>	3.5	<1
<i>Indigofera georgei</i>	0.4	<1
<i>Iseilema membranaceum</i>	0.1	<1
<i>Isotropis iophyta</i>	0.3	<1
<i>Ptilotus obovatus</i>	0.5	<1
<i>Sida</i> sp. dark green fruits (S. van Leeuwen 2260)	0.2	<1
<i>Solanum lasiophyllum</i>	0.2	<1

HR2165

Staff LJA **Date** 6/04/2021 **Season** P
Revisit
Type Q 20 m x 20 m
Location Old Highway Haul Route
MGA Zone 50 **723527 mE** **7165479 mN** **Lat.** -25.6113 **Long.** 119.2259
Habitat Flat
Aspect N/A **Slope** N/A
Soil Type Pale orange powdery clay
Rock Type Calcrete
Loose Rock 10-20 % cover **Litter** 35 % cover ; 1-5 cm in depth
Bare ground 50 % cover **Weeds** <1 % cover
Vegetation U ^*Codonocarpus cotinifolius*^tree\6\bi;M+ ^^*Acacia burkittii*,*Acacia pyrifolia* var. *pyrifolia*,*Acacia macraneura*^shrub\4\i;G ^^*Senna artemisioides* subsp. *x artemisioides*,*Eragrostis setifolia*,
Ptilotus obovatus^shrub,tussock grass\2\c
Veg. Condition Very Good
Disturbance Cattle grazing
Fire Age >10 years

Notes



Species	WA Cons.	Height (m)	Cover (%)	Count
<i>Abutilon fraseri</i>		0.3	<1	
<i>Acacia burkittii</i>		4	10	
<i>Acacia macraneura</i>		2.5	5	
<i>Acacia pyrifolia</i> var. <i>pyrifolia</i>		3	5	

<i>Amyema fitzgeraldii</i>	0.3	<1
* <i>Cenchrus ciliaris</i>	0.3	<1
<i>Codonocarpus cotinifolius</i>	8	<1
<i>Duperreya commixta</i>	1.5	<1
<i>Enneapogon caerulescens</i>	0.1	<1
<i>Eragrostis setifolia</i>	0.1	5
<i>Pimelea microcephala</i>	1.5	<1
<i>Ptilotus obovatus</i>	0.6	2
<i>Santalum lanceolatum</i>	1.5	<1
<i>Senna artemisioides</i> subsp. <i>x artemisioides</i>	0.8	20
<i>Senna stricta</i>	0.5	<1
<i>Sida</i> sp. L (A.M. Ashby 4202)	0.1	2
<i>Teucrium teucriiflorum</i>	0.5	<1

HR2166

Staff KCP **Date** 7/04/2021 **Season** P
Revisit
Type Q 20 m x 20 m
Location Old Highway Haul Route
MGA Zone 50 732622 mE 7165185 mN **Lat.** -25.6126 **Long.** 119.3165
Habitat Flat
Aspect N/A **Slope** N/A
Soil Type Orange brown clay loam
Rock Type Ironstone
Loose Rock >90 % cover; 6-20 mm in size **Litter** <1 % cover ; <5 cm in depth
Bare ground 95 % cover **Weeds** 0 % cover
Vegetation M+ ^*Acacia pteraneura*,^*Acacia aptaneura*\^shrub\4\r;G ^*Eremophila phyllopoda* subsp. *phyllopoda*,^*Senna artemisioides* subsp. *x artemisioides*\^shrub\2\bi
Veg. Condition Excellent
Disturbance None
Fire Age >10 years

Notes



Species	WA Cons.	Height (m)	Cover (%)	Count
<i>Acacia aptaneura</i>		3	1	
<i>Acacia pteraneura</i>		2	1.5	
<i>Eremophila phyllopoda</i> subsp. <i>phyllopoda</i>		0.7	<1	
<i>Eremophila spathulata</i>		0.5	<1	
<i>Maireana triptera</i>		0.05	<1	

<i>Ptilotus obovatus</i>	0.2	<1
<i>Ptilotus rotundifolius</i>	0.5	<1
<i>Senna artemisioides</i> subsp. <i>x artemisioides</i>	0.5	<1
<i>Senna</i> sp. Meekatharra (E. Bailey 1-26)	0.5	<1
<i>Solanum lasiophyllum</i>	0.1	<1

HR2167

Staff KCP **Date** 7/04/2021 **Season** P
Revisit
Type Q 20 m x 20 m
Location Old Highway Haul Route
MGA Zone 50 733622 mE 7166263 mN **Lat.** -25.6027 **Long.** 119.3262
Habitat Flat
Aspect SE **Slope** Very Gentle
Soil Type Orange brown clay loam
Rock Type Ironstone, quartz
Loose Rock >90 % cover; 20-60 mm in size **Litter** 0 % cover ; 0 cm in depth
Bare ground 95 % cover **Weeds** 0 % cover
Vegetation U ^*Acacia aptaneura*\^tree\6\bi;M+ ^*Eremophila linearis*\^Shrub\3\r;G ^*Senna* sp. Meekatharra (E. Bailey 1-26)\^shrub\2\bi
Veg. Condition Excellent
Disturbance
Fire Age >10 years

Notes



Species	WA Cons.	Height (m)	Cover (%)	Count
<i>Acacia aptaneura</i>		4	1.5	
<i>Eremophila linearis</i>		2	2	
<i>Sclerolaena eriacantha</i>		.1	<1	
<i>Senna</i> sp. Meekatharra (E. Bailey 1-26)		1	<1	
<i>Solanum lasiophyllum</i>		.3	<1	

HR2168

Staff KCP **Date** 8/04/2021 **Season** P
Revisit
Type Q 20 m x 20 m
Location Old Highway Haul Route
MGA Zone 50 734262 mE 7168682 mN **Lat.** -25.5808 **Long.** 119.3322
Habitat River
Aspect W **Slope** Very Gentle
Soil Type Orange sand, clay
Rock Type
Loose Rock <2 % cover **Litter** 50 % cover ; 2 cm in depth
Bare ground 20 % cover **Weeds** <1 % cover
Vegetation U+ ^*Corymbia candida*,^*Acacia subcontorta*^tree\7\d;M ^^*Acacia aptaneura*,*Acacia tetragonophylla*,*Psydrax latifolia*^shrub\4\i;G ^*Duperreya commixta*^forb\1\i
Veg. Condition Very Good
Disturbance Minor cattle track
Fire Age >10 years

Notes



Species	WA Cons.	Height (m)	Cover (%)	Count
<i>Abutilon cryptopetalum</i>		.1	<1	
<i>Acacia aptaneura</i>		5	10	
<i>Acacia fuscaneura</i>		1	<1	
<i>Acacia subcontorta</i>		10	35	
<i>Acacia tetragonophylla</i>		2.5	1.5	

<i>Alternanthera denticulata</i>	.3	<1
* <i>Bidens subalternans</i>	.15	<1
<i>Corymbia candida</i>	20	40
<i>Digitaria brownii</i>	.3	<1
<i>Duperreya commixta</i>	.4	30
<i>Eremophila galeata</i>	2	<1
<i>Eriachne flaccida</i>	.3	<1
<i>Eriachne pulchella</i> subsp. <i>pulchella</i>	.1	<1
<i>Evolvulus alsinoides</i> var. <i>villosicalyx</i>	.3	<1
<i>Glycine canescens</i>	.4	<1
<i>Isotropis iophyta</i>	.5	<1
<i>Marsdenia australis</i>	.1	<1
<i>Marsilea exarata</i>	.1	<1
<i>Perotis rara</i>	.05	<1
<i>Psyrdrax latifolia</i>	1.5	1
<i>Psyrdrax rigidula</i>	2	<1
<i>Ptilotus obovatus</i>	.4	<1
<i>Senna artemisioides</i> subsp. <i>helmsii</i>	.4	<1
<i>Senna glaucifolia</i>	.08	<1

HR2169

Staff KCP **Date** 8/04/2021 **Season** P
Revisit
Type Q 20 m x 20 m
Location Old Highway Haul Route
MGA Zone 50 734673 mE 7171438 mN **Lat.** -25.5558 **Long.** 119.3358
Habitat Lower-Slope
Aspect N **Slope** Gentle
Soil Type Orange clay loam
Rock Type
Loose Rock 50-90 % cover; 6-20 mm in size **Litter** 1 % cover ; 1 cm in depth
Bare ground 85 % cover **Weeds** 0 % cover
Vegetation U+ ^*Acacia subcontorta*, ^*Acacia incurvaneura* ^tree\6\i; M ^*Acacia pteraneura* ^shrub\4\r; G ^*Eremophila latrobei* ^shrub\2\bi
Veg. Condition Very Good
Disturbance
Fire Age >10 years
Notes Vehicle tracks



Species	WA Cons.	Height (m)	Cover (%)	Count
<i>Acacia incurvaneura</i>		4	3	
<i>Acacia pteraneura</i>		4	2	
<i>Acacia subcontorta</i>		5	5	
<i>Aristida holathera</i> var. <i>holathera</i>		.3	<1	
<i>Eremophila latrobei</i>		1	1	

<i>Grevillea berryana</i>	.5	<1
<i>Ptilotus schwartzii</i>	.3	<1
<i>Solanum lachnophyllum</i>	1	<1

HR2170

Staff KCP **Date** 9/04/2021 **Season** P
Revisit
Type Q 20 m x 20 m
Location Old Highway Haul Route
MGA Zone 50 734364 mE 7168168 mN **Lat.** -25.5854 **Long.** 119.3333
Habitat Flat
Aspect N/A **Slope** N/A
Soil Type Orange clay
Rock Type
Loose Rock 0 % cover **Litter** 10 % cover ; .05 cm in depth
Bare ground 35 % cover **Weeds** <1 % cover
Vegetation U+ ^^*Acacia aptaneura*,*Acacia mulganeura*,*Acacia tetragonophylla*^tree\6\c;M ^*Rhagodia eremaea*,^*Psyrax latifolia*^shrub\3\r;G ^^*Ptilotus obovatus*,*Abutilon cryptopetalum*,*Bidens subalternans*^shrub,forb\1\r
Veg. Condition Very Good
Disturbance
Fire Age >10 years

Notes



Species	WA Cons.	Height (m)	Cover (%)	Count
<i>Abutilon cryptopetalum</i>		.3	1	
<i>Acacia aneura</i>		2	2	
<i>Acacia aptaneura</i>		8	35	
<i>Acacia mulganeura</i>		7	5	

<i>Acacia tetragonophylla</i>	2	3
<i>Atriplex codonocarpa</i>	.1	<1
* <i>Bidens subalternans</i>	.1	<1
<i>Eremophila galeata</i>	2	<1
<i>Hibiscus</i> sp. Gardneri (A.L. Payne PRP 1435)	.3	<1
Indeterminant spp.	1	<1
<i>Isotropis iophyta</i>	1	<1
<i>Marsdenia australis</i>	1	<1
<i>Portulaca oleracea</i>	.02	<1
<i>Psyrax latifolia</i>	1	1
<i>Psyrax rigidula</i>	1	<1
<i>Ptilotus exaltatus</i>	.1	<1
<i>Ptilotus obovatus</i>	1	2
<i>Rhagodia eremaea</i>	1	1.5
<i>Sclerolaena cuneata</i>	.2	<1
<i>Sclerolaena eriacantha</i>	.3	<1
<i>Senna glaucifolia</i>	1.4	<1
<i>Senna glutinosa</i> subsp. x <i>luerssenii</i>	1.5	<1
<i>Senna</i> sp. Meekatharra (E. Bailey 1-26)	1	<1
<i>Sida platycalyx</i>	.2	<1
<i>Sida</i> sp. L (A.M. Ashby 4202)	.1	<1
<i>Teucrium teucriiflorum</i>	.4	<1
<i>Trianthema triquetrum</i>	.1	1

HR2171

Staff LJA **Date** 9/04/2021 **Season** P
Revisit
Type Q 20 m x 20 m
Location Old Highway Haul Route
MGA Zone 50 734294 mE 7166829 mN **Lat.** -25.5975 **Long.** 119.3328
Habitat River bed
Aspect N/A **Slope** N/A
Soil Type Orange brown sandy clay
Rock Type Ironstone
Loose Rock 20-50 % cover; 6-20 mm in size **Litter** 15 % cover ; <10 cm in depth
Bare ground 70 % cover **Weeds** <1 % cover
Vegetation U+ ^*Acacia subcontorta*, ^*Acacia pteraneura* ^tree\6\c;M ^*Acacia kempeana* ^shrub\4\r;G
 ^^*Duperreya commixta*, *Ptilotus obovatus*, *Cymbopogon ambiguus* ^vine, shrub, tussock grass\1\r
Veg. Condition Very Good
Disturbance Minor cattle evidence
Fire Age >10 years

Notes



Species	WA Cons.	Height (m)	Cover (%)	Count
<i>Abutilon cryptopetalum</i>		0.3	<1	
<i>Acacia aptaneura</i>		4	<1	
<i>Acacia craspedocarpa</i>		0.5	<1	
<i>Acacia fusca</i>		1.5	<1	
<i>Acacia kempeana</i>		1.5	2	

<i>Acacia pteraneura</i>	7	10
<i>Acacia subcontorta</i>	6	30
<i>Aristida contorta</i>	0.1	<1
<i>Aristida inaequiglumis</i>	0.4	<1
* <i>Bidens subalternans</i>		<1
<i>Cymbopogon ambiguus</i>	0.6	<1
<i>Digitaria brownii</i>	0.2	<1
<i>Dodonaea viscosa</i> subsp. <i>spatulata</i>	1	<1
<i>Duperreya commixta</i>	0.6	5
<i>Enneapogon caeruleus</i>	.2	<1
<i>Eremophila galeata</i>	2	<1
<i>Eremophila latrobei</i> subsp. <i>latrobei</i>	0.8	<1
<i>Eriachne flaccida</i>	0.2	<1
<i>Eriachne pulchella</i> subsp. <i>pulchella</i>	0.1	<1
<i>Euphorbia drummondii</i>	0.05	<1
<i>Evolvulus alsinoides</i> var. <i>villosicalyx</i>	0.2	<1
<i>Glycine canescens</i>	0.05	<1
<i>Heliotropium inexplicitum</i>	0.3	<1
<i>Hibiscus</i> sp. <i>Gardneri</i> (A.L. Payne PRP 1435)	0.4	<1
<i>Isotropis iophyta</i>	0.3	<1
<i>Leiocarpa semicalva</i> subsp. <i>semicalva</i>	0.25	<1
Malvaceae sp.	1	<1
<i>Marsdenia australis</i>	0.1	<1
<i>Pluchea dentex</i>	0.1	<1
<i>Psyrax latifolia</i>	0.6	<1
<i>Psyrax rigidula</i>	0.6	<1
<i>Ptilotus obovatus</i>	0.4	1
<i>Santalum spicatum</i>	1.5	<1
<i>Senna artemisioides</i> subsp. <i>x artemisioides</i>	0.8	<1
<i>Senna</i> sp. <i>Meekatharra</i> (E. Bailey 1-26)	0.6	<1
<i>Sida platycalyx</i>	0.2	<1
<i>Sida</i> sp. <i>L</i> (A.M. Ashby 4202)	0.15	<1
<i>Themeda triandra</i>	0.6	<1

HR2172

Staff KCP **Date** 10/04/2021 **Season** P
Revisit
Type Q 20 m x 20 m
Location Old Highway Haul Route
MGA Zone 50 734308 mE 7168519 mN **Lat.** -25.5822 **Long.** 119.3327
Habitat Grove, drainage
Aspect N/A **Slope** N/A
Soil Type Orange clay
Rock Type
Loose Rock <2 % cover; 2-6 mm in size **Litter** 40 % cover ; 10 cm in depth
Bare ground 10 % cover **Weeds** 0 % cover
Vegetation U+ ^^Acacia aptaneura,Acacia aneura,Acacia subcontorta\^tree\6\c;M ^Psydrax latifolia\^shrub\3\bi;G ^Ptilotus obovatus,^Rhagodia eremaea\^shrub,chenopod shrub\2\r
Veg. Condition Very Good
Disturbance
Fire Age >10 years
Notes Minor animal track



Species	WA Cons.	Height (m)	Cover (%)	Count
<i>Acacia aneura</i>		8	10	
<i>Acacia aptaneura</i>		6	15	
<i>Acacia kempeana</i>		2.5	<1	
<i>Acacia pruinocarpa</i>		1.5	<1	
<i>Acacia subcontorta</i>		7	8	

<i>Acacia tetragonophylla</i>		1.2	<1
<i>Eremophila latrobei</i> subsp. <i>latrobei</i>		1	<1
<i>Eremophila spectabilis</i>		1	<1
<i>Hibiscus</i> sp. <i>Gardneri</i> (A.L. Payne PRP 1435)		.3	<1
<i>Marsdenia australis</i>		.5	<1
<i>Psyrax latifolia</i>		1	1
<i>Psyrax suaveolens</i>		.5	<1
<i>Ptilotus obovatus</i>		1	2
<i>Rhagodia eremaea</i>		1	1.5
<i>Senna artemisioides</i> subsp. <i>helmsii</i>		1	<1
<i>Sida picklesiana</i>	P 3	1	<1

HR2173

Staff KCP **Date** 10/04/2021 **Season** P
Revisit
Type Q 20 m x 20 m
Location Old Highway Haul Route
MGA Zone 50 734319 mE 7168781 mN **Lat.** -25.5799 **Long.** 119.3327
Habitat Flat
Aspect N/A **Slope** N/A
Soil Type Orange brown sandy clay
Rock Type Ironstone
Loose Rock >90 % cover; 6-20 mm in size **Litter** 0 % cover ; 0 cm in depth
Bare ground 95 % cover **Weeds** 0 % cover
Vegetation U+ ^*Acacia pteraneura*\^tree\6\r;G ^*Eremophila phyllopoda* subsp. *phyllopoda*,^*Senna* sp. Meekatharra (E. Bailey 1-26)\^shrub\2\bi
Veg. Condition Very Good
Disturbance Minor tracks
Fire Age >10 years

Notes



Species	WA Cons.	Height (m)	Cover (%)	Count
<i>Acacia pteraneura</i>		3.5	2	
<i>Acacia tetragonophylla</i>		1	<1	
<i>Eremophila phyllopoda</i> subsp. <i>phyllopoda</i>		1	1	
<i>Senna artemisioides</i> subsp. <i>helmsii</i>		0.8	<1	
<i>Senna</i> sp. Meekatharra (E. Bailey 1-26)		0.8	<1	

Senna stricta

0.7

<1

HR2174

Staff KCP **Date** 10/04/2021 **Season** P
Revisit
Type Q 20 m x 20 m
Location Old Highway Haul Route
MGA Zone 50 **734285 mE** **7169036 mN** **Lat.** -25.5776 **Long.** 119.3324
Habitat Flat
Aspect N/A **Slope** N/A
Soil Type Orange clay
Rock Type
Loose Rock >90 % cover; 2-6 mm in size **Litter** 1 % cover ; 1 cm in depth
Bare ground 90 % cover **Weeds** 0 % cover
Vegetation M+ ^^*Acacia pteraneura*,*Acacia* sp.,*Acacia kempeana*\^shrub\3\r;G ^^*Eremophila margarethae*,
Eremophila spathulata,*Ptilotus rotundifolius*\^shrub\2\r
Veg. Condition Very Good
Disturbance Some vehicle tracks nearby
Fire Age >10 years

Notes



Species	WA Cons.	Height (m)	Cover (%)	Count
<i>Acacia kempeana</i>		3	1	
<i>Acacia pteraneura</i>		3.5	3	
<i>Acacia</i> sp.		3.5	2	
<i>Eremophila margarethae</i>		0.4	1.5	
<i>Eremophila spathulata</i>		1	1	

<i>Psydrax latifolia</i>	.4	<1
<i>Ptilotus obovatus</i>	.5	<1
<i>Ptilotus rotundifolius</i>	0.5	<1
<i>Ptilotus schwartzii</i>	.3	<1
<i>Rhagodia eremaea</i>	1	<1

HR2175

Staff KCP **Date** 10/04/2021 **Season** P
Revisit
Type Q 20 m x 20 m
Location Old Highway Haul Route
MGA Zone 50 734358 mE 7169115 mN **Lat.** -25.5769 **Long.** 119.3331
Habitat Flat
Aspect N/A **Slope** N/A
Soil Type Orange clay
Rock Type Ironstone
Loose Rock >90 % cover; 2-6 mm in size **Litter** <1 % cover ; <5 cm in depth
Bare ground 95 % cover **Weeds** 0 % cover
Vegetation U ^*Acacia pteraneura*^tree\6\bi;M+ ^*Acacia aptaneura*^shrub\3\r;G ^*Eremophila spathulata*,
^*Acacia kempeana*^shrub\2\r
Veg. Condition Very Good
Disturbance Minor tracks
Fire Age >10 years

Notes



Species	WA Cons.	Height (m)	Cover (%)	Count
<i>Acacia aptaneura</i>		2	2.5	
<i>Acacia kempeana</i>		0.7	<1	
<i>Acacia pteraneura</i>		4	1	
<i>Eremophila margarethae</i>		0.4	<1	
<i>Eremophila phyllopoda</i> subsp. <i>phyllopoda</i>		0.7	<1	

<i>Eremophila spathulata</i>	0.7	1.5
<i>Psyrax latifolia</i>	0.4	<1
<i>Ptilotus rotundifolius</i>	0.6	<1
<i>Solanum lasiophyllum</i>	0.6	<1

HR2176

Staff KCP **Date** 10/04/2021 **Season** P
Revisit
Type Q 20 m x 20 m
Location Old Highway Haul Route
MGA Zone 50 734309 mE 7169905 mN **Lat.** -25.5697 **Long.** 119.3324
Habitat Flat
Aspect N/A **Slope** N/A
Soil Type Orange sandy clay
Rock Type Ironstone
Loose Rock 50-90 % cover; 2-6 mm in size **Litter** <1 % cover ; <5 cm in depth
Bare ground 95 % cover **Weeds** 0 % cover
Vegetation U ^*Acacia pteraneura*^tree\6\bi;M+ ^*Eremophila linearis*,^*Acacia aptaneura*^shrub\3\r;G ^*Senna* sp. Meekatharra (E. Bailey 1-26)\^shrub\2\bi
Veg. Condition Good
Disturbance Minor tracks and possible prospecting activity within quadrat
Fire Age >10 years

Notes



Species	WA Cons.	Height (m)	Cover (%)	Count
<i>Acacia aptaneura</i>		2	1	
<i>Acacia cuspidifolia</i>		0.3	<1	
<i>Acacia pteraneura</i>		4	1	
<i>Eremophila linearis</i>		2	2.5	
<i>Eremophila phyllopoda</i> subsp. <i>phyllopoda</i>		0.6	<1	

<i>Leichardtia australis</i>	0.05	<1
<i>Maireana triptera</i>	0.1	<1
<i>Marsdenia australis</i>	0.05	<1
<i>Senna</i> sp. Meekatharra (E. Bailey 1-26)	1	<1

HR2177

Staff KCP **Date** 10/04/2021 **Season** P
Revisit
Type Q 20 m x 20 m
Location Old Highway Haul Route
MGA Zone 50 734324 mE 7170164 mN **Lat.** -25.5674 **Long.** 119.3325
Habitat Flat
Aspect N **Slope** Very Gentle
Soil Type Orange brown clay loam
Rock Type
Loose Rock >90 % cover; 2-6 mm in size **Litter** <1 % cover ; 1 cm in depth
Bare ground 95 % cover **Weeds** 0 % cover
Vegetation U+ ^*Acacia incurvaneura*^tree\6\r;M ^*Eremophila linearis*^shrub\3\bi;G ^*Senna* sp. Meekatharra (E. Bailey 1-26)^shrub\2\bi
Veg. Condition Excellent
Disturbance
Fire Age >10 years

Notes



Species	WA Cons.	Height (m)	Cover (%)	Count
<i>Acacia aptaneura</i>		1	<1	
<i>Acacia incurvaneura</i>		4	4	
<i>Eremophila linearis</i>		2	1.5	
<i>Maireana georgei</i>		.2	<1	
<i>Ptilotus obovatus</i>		.3	<1	

<i>Ptilotus rotundifolius</i>	1	<1
<i>Senna</i> sp. Meekatharra (E. Bailey 1-26)	1	<1

HR2178

Staff KCP **Date** 10/04/2021 **Season** P
Revisit
Type Q 20 m x 20 m
Location Old Highway Haul Route
MGA Zone 50 734446 mE 7170366 mN **Lat.** -25.5655 **Long.** 119.3337
Habitat Flat
Aspect N/A **Slope** N/A
Soil Type Orange clay loam
Rock Type Ironstone
Loose Rock 50-90 % cover; 2-6 mm in size **Litter** <1 % cover ; <5 cm in depth
Bare ground 90 % cover **Weeds** 0 % cover
Vegetation M ^*Acacia pteraneura*\^shrub\4\bi;G+ ^*Aristida contorta*,^*Ptilotus rotundifolius*\^tussock grass, shrub\2\r
Veg. Condition Very Good
Disturbance Minor tracks
Fire Age >10 years
Notes Lots of dead plants in upper, mid and ground stratum



Species	WA Cons.	Height (m)	Cover (%)	Count
<i>Acacia pteraneura</i>		4	<1	
<i>Aristida contorta</i>		0.3	3	
<i>Eremophila galeata</i>		0.5	<1	
<i>Eriachne mucronata</i>		0.2	<1	
<i>Hibiscus burtonii</i>		0.3	<1	

<i>Maireana triptera</i>	0.1	<1
<i>Marsdenia australis</i>	0.05	<1
<i>Monachather paradoxus</i>	0.35	<1
<i>Psyrax latifolia</i>	0.3	<1
<i>Psyrax rigidula</i>	0.3	<1
<i>Psyrax suaveolens</i>	0.4	<1
<i>Ptilotus aervoides</i>	0.1	<1
<i>Ptilotus obovatus</i>	0.2	<1
<i>Ptilotus rotundifolius</i>	0.8	1
<i>Ptilotus schwartzii</i>	0.2	<1
<i>Sclerolaena eriacantha</i>	0.1	<1
<i>Senna artemisioides</i> subsp. <i>helmsii</i>	0.2	<1
<i>Sida</i> sp. L (A.M. Ashby 4202)	0.1	<1
<i>Solanum lachnophyllum</i>	0.2	<1
<i>Solanum lasiophyllum</i>	0.3	<1
<i>Tribulus astrocarpus</i>	.05	<1

HR2179

Staff KCP **Date** 10/04/2021 **Season** P
Revisit
Type Q 20 m x 20 m
Location Old Highway Haul Route
MGA Zone 50 734397 mE 7170447 mN **Lat.** -25.5648 **Long.** 119.3332
Habitat Flat
Aspect N/A **Slope** N/A
Soil Type Orange clay
Rock Type
Loose Rock >90 % cover; 6-20 mm in size **Litter** 1 % cover ; 1 cm in depth
Bare ground 95 % cover **Weeds** 0 % cover
Vegetation U+ ^*Acacia pteraneura*\^tree\6\r;M ^*Ptilotus rotundifolius*\^shrub\3\bi;G ^*Aristida contorta*\^tussock grass\1\bi
Veg. Condition Very Good
Disturbance
Fire Age >10 years
Notes Tracks nearby, lots of dead plants likely drought affected.



Species	WA Cons.	Height (m)	Cover (%)	Count
<i>Acacia pteraneura</i>		3.5	2	
<i>Aristida contorta</i>		.3	1	
<i>Eriachne pulchella</i> subsp. <i>dominii</i>		.05	<1	
<i>Heliotropium heteranthum</i>		.08	<1	
<i>Hibiscus burtonii</i>		.15	<1	

<i>Homalocalyx echinulatus</i>	P 3	.4	<1
<i>Maireana triptera</i>		.05	<1
<i>Monachather paradoxus</i>		.3	<1
<i>Pluchea rubelliflora</i>		.05	<1
<i>Ptilotus aervoides</i>		.08	<1
<i>Ptilotus obovatus</i>		.5	<1
<i>Ptilotus rotundifolius</i>		1	1
<i>Ptilotus schwartzii</i>		.3	<1
<i>Senna</i> sp. Meekatharra (E. Bailey 1-26)		.1	<1
<i>Sida</i> sp. dark green fruits (S. van Leeuwen 2260)		.15	<1
<i>Trianthema glossostigmum</i>		.05	<1
<i>Tribulus astrocarpus</i>		.01	<1

HR2180

Staff KCP **Date** 10/04/2021 **Season** P
Revisit
Type Q 20 m x 20 m
Location Old Highway Haul Route
MGA Zone 50 734479 mE 7170785 mN **Lat.** -25.5618 **Long.** 119.3340
Habitat Flat
Aspect N/A **Slope** N/A
Soil Type Orange clay loam
Rock Type
Loose Rock >90 % cover; 2-6 mm in size **Litter** 2 % cover ; 5 cm in depth
Bare ground 80 % cover **Weeds** 0 % cover
Vegetation U+ ^*Acacia pruinocarpa*^tree\7\i;M ^*Acacia pteraneura*,^*Acacia kempeana*^shrub\4\i;
Veg. Condition Excellent
Disturbance
Fire Age >10 years

Notes



Species	WA Cons.	Height (m)	Cover (%)	Count
<i>Acacia kempeana</i>		2	2	
<i>Acacia pruinocarpa</i>		9	15	
<i>Acacia pteraneura</i>		4	8	
<i>Acacia tetragonophylla</i>		1.5	<1	
<i>Digitaria brownii</i>		.3	<1	

<i>Enchylaena tomentosa</i>	.1	<1
<i>Eremophila galeata</i>	1.5	<1
<i>Eremophila spectabilis</i>	1	<1
<i>Psyrax latifolia</i>	1	<1
<i>Ptilotus obovatus</i>	.3	<1
<i>Ptilotus schwartzii</i>	.3	<1
<i>Solanum lachnophyllum</i>	.5	<1

HR2181

Staff LJA **Date** 10/04/2021 **Season** P
Revisit
Type Q 20 m x 20 m
Location Old Highway Haul Route
MGA Zone 50 734556 mE 7170908 mN **Lat.** -25.5606 **Long.** 119.3347
Habitat Flat
Aspect N/A **Slope** N/A
Soil Type Orange clay
Rock Type
Loose Rock 50-90 % cover; 6-20 mm in size **Litter** 1 % cover ; <5 cm in depth
Bare ground 90 % cover **Weeds** 0 % cover
Vegetation U+ ^*Acacia pruinocarpa*^tree\6\i;M ^^*Acacia pteraneura*,*Acacia kempeana*,*Acacia aptaneura*^shrub\4\i;
Veg. Condition Good
Disturbance Vehicle tracks
Fire Age >10 years

Notes



Species	WA Cons.	Height (m)	Cover (%)	Count
<i>Acacia aptaneura</i>		3	1.5	
<i>Acacia kempeana</i>		2	2	
<i>Acacia pruinocarpa</i>		4	2	
<i>Acacia pteraneura</i>		3	10	
<i>Psyrax suaveolens</i>		0.5	<1	

Ptilotus schwartzii

0.3

<1

HR2182

Staff KCP **Date** 10/04/2021 **Season** P
Revisit
Type Q 20 m x 20 m
Location Old Highway Haul Route
MGA Zone 50 **734771 mE** **7171487 mN** **Lat.** -25.5554 **Long.** 119.3367
Habitat Lower-Slope
Aspect NW **Slope** Very Gentle
Soil Type Orange brown clay loam
Rock Type
Loose Rock 50-90 % cover; 2-6 mm in size **Litter** 2 % cover ; 1 cm in depth
Bare ground 80 % cover **Weeds** 0 % cover
Vegetation M+ *Acacia aptaneura*, *Acacia subcontorta*, *Grevillea berryana* \shrub\4\i;
Veg. Condition Very Good
Disturbance
Fire Age >10 years
Notes Tracks nearby



Species	WA Cons.	Height (m)	Cover (%)	Count
<i>Acacia aptaneura</i>		4	15	
<i>Acacia subcontorta</i>		5	3	
<i>Aluta maisonneuvei</i> subsp. <i>auriculata</i>		.4	<1	
<i>Eremophila latrobei</i>		.6	<1	
<i>Grevillea berryana</i>		2.5	1	

<i>Hemigenia botryphylla</i>	.4	<1
<i>Ptilotus schwartzii</i>	.3	<1

HR2183

Staff KCP **Date** 10/04/2021 **Season** P
Revisit
Type Q 20 m x 20 m
Location Old Highway Haul Route
MGA Zone 50 734754 mE 7171624 mN **Lat.** -25.5541 **Long.** 119.3366
Habitat Lower-Slope
Aspect N **Slope** Very Gentle
Soil Type Orange brown clay loam
Rock Type
Loose Rock 50-90 % cover; 6-20 mm in size **Litter** 12 % cover ; <5 cm in depth
Bare ground 85 % cover **Weeds** 0 % cover
Vegetation U+ ^^*Acacia pteraneura*,*Acacia subcontorta*,*Acacia pruinocarpa*^tree\6\i;M ^*Eremophila latrobei*,
^*Senna glaucifolia*^shrub\3\r;
Veg. Condition Very Good
Disturbance Minor tracks
Fire Age >10 years

Notes



Species	WA Cons.	Height (m)	Cover (%)	Count
<i>Acacia pruinocarpa</i>		5	2	
<i>Acacia pteraneura</i>		5	20	
<i>Acacia subcontorta</i>		7	3	
<i>Acacia tetragonophylla</i>		1.5	<1	
<i>Eremophila latrobei</i>		1.2	3	

<i>Grevillea berryana</i>	3	<1
<i>Hibiscus burtonii</i>	0.15	<1
<i>Ptilotus schwartzii</i>	0.2	<1
<i>Senna glaucifolia</i>	1	1

HR2184

Staff KCP **Date** 10/04/2021 **Season** P
Revisit
Type Q 20 m x 20 m
Location Old Highway Haul Route
MGA Zone 50 734756 mE 7171568 mN **Lat.** -25.5547 **Long.** 119.3366
Habitat Lower-Slope
Aspect W **Slope** Very Gentle
Soil Type Orange brown clay loam
Rock Type Slatey
Loose Rock >90 % cover **Litter** <1 % cover ; 1 cm in depth
Bare ground 80 % cover **Weeds** 0 % cover
Vegetation U ^*Acacia aptaneura*^tree\6\bi;M+ ^*Thryptomene* sp. Leinster (B.J. Lepschi & L.A. Craven 4362) ^shrub\3\r;
Veg. Condition Excellent
Disturbance
Fire Age >10 years

Notes



Species	WA Cons.	Height (m)	Cover (%)	Count
<i>Acacia aptaneura</i>		4	2	
<i>Aristida contorta</i>		.2	<1	
<i>Eremophila demissa</i>	P 1	.2	<1	2
<i>Eremophila latrobei</i>		1	<1	
<i>Eriachne mucronata</i>		.2	<1	

<i>Grevillea berryana</i>		1.5	<1
<i>Ptilotus schwartzii</i>		.3	<1
<i>Sida</i> sp. Excedentifolia (J.L. Egan 1925)		.15	<1
<i>Sida</i> sp. Golden calyces glabrous (H.N. Foote 32)		.1	<1
<i>Solanum lasiophyllum</i>		.05	<1
<i>Thryptomene</i> sp. Leinster (B.J. Lepschi & L.A. Craven 4362)	P 3	1.5	5

HR2185

Staff KCP **Date** 10/04/2021 **Season** P
Revisit
Type Q 20 m x 20 m
Location Old Highway Haul Route
MGA Zone 50 734720 mE 7171467 mN **Lat.** -25.5556 **Long.** 119.3362
Habitat Lower-Slope
Aspect N **Slope** Very Gentle
Soil Type Orange clay loam
Rock Type
Loose Rock >90 % cover; 6-20 mm in size **Litter** <1 % cover ; <5 cm in depth
Bare ground 95 % cover **Weeds** 0 % cover
Vegetation M+ ^*Thryptomene* sp. Leinster (B.J. Lepschi & L.A. Craven 4362)\^shrub\3\r;
Veg. Condition Very Good
Disturbance Vehicle tracks
Fire Age >10 years
Notes Many dead plants



Species	WA Cons.	Height (m)	Cover (%)	Count
<i>Acacia aptaneura</i>		1.8	1	
<i>Aristida contorta</i>		0.2	<1	
<i>Eremophila demissa</i>	P 1	0.2	<1	2
<i>Eriachne pulchella</i> subsp. <i>dominii</i>		0.05	<1	
<i>Eriachne pulchella</i> subsp. <i>pulchella</i>		0.1	<1	

<i>Hibiscus burtonii</i>		0.1	<1
Indeterminant spp.		0.2	<1
<i>Mirbelia rhagodioides</i>		0.3	<1
<i>Monachather paradoxus</i>		0.1	<1
<i>Paspalidium clementii</i>		0.1	<1
<i>Polygala glaucifolia</i>			<1
<i>Ptilotus schwartzii</i>		0.2	<1
<i>Thryptomene</i> sp. Leinster (B.J. Lepschi & L.A. Craven 4362)	P 3	2	2

HR2186

Staff KCP **Date** 10/04/2021 **Season** P
Revisit
Type Q 20 m x 20 m
Location Old Highway Haul Route
MGA Zone 50 734615 mE 7171339 mN **Lat.** -25.5567 **Long.** 119.3352
Habitat Crest
Aspect S **Slope** Gentle
Soil Type Orange clay loam
Rock Type
Loose Rock >90 % cover; 20-60 mm in size **Litter** <1 % cover ; 1 cm in depth
Bare ground 75 % cover **Weeds** 0 % cover
Vegetation M+ ^*Acacia subcontorta*^shrub\4\bi;G ^*Aluta maisonneuvei* subsp. *auriculata*,^*Aristida contorta*^shrub,tussock grass\1\bi
Veg. Condition Excellent
Disturbance
Fire Age >10 years
Notes Lots of dead Aluta, likely drought affected



Species	WA Cons.	Height (m)	Cover (%)	Count
<i>Acacia subcontorta</i>		2	2	
<i>Aluta maisonneuvei</i> subsp. <i>auriculata</i>		.5	1.5	
<i>Aristida contorta</i>		.2	<1	
<i>Eragrostis eriopoda</i>		.3	<1	
<i>Eriachne pulchella</i> subsp. <i>dominii</i>		.1	<1	

<i>Goodenia nuda</i>	P 4	.3	<1
<i>Hibiscus burtonii</i>		.3	<1
<i>Homalocalyx echinulatus</i>	P 3	.4	<1
Indeterminant spp.		.2	<1
<i>Psyrax latifolia</i>		2	<1
<i>Ptilotus obovatus</i>		.3	<1
<i>Sida picklesiana</i>	P 3	.5	<1
<i>Sida</i> sp. Golden calyces glabrous (H.N. Foote 32)		.1	<1

HR2187

Staff KCP **Date** 11/04/2021 **Season** P
Revisit
Type Q 20 m x 20 m
Location Old Highway
MGA Zone 50 721140 mE 7165647 mN **Lat.** -25.6102 **Long.** 119.2021
Habitat Flat
Aspect N/A **Slope** N/A
Soil Type Orange clay
Rock Type Ironstone
Loose Rock <2 % cover; 2-6 mm in size **Litter** 0 % cover ; 0 cm in depth
Bare ground 98 % cover **Weeds** 0 % cover
Vegetation M ^*Acacia aptaneura*\^shrub\3\bi;G+ ^*Ptilotus schwartzii*\^forb\1\bi
Veg. Condition Very Good
Disturbance
Fire Age >10 years
Notes Some dead plants



Species	WA Cons.	Height (m)	Cover (%)	Count
<i>Acacia aptaneura</i>		1	<1	
<i>Eriachne mucronata</i>		.2	<1	
<i>Goodenia nuda</i>	P 4	.05	<1	
<i>Ptilotus schwartzii</i>		.3	1	

HR2188

Staff KCP **Date** 11/04/2021 **Season** P
Revisit
Type Q 20 m x 20 m
Location Old Highway
MGA Zone 50 **721725 mE** **7165555 mN** **Lat.** -25.6109 **Long.** 119.2080
Habitat Flat
Aspect N/A **Slope** N/A
Soil Type Orange clay
Rock Type Ironstone, quartz
Loose Rock <2 % cover; 2-6 mm in size **Litter** 0 % cover ; 0 cm in depth
Bare ground 98 % cover **Weeds** 0 % cover
Vegetation M+ ^*Acacia kempeana*\^shrub\3\bi;G ^*Ptilotus schwartzii*\^forb\1\bi
Veg. Condition Very Good
Disturbance
Fire Age >10 years
Notes



Species	WA Cons.	Height (m)	Cover (%)	Count
<i>Acacia kempeana</i>		1	1	
<i>Areocleome oxalidea</i>		.05	<1	
<i>Goodenia nuda</i>	P 4	.04	<1	
<i>Ptilotus schwartzii</i>		.3	<1	

OH2101

Staff LJA **Date** 5/04/2021 **Season** P
Revisit
Type Q 20 m x 20 m
Location Old Highway
MGA Zone 50 **717577 mE** **7162001 mN** **Lat.** -25.6436 **Long.** 119.1673
Habitat Flat
Aspect N/A **Slope** N/A
Soil Type Orange clay
Rock Type Ironstone, quartz
Loose Rock 20-50 % cover; 2-6 mm in size **Litter** 5 % cover ; <1 cm in depth
Bare ground 95 % cover **Weeds** 0 % cover
Vegetation M+ ^*Acacia aptaneura*,^*Acacia incurvaneura*\^shrub\4\r;
Veg. Condition Poor
Disturbance Vehicle tracks, grazing, prospecting
Fire Age >10 years
Notes Ground stratum virtually all dead; would have been *Eremophila margarethae*, *spectabilis*



Species	WA Cons.	Height (m)	Cover (%)	Count
<i>Acacia aptaneura</i>		3.5	5	
<i>Acacia incurvaneura</i>		3	3	
<i>Acacia subcontorta</i>		1.5	<1	
<i>Eremophila jucunda</i> subsp. <i>jucunda</i>		0.3	<1	
<i>Hibiscus burtonii</i>		0.1	<1	

Sida sp. Golden calyces glabrous (H.N. Foote 32)

0.2

<1

OH2102

Staff LJA **Date** 4/04/2021 **Season** P
Revisit
Type Q 20 m x 20 m
Location Old Highway
MGA Zone 50 **717277 mE** **7163149 mN** **Lat.** -25.6333 **Long.** 119.1641
Habitat Lower-Slope
Aspect SE **Slope** Gentle
Soil Type Red brown loamy clay
Rock Type Ironstone
Loose Rock >90 % cover; 60-200 mm in size **Litter** 2 % cover ; <1 cm in depth
Bare ground 95 % cover **Weeds** 0 % cover
Vegetation M+ ^*Acacia incurvaneura*\^shrub\4\i;G ^*Aluta maisonneuvei* subsp. *auriculata*\^shrub\1\i
Veg. Condition Excellent
Disturbance None obvious
Fire Age >10 years
Notes Lots of seedling Indigofera



Species	WA Cons.	Height (m)	Cover (%)	Count
<i>Acacia incurvaneura</i>		4	15	
<i>Aluta maisonneuvei</i> subsp. <i>auriculata</i>		0.5	10	
<i>Aristida contorta</i>		0.3	<1	
<i>Brunonia australis</i>		0.2	<1	
<i>Eragrostis eriopoda</i>		0.3	<1	

<i>Eriachne pulchella</i> subsp. <i>dominii</i>		0.1	<1
<i>Goodenia triodiophila</i>		0.2	<1
<i>Hibiscus burtonii</i>		0.2	<1
<i>Indigofera fractiflexa</i> subsp. <i>augustensis</i>	P 2	0.5	<1
<i>Monachather paradoxus</i>		0.3	<1
<i>Ptilotus schwartzii</i>			<1
<i>Senna glaucifolia</i>		0.5	<1
<i>Sida</i> sp. Golden calyces glabrous (H.N. Foote 32)		0.3	<1
<i>Synaptantha tillaeacea</i> var. <i>tillaeacea</i>		0.1	<1

OH2103

Staff LJA **Date** 4/04/2021 **Season** P
Revisit
Type Q 20 m x 20 m
Location Old Highway
MGA Zone 50 **716953 mE** **7162993 mN** **Lat.** -25.6348 **Long.** 119.1609
Habitat Lower-Slope
Aspect S **Slope** Gentle
Soil Type Red brown loamy clay
Rock Type Ironstone
Loose Rock >90 % cover; 60-200 mm in size **Litter** 15 % cover ; 1 cm in depth
Bare ground 80 % cover **Weeds** 0 % cover
Vegetation M+ ^*Acacia incurvaneura*\^shrub\4\i;G ^*Aluta maisonneuvei* subsp. *auriculata*,^*Sida* sp. Golden calyces glabrous (H.N. Foote 32)\^shrub\2\i
Veg. Condition Excellent
Disturbance
Fire Age

Notes



Species	WA Cons.	Height (m)	Cover (%)	Count
<i>Acacia incurvaneura</i>		2.5	17	
<i>Acacia</i> sp.		2	<1	
<i>Aluta maisonneuvei</i> subsp. <i>auriculata</i>		0.6	15	
<i>Aristida contorta</i>		0.1	<1	
<i>Brunonia australis</i>		0.3	<1	

<i>Eragrostis eriopoda</i>		0.4	<1	
<i>Eremophila jucunda</i> subsp. <i>jucunda</i>		0.8	<1	
<i>Eriachne pulchella</i> subsp. <i>dominii</i>		0.1	<1	
<i>Goodenia triodiophila</i>		0.4	<1	
<i>Hibiscus burtonii</i>		0.2	<1	
<i>Indigofera fractiflexa</i> subsp. <i>augustensis</i>	P 2	0.6	<1	20
<i>Monachather paradoxus</i>		0.4	<1	
<i>Ptilotus schwartzii</i>		0.2	<1	
<i>Senna glaucifolia</i>		0.1	<1	
<i>Sida</i> sp. Golden calyces glabrous (H.N. Foote 32)		0.3	2	

OH2104

Staff LJA **Date** 31/03/2021 **Season** P
Revisit
Type Q 20 m x 20 m
Location Old Highway
MGA Zone 50 **714883 mE** **7160345 mN** **Lat.** -25.6590 **Long.** 119.1407
Habitat Flat
Aspect N/A **Slope** N/A
Soil Type Orange clay loam
Rock Type Mixed
Loose Rock <2 % cover; 6-20 mm in size **Litter** 30 % cover ; 1-5 cm in depth
Bare ground 65 % cover **Weeds** <1 % cover
Vegetation U+ ^*Acacia aptaneura*,^*Acacia pruinocarpa*^tree\6\i;M ^*Acacia caesaneura*,^*Eremophila galeata*^shrub\4\r;G ^*Ptilotus obovatus*^shrub\2\i
Veg. Condition Excellent
Disturbance None obvious
Fire Age >10 years
Notes Senescent; lots of dead shrubs likely due to prolonged drought



Species	WA Cons.	Height (m)	Cover (%)	Count
<i>Abutilon cryptopetalum</i>		0.2	<1	
<i>Acacia aptaneura</i>		8	15	
<i>Acacia caesaneura</i>		4	2	
<i>Acacia incurvaneura</i>		3	<1	
<i>Acacia pruinocarpa</i>		7	2	

<i>Acacia</i> sp.	0.3	<1
<i>Acacia subcontorta</i>	3.5	<1
* <i>Bidens subalternans</i>	0.2	<1
<i>Digitaria brownii</i>	0.4	<1
<i>Eragrostis kennedyae</i>	0.3	<1
<i>Eremophila galeata</i>	1.5	2
<i>Eremophila</i> sp.	0.4	<1
<i>Eremophila spectabilis</i>	0.5	<1
<i>Glycine canescens</i>	0.4	<1
<i>Maireana ?planifolia</i>	0.5	<1
<i>Marsdenia australis</i>	1	<1
<i>Paspalidium clementii</i>	0.4	<1
<i>Perotis rara</i>	0.2	<1
<i>Psyrax latifolia</i>	1.5	<1
<i>Psyrax rigidula</i>	0.6	<1
<i>Psyrax suaveolens</i>	1.7	<1
<i>Ptilotus obovatus</i>	0.6	15
<i>Rhagodia eremaea</i>	2	<1
<i>Senna glaucifolia</i>	0.5	<1
<i>Sida</i> sp. L (A.M. Ashby 4202)	0.2	<1
<i>Solanum lasiophyllum</i>	0.3	<1

OH2105

Staff LJA **Date** 3/04/2021 **Season** P
Revisit
Type Q 20 m x 20 m
Location Old Highway
MGA Zone 50 716017 mE 7160547 mN **Lat.** -25.6570 **Long.** 119.1520
Habitat Flat
Aspect N/A **Slope** N/A
Soil Type Orange sandy clay
Rock Type Quartz, ironstone
Loose Rock 10-20 % cover; 20-60 mm in size **Litter** 2 % cover ; 1-10 cm in depth
Bare ground 80 % cover **Weeds** 0 % cover
Vegetation U+ ^*Acacia aptaneura*, ^*Acacia sclerosperma* subsp. *sclerosperma* \^tree\6\i; G ^*Ptilotus obovatus* \^shrub\1\r
Veg. Condition Very Good
Disturbance Previously grazed
Fire Age >10 years
Notes On edge of but not part of drainage line



Species	WA Cons.	Height (m)	Cover (%)	Count
<i>Abutilon cryptopetalum</i>		0.3	<1	
<i>Acacia aneura</i>		1	<1	
<i>Acacia aptaneura</i>		7	20	
<i>Acacia sclerosperma</i> subsp. <i>sclerosperma</i>		5	5	
<i>Aristida contorta</i>		0.2	<1	

<i>Arivela viscosa</i>	0.3	<1
<i>Duperreya commixta</i>	0.5	<1
<i>Eremophila margarethae</i>	0.4	<1
<i>Evolvulus alsinoides</i> var. <i>villosicalyx</i>	0.2	<1
<i>Hibiscus burtonii</i>	0.3	<1
<i>Maireana</i> ? <i>planifolia</i>	0.3	<1
<i>Marsdenia australis</i>	1	<1
<i>Ptilotus obovatus</i>	0.5	4
<i>Rhagodia eremaea</i>	0,8	<1
<i>Santalum spicatum</i>	3	<1

OH2106

Staff LJA **Date** 3/04/2021 **Season** P
Revisit
Type Q 20 m x 20 m
Location Old Highway
MGA Zone 50 716523 mE 7160895 mN **Lat.** -25.6537 **Long.** 119.1569
Habitat Creek
Aspect N/A **Slope** N/A
Soil Type Orange clayey sand
Rock Type Quartz, ironstone
Loose Rock 2-10 % cover; 2-6 mm in size **Litter** 5 % cover ; 1-5 cm in depth
Bare ground 90 % cover **Weeds** 0 % cover
Vegetation U+ ^*Acacia pruinocarpa*,^,*Acacia aptaneura*^tree\6\c;M ^*Acacia craspedocarpa*,^*Eremophila galeata*^shrub\3\r;G ^*Ptilotus obovatus*^shrub\1\r
Veg. Condition Good
Disturbance Cattle grazing (recent)
Fire Age >10 years

Notes



Species	WA Cons.	Height (m)	Cover (%)	Count
<i>Acacia aptaneura</i>		4	10	
<i>Acacia craspedocarpa</i>		2	2	
<i>Acacia fuscaneura</i>		3	1	
<i>Acacia pruinocarpa</i>		8	10	
<i>Acacia tetragonophylla</i>		5	2	

<i>Aristida contorta</i>	0.3	<1
<i>Boerhavia coccinea</i>	0.1	<1
<i>Dactyloctenium radulans</i>	0.1	1
<i>Duperreya commixta</i>	0.2	<1
<i>Eragrostis cumingii</i>	0.3	<1
<i>Eragrostis kennedyae</i>	0.1	<1
<i>Eragrostis pergracilis</i>	0.1	<1
<i>Eremophila galeata</i>	2	1
<i>Evolvulus alsinoides</i> var. <i>villosicalyx</i>	0.2	<1
<i>Fimbristylis dichotoma</i>	0.1	<1
<i>Heliotropium inexplicitum</i>	0.2	<1
<i>Hibiscus burtonii</i>	0.3	<1
<i>Maireana ?planifolia</i>	0.3	<1
<i>Paspalidium clementii</i>	0.2	1
<i>Perotis rara</i>	0.1	1
<i>Portulaca oleracea</i>	0.1	<1
<i>Ptilotus obovatus</i>	0.5	2
<i>Sida picklesiana</i>	P 3 0.6	<1

OH2107

Staff LJA **Date** 3/04/2021 **Season** P
Revisit
Type Q 20 m x 20 m
Location Old Highway
MGA Zone 50 715550 mE 7160181 mN **Lat.** -25.6603 **Long.** 119.1474
Habitat Creek
Aspect N/A **Slope** N/A
Soil Type Orange sandy clay
Rock Type Ironstone, quartz
Loose Rock 10-20 % cover; 20-60 mm in size **Litter** 1 % cover ; 1-2 cm in depth
Bare ground 75 % cover **Weeds** 2 % cover
Vegetation U+ ^^*Acacia aptaneura*,*Acacia subcontorta*,*Psydrax latifolia*\^tree\6\i;M ^*Eremophila galeata*,
^*Ptilotus obovatus*\^shrub\3\r;G ^^*Perotis rara*,*Bidens subalternans*,*Eragrostis kennedyae*\^other
grass,forb\1\i
Veg. Condition Very Good
Disturbance Previously grazed
Fire Age >10 years
Notes Drainage line



Species	WA Cons.	Height (m)	Cover (%)	Count
<i>Acacia aptaneura</i>		7	15	
<i>Acacia subcontorta</i>		5	3	
<i>Aristida contorta</i>		0.3	1	
* <i>Bidens subalternans</i>		0.3	2	

<i>Cheilanthes sieberi</i>	0.2	<1
<i>Chrysopogon fallax</i>	0.7	<1
<i>Eragrostis cumingii</i>	0.4	1
<i>Eragrostis kennedyae</i>	0.4	2
<i>Eremophila galeata</i>	1.5	1
<i>Eremophila margarethae</i>	0.3	<1
<i>Eriachne pulchella</i> subsp. <i>dominii</i>	0.1	<1
<i>Eriachne pulchella</i> subsp. <i>pulchella</i>	0.2	1
<i>Euphorbia</i> sp.	0.1	<1
<i>Evolvulus alsinoides</i> var. <i>villosicalyx</i>	0.3	<1
<i>Fimbristylis dichotoma</i>	0.2	<1
<i>Glycine canescens</i>	0.3	<1
<i>Hibiscus burtonii</i>	0.4	<1
<i>Marsdenia australis</i>	1	<1
<i>Monachather paradoxus</i>	0.3	<1
<i>Paspalidium clementii</i>	0.3	<1
<i>Perotis rara</i>	0.1	5
<i>Psydrax latifolia</i>	5	2
<i>Psydrax rigidula</i>	2	<1
<i>Ptilotus obovatus</i>	0.8	1
<i>Santalum lanceolatum</i>	1	<1
<i>Santalum spicatum</i>	2	<1
<i>Senna glaucifolia</i>	0.3	<1
<i>Sida ectogama</i>	0.5	<1
<i>Sida</i> sp. L (A.M. Ashby 4202)	0.5	2

OH2108

Staff LJA **Date** 31/03/2021 **Season** P
Revisit
Type Q 20 m x 20 m
Location Old Highway
MGA Zone 50 **714926 mE** **7160769 mN** **Lat.** -25.6551 **Long.** 119.1411
Habitat Flat
Aspect N/A **Slope** N/A
Soil Type Orange clay
Rock Type Quartz
Loose Rock 10-20 % cover; 20-60 mm in size **Litter** 1 % cover ; <1 cm in depth
Bare ground 98 % cover **Weeds** 0 % cover
Vegetation M+ ^*Acacia ayersiana*,^*Acacia incurvaneura*^shrub\3\r;G ^*Ptilotus schwartzii*^forb\1\bi
Veg. Condition Excellent
Disturbance None obvious
Fire Age >10 years

Notes



Species	WA Cons.	Height (m)	Cover (%)	Count
<i>Abutilon cryptopetalum</i>		0.1	<1	
<i>Acacia ayersiana</i>		1.8	3	
<i>Acacia incurvaneura</i>		1.5	2	
<i>Aristida contorta</i>		0.2	<1	
<i>Evolvulus alsinoides</i> var. <i>villosicalyx</i>		0.1	<1	

<i>Grevillea berryana</i>	2	<1
<i>Monachather paradoxus</i>	0.3	<1
<i>Ptilotus obovatus</i>	0.3	<1
<i>Ptilotus schwartzii</i>	0.4	<1

OH2109

Staff LJA **Date** 31/03/2021 **Season** P
Revisit
Type Q 20 m x 20 m
Location Old Highway
MGA Zone 50 716020 mE 7161241 mN **Lat.** -25.6507 **Long.** 119.1519
Habitat Flat
Aspect N/A **Slope** N/A
Soil Type Pale orange sandy clay
Rock Type Unknown
Loose Rock >90 % cover; 20-60 mm in size **Litter** <1 % cover ; <1 cm in depth
Bare ground 99 % cover **Weeds** 0 % cover
Vegetation M+ ^*Acacia incurvaneura*, ^*Acacia subcontorta* \shrub\4\r;G ^*Ptilotus schwartzii* \^forb\1\bi
Veg. Condition Excellent
Disturbance None obvious
Fire Age >10 years
Notes Most large shrubs dead; recently germinated Acacias noted



Species	WA Cons.	Height (m)	Cover (%)	Count
<i>Acacia incurvaneura</i>		3.5	5	
<i>Acacia subcontorta</i>		3.5	2	
<i>Aristida contorta</i>		0.2	<1	
<i>Brunonia australis</i>		0.3	<1	
<i>Eremophila galeata</i>		1	<1	

<i>Eremophila latrobei</i> subsp. <i>latrobei</i>	0.3	<1
<i>Goodenia prostrata</i>	0.1	<1
<i>Grevillea berryana</i>	2	<1
<i>Heliotropium heteranthum</i>	0.05	<1
<i>Hibiscus burtonii</i>	0.3	<1
Indeterminant spp.	0.1	<1
<i>Monachather paradoxus</i>	0.3	<1
<i>Paspalidium clementii</i>	0.2	<1
<i>Ptilotus obovatus</i>	0.4	<1
<i>Ptilotus schwartzii</i>	0.3	<1
<i>Senna glaucifolia</i>	0.5	<1
<i>Sida</i> sp. dark green fruits (S. van Leeuwen 2260)	0.3	<1
<i>Sida</i> sp. L (A.M. Ashby 4202)	0.4	<1
<i>Solanum lasiophyllum</i>	0.1	<1

OH2110

Staff LJA **Date** 4/04/2021 **Season** P
Revisit
Type Q 20 m x 20 m
Location Old Highway
MGA Zone 50 717100 mE 7162651 mN **Lat.** -25.6378 **Long.** 119.1624
Habitat Flat
Aspect N/A **Slope** N/A
Soil Type Orange sandy clay
Rock Type Mixed
Loose Rock 20-50 % cover; 20-60 mm in size **Litter** <1 % cover ; <1 cm in depth
Bare ground 99 % cover **Weeds** 0 % cover
Vegetation M+ *Acacia aptaneura* shrub; *G. Ptilotus schwartzii* forb
Veg. Condition Poor
Disturbance Historical grazing, prospecting
Fire Age >10 years

Notes



Species	WA Cons.	Height (m)	Cover (%)	Count
<i>Acacia aptaneura</i>		2.5	5	
<i>Acacia incurvaneura</i>		1	<1	
<i>Acacia kempeana</i>		0.6	<1	
<i>Eremophila spectabilis</i>		0.1	<1	
<i>Ptilotus schwartzii</i>		0.3	<1	

OH2111

Staff LJA **Date** 5/04/2021 **Season** P
Revisit
Type Q 20 m x 20 m
Location Old Highway
MGA Zone 50 **717725 mE** **7161400 mN** **Lat.** -25.6490 **Long.** 119.1688
Habitat Flat
Aspect N/A **Slope** N/A
Soil Type
Rock Type Quartz, ironstone
Loose Rock 2-10 % cover; 20-60 mm in size **Litter** <1 % cover ; <1 cm in depth
Bare ground 99 % cover **Weeds** 0 % cover
Vegetation M+ ^*Acacia aptaneura*,*Acacia aneura*^shrub\3\bi;G ^*Eremophila galeata*,*Aristida contorta*,*Acacia craspedocarpa*^shrub,other grass\1\bi
Veg. Condition Degraded
Disturbance Heavily grazed
Fire Age >10 years
Notes Most shrubs and grasses dead. May have been chained



Species	WA Cons.	Height (m)	Cover (%)	Count
<i>Acacia aneura</i>		2.5	<1	
<i>Acacia aptaneura</i>		1.8	<1	
<i>Acacia craspedocarpa</i>		0.5	<1	
<i>Aristida contorta</i>		0.2	<1	
<i>Boerhavia coccinea</i>		0.1	<1	

<i>Eremophila galeata</i>	0.5	<1
<i>Evolvulus alsinoides</i> var. <i>villosicalyx</i>	0.2	<1
<i>Goodenia prostrata</i>	0.1	<1
Malvaceae sp.	0.1	<1
<i>Perotis rara</i>	0.1	<1
<i>Senna glaucifolia</i>	0.3	<1
<i>Tribulus astrocarpus</i>	0.1	<1

OH2112

Staff LJA **Date** 5/04/2021 **Season** P
Revisit
Type Q 20 m x 20 m
Location Old Highway
MGA Zone 50 **715851 mE** **7161046 mN** **Lat.** -25.6525 **Long.** 119.1502
Habitat Crest
Aspect S **Slope** Moderate
Soil Type Orange brown sandy clay
Rock Type Banded ironstone, quartz
Loose Rock >90 % cover; 60-200 mm in size **Litter** 3 % cover ; 1 cm in depth
Bare ground 90 % cover **Weeds** 0 % cover
Vegetation M+ ^*Acacia aptaneura*, ^*Acacia subcontorta* \^shrub\4i; G ^*Eremophila latrobei* subsp. *latrobei*, ^*Dodonaea viscosa* subsp. *spatulata* \^shrub\2\bi
Veg. Condition Excellent
Disturbance None obvious
Fire Age >10 years
Notes Banded ironstone and quartz knoll



Species	WA Cons.	Height (m)	Cover (%)	Count
<i>Acacia aptaneura</i>		3	5	
<i>Acacia subcontorta</i>		3	5	
<i>Dodonaea viscosa</i> subsp. <i>spatulata</i>		0.7	<1	
<i>Eremophila jucunda</i> subsp. <i>jucunda</i>		0.5	<1	
<i>Eremophila latrobei</i> subsp. <i>latrobei</i>		0.8	1	

<i>Eriachne mucronata</i>		0.1	<1
<i>Grevillea berryana</i>		2	<1
<i>Indigofera fractiflexa</i> subsp. <i>augustensis</i>	P 2	0.8	<1
<i>Marsdenia australis</i>		0.5	<1
<i>Ptilotus obovatus</i>		0.6	<1
<i>Ptilotus schwartzii</i>		0.3	<1
<i>Sida</i> sp. <i>Excedentifolia</i> (J.L. Egan 1925)		0.3	<1

OH2113

Staff LJA **Date** 3/04/2021 **Season** P
Revisit
Type Q 20 m x 20 m
Location Old Highway
MGA Zone 50 **717722 mE** **7160976 mN** **Lat.** -25.6528 **Long.** 119.1689
Habitat Flat
Aspect N/A **Slope**
Soil Type Orange sandy clay
Rock Type Quartz, ironstone
Loose Rock 50-90 % cover; 20-60 mm in size **Litter** <1 % cover ; <1 cm in depth
Bare ground 99 % cover **Weeds** 0 % cover
Vegetation M+ ^*Acacia incurvaneura*\^shrub\4\r;G ^*Eremophila margarethae*,^*Ptilotus schwartzii*\^shrub, forb\1\bi
Veg. Condition Very Good
Disturbance Cattle grazing, historical prospecting
Fire Age >10 years
Notes Quartz plain



Species	WA Cons.	Height (m)	Cover (%)	Count
<i>Acacia incurvaneura</i>		2.5	3	
<i>Acacia pruinocarpa</i>		2	<1	
<i>Acacia subcontorta</i>		2	<1	
<i>Aristida contorta</i>		0.2	<1	
<i>Eremophila margarethae</i>		0.4	<1	

<i>Goodenia nuda</i>	P 4	0.2	<1
<i>Psyrax latifolia</i>		0.5	<1
<i>Psyrax rigidula</i>		1.8	<1
<i>Ptilotus schwartzii</i>		0.3	<1

OH2114

Staff LJA **Date** 3/04/2021 **Season** P
Revisit
Type Q 20 m x 20 m
Location Old Highway
MGA Zone 50 **717884 mE** **7162420 mN** **Lat.** -25.6398 **Long.** 119.1703
Habitat Flat
Aspect N/A **Slope** N/A
Soil Type Red brown loamy clay
Rock Type Quartz, ironstone
Loose Rock **Litter** <1 % cover ; <1 cm in depth
Bare ground 99 % cover **Weeds** 0 % cover
Vegetation U ^*Grevillea berryana*^tree\6\bi;M+ ^*Acacia aptaneura*^shrub\4\r;G ^*Ptilotus schwartzii*^forb\1\r
Veg. Condition Good
Disturbance Previously grazed
Fire Age >10 years

Notes



Species	WA Cons.	Height (m)	Cover (%)	Count
<i>Acacia aptaneura</i>		2.5	2	
<i>Aristida contorta</i>		0.3	<1	
<i>Eremophila incisa</i>		0.3	<1	
<i>Eremophila spectabilis</i>		0.6	<1	
<i>Goodenia nuda</i>	P 4	0.1	<1	

<i>Grevillea berryana</i>	3	<1
<i>Maireana ?planifolia</i>	0.3	<1
<i>Monachather paradoxus</i>	0.3	<1
<i>Ptilotus schwartzii</i>	0.3	2

OH2115

Staff LJA **Date** 5/04/2021 **Season** P
Revisit
Type Q 20 m x 20 m
Location Old Highway
MGA Zone 50 **717157 mE** **7161178 mN** **Lat.** -25.6511 **Long.** 119.1632
Habitat Flat
Aspect N/A **Slope** N/A
Soil Type Red brown sandy clay
Rock Type Quartz, ironstone
Loose Rock <2 % cover; 20-60 mm in size **Litter** 2 % cover ; 1 cm in depth
Bare ground 85 % cover **Weeds** <1 % cover
Vegetation U+ ^*Acacia incurvaneura*^tree\6\r;M ^^*Acacia tetragonophylla*,*Acacia craspedocarpa*,*Acacia aptaneura*^shrub\4\r;G ^*Ptilotus obovatus*^shrub\2\r
Veg. Condition Good
Disturbance Grazing
Fire Age >10 years
Notes Runoff area; dispersed drainage. Similar to OH2111 but in better condition



Species	WA Cons.	Height (m)	Cover (%)	Count
<i>Abutilon cryptopetalum</i>		0.1	<1	
<i>Acacia aptaneura</i>		1	2	
<i>Acacia caesaneura</i>		3	1	
<i>Acacia craspedocarpa</i>		2	2	
<i>Acacia incurvaneura</i>		5	3	

<i>Acacia tetragonophylla</i>	3	2
<i>Areocleome oxalidea</i>	0.1	<1
<i>Aristida contorta</i>	0.2	<1
* <i>Bidens subalternans</i>	0.2	1
<i>Boerhavia coccinea</i>	0.1	<1
<i>Dactyloctenium radulans</i>	0.1	<1
<i>Dichanthium sericeum</i> subsp. <i>humilius</i>	0.1	<1
<i>Eremophila galeata</i>	1	<1
<i>Eriachne pulchella</i> subsp. <i>dominii</i>	0.1	<1
<i>Euphorbia</i> sp.	0.1	<1
<i>Evolvulus alsinoides</i> var. <i>villosicalyx</i>	0.1	<1
<i>Fimbristylis dichotoma</i>	0.1	<1
<i>Heliotropium inexplicitum</i>	0.1	<1
<i>Hibiscus burtonii</i>	0.2	<1
<i>Maireana</i> ? <i>planifolia</i>	0.3	<1
<i>Marsdenia australis</i>	0.5	<1
<i>Paspalidium clementii</i>	0.1	<1
<i>Perotis rara</i>	0.1	<1
<i>Portulaca oleracea</i>	0.1	<1
<i>Psydrax suaveolens</i>	2	<1
<i>Ptilotus obovatus</i>	0.6	<1
<i>Sida</i> sp. L (A.M. Ashby 4202)	0.1	<1
<i>Tribulus astrocarpus</i>	0.1	<1

OH2116

Staff LJA **Date** 5/04/2021 **Season** P
Revisit
Type Q 20 m x 20 m
Location Old Highway
MGA Zone 50 716852 mE 7161012 mN **Lat.** -25.6527 **Long.** 119.1602
Habitat Flat
Aspect N/A **Slope** N/A
Soil Type Orange clay
Rock Type Quartz
Loose Rock 2-10 % cover; 60-200 mm in size **Litter** 1 % cover ; 1 cm in depth
Bare ground 95 % cover **Weeds** <1 % cover
Vegetation U+ ^*Acacia aptaneura*,*Santalum spicatum*\^tree\6\r;M ^*Acacia caesaneura*,*Eremophila galeata*\^shrub\4\r;G ^^*Ptilotus obovatus*,*Eremophila margarethae*,*Sida picklesiana*\^shrub\2\bi
Veg. Condition Poor
Disturbance Cattle grazing
Fire Age >10 years

Notes



Species	WA Cons.	Height (m)	Cover (%)	Count
<i>Abutilon cryptopetalum</i>		0.2	<1	
<i>Acacia aptaneura</i>		6	5	
<i>Acacia caesaneura</i>		2.5	2	
<i>Acacia pruinocarpa</i>		0.4	<1	
<i>Aristida contorta</i>		0.2	<1	

<i>*Bidens subalternans</i>		0.1	<1
<i>Eremophila galeata</i>		2	1
<i>Eremophila margarethae</i>		0.5	1
<i>Evolvulus alsinoides</i> var. <i>villosicalyx</i>		0.2	<1
<i>Hibiscus burtonii</i>		0.1	<1
Indeterminant spp.		0.3	<1
<i>Maireana ?planifolia</i>		0.3	<1
<i>Paspalidium clementii</i>		0.1	<1
<i>Ptilotus obovatus</i>		0.6	1
<i>Santalum spicatum</i>		4	2
<i>Sida picklesiana</i>	P 3	0.6	<1
<i>Sida</i> sp. L (A.M. Ashby 4202)		0.1	<1

OH2117

Staff LJA **Date** 3/04/2021 **Season** P
Revisit
Type Q 20 m x 20 m
Location Old Highway
MGA Zone 50 718156 mE 7161060 mN **Lat.** -25.6520 **Long.** 119.1732
Habitat Flat
Aspect N/A **Slope** N/A
Soil Type Orange sandy clay
Rock Type Quartz, ironstone
Loose Rock 50-90 % cover; 20-60 mm in size **Litter** <1 % cover ; <1 cm in depth
Bare ground 99 % cover **Weeds** 0 % cover
Vegetation M+ ^*Acacia aptaneura*, ^*Senna glutinosa* subsp. x *luerssenii* ^shrub\4\r; G ^*Eremophila margarethae*, ^*Senna* sp. Meekatharra (E. Bailey 1-26) ^shrub\1\r
Veg. Condition Very Good
Disturbance Grazing, historical prospecting
Fire Age >10 years
Notes Quartz plain



Species	WA Cons.	Height (m)	Cover (%)	Count
<i>Acacia aptaneura</i>		4	3	
<i>Acacia pruinocarpa</i>		2	<1	
<i>Acacia</i> sp.		0.3	<1	
<i>Acacia tetragonophylla</i>		0.7	<1	
<i>Eremophila galeata</i>		1	<11	

<i>Eremophila margarethae</i>	0.5	2
<i>Ptilotus obovatus</i>	0.5	1
<i>Senna glutinosa</i> subsp. x <i>luerssenii</i>	1.5	2
<i>Senna</i> sp. Meekatharra (E. Bailey 1-26)	0.5	2

OH2118

Staff LJA **Date** 3/04/2021 **Season** P
Revisit
Type Q 20 m x 20 m
Location Old Highway
MGA Zone 50 **718778 mE** **7160976 mN** **Lat.** -25.6527 **Long.** 119.1794
Habitat Flat
Aspect N/A **Slope** N/A
Soil Type Orange sandy clay
Rock Type Quartz, ironstone
Loose Rock >90 % cover; 20-60 mm in size **Litter** <1 % cover ; <1 cm in depth
Bare ground 99 % cover **Weeds** 0 % cover
Vegetation U+ ^*Acacia cuspidifolia*\^tree\6\r;M ^*Acacia aptaneura*\^shrub\3\r;G ^*Senna* sp. Meekatharra (E. Bailey 1-26)\^shrub\2\r
Veg. Condition Very Good
Disturbance Historical grazing and prospecting
Fire Age >10 years
Notes Mulga intergrove; quartz plain



Species	WA Cons.	Height (m)	Cover (%)	Count
<i>Acacia aptaneura</i>		2	2	
<i>Acacia cuspidifolia</i>		2.5	2	
<i>Acacia tetragonophylla</i>		1	<1	
<i>Eremophila galeata</i>		0.6	<1	
<i>Eremophila margarethae</i>		0.6	<1	

<i>Grevillea striata</i>	5	1
<i>Lawrencia densiflora</i>	0.1	<1
<i>Lepidium platypetalum</i>	0.4	<1
<i>Maireana georgei</i>	0.3	<1
<i>Maireana triptera</i>	0.3	<1
<i>Ptilotus obovatus</i>	0.5	<1
<i>Scaevola spinescens</i>	0.6	<1
<i>Sclerolaena eriacantha</i>	0.4	<1
<i>Senna</i> sp. Meekatharra (E. Bailey 1-26)	0.6	2

OH2119

Staff LJA **Date** 3/04/2021 **Season** P
Revisit
Type Q 20 m x 20 m
Location Old Highway
MGA Zone 50 **716825 mE** **7160526 mN** **Lat.** -25.6570 **Long.** 119.1600
Habitat Flat
Aspect N/A **Slope** N/A
Soil Type Orange sandy clay
Rock Type Quartz, ironstone
Loose Rock >90 % cover; 20-60 mm in size **Litter** <1 % cover ; <2 cm in depth
Bare ground 99 % cover **Weeds** 0 % cover
Vegetation U+ ^*Acacia pteraneura*^tree\6\bi;M ^*Eremophila galeata*,^*Senna* sp. Meekatharra (E. Bailey 1-26) ^shrub\3\;G ^*Eremophila margarethae*^shrub\1\bi
Veg. Condition Very Good
Disturbance Grazing, historical prospecting
Fire Age >10 years
Notes Quartz plain



Species	WA Cons.	Height (m)	Cover (%)	Count
<i>Acacia kempeana</i>		0.3	<1	
<i>Acacia pteraneura</i>		4	1.5	
<i>Acacia tetragonophylla</i>		1	<1	
<i>Eremophila galeata</i>		1.5	1	
<i>Eremophila margarethae</i>		0.5	1	

<i>Maireana georgei</i>	0.2	<1
<i>Maireana triptera</i>	0.1	<1
<i>Ptilotus obovatus</i>	0.3	<1
<i>Rhagodia eremaea</i>	0.7	<1
<i>Senna</i> sp. Meekatharra (E. Bailey 1-26)	1.2	2

OH2120

Staff LJA **Date** 3/04/2021 **Season** P
Revisit
Type Q 20 m x 20 m
Location Old Highway
MGA Zone 50 716418 mE 7160027 mN **Lat.** -25.6616 **Long.** 119.1560
Habitat Flat
Aspect N/A **Slope** N/A
Soil Type Orange sandy clay
Rock Type Ironstone, quartz
Loose Rock 2-10 % cover; 6-20 mm in size **Litter** 5 % cover ; <1 cm in depth
Bare ground 95 % cover **Weeds** 0 % cover
Vegetation M+ ^*Acacia aptaneura*,^*Acacia incurvaneura*\^shrub\4\i;G ^*Eremophila forrestii*\^shrub\2\r
Veg. Condition Poor
Disturbance Historical grazing and prospecting
Fire Age >10 years
Notes Senescent; shrubs mostly dead (mostly *Eremophila spectabilis*)



Species	WA Cons.	Height (m)	Cover (%)	Count
<i>Acacia aptaneura</i>		4	7	
<i>Acacia ayersiana</i>		1	<1	
<i>Acacia incurvaneura</i>		4	5	
<i>Eremophila forrestii</i>		0.8	2	
<i>Hibiscus burtonii</i>		0.2	<1	

<i>Marsdenia australis</i>	0.5	<1
<i>Psydrax suaveolens</i>	4	<1

OH2121

Staff LJA **Date** 2/04/2021 **Season** P
Revisit
Type Q 20 m x 20 m
Location Old Highway east
MGA Zone 50 720224 mE 7161994 mN **Lat.** -25.6433 **Long.** 119.1936
Habitat Flat
Aspect N/A **Slope** N/A
Soil Type Orange loamy clay
Rock Type Mixed
Loose Rock 20-50 % cover; 6-20 mm in size **Litter** 1 % cover ; <1 cm in depth
Bare ground 99 % cover **Weeds** 0 % cover
Vegetation M+ ^*Acacia aptaneura*^shrub\3\bi;G ^*Eremophila demissa*,^*Eremophila galeata*^shrub\1\bi
Veg. Condition Degraded
Disturbance Grazing
Fire Age >10 years
Notes Lots of dead plants due to prolonged drought. Lack of diversity possibly due to historical grazing



Species	WA Cons.	Height (m)	Cover (%)	Count
<i>Acacia aptaneura</i>		1.5	<1	
<i>Eremophila demissa</i>	P 1	0.2	<1	
<i>Eremophila galeata</i>		0.5	<1	
<i>Eremophila incisa</i>		0.3	<1	
<i>Ptilotus schwartzii</i>		0.2	<1	

OH2122

Staff LJA **Date** 2/04/2021 **Season** P
Revisit
Type Q 20 m x 20 m
Location Old Highway east
MGA Zone 50 720053 mE 7161895 mN **Lat.** -25.6442 **Long.** 119.1919
Habitat Flat
Aspect N/A **Slope** N/A
Soil Type Orange loamy clay
Rock Type Mixed
Loose Rock 2-10 % cover; 6-20 mm in size **Litter** <1 % cover ; <1 cm in depth
Bare ground 99 % cover **Weeds** 0 % cover
Vegetation M+ ^*Acacia aptaneura*,^*Eremophila galeata*^shrub\3\bi;
Veg. Condition Degraded
Disturbance Grazed
Fire Age >10 years
Notes Most plants dead likely due to drought. Lack of diversity possibly due to historical grazing



Species	WA Cons.	Height (m)	Cover (%)	Count
<i>Acacia aptaneura</i>		1.2	<1	
<i>Eremophila demissa</i>	P 1	0.2	<1	
<i>Eremophila galeata</i>		1	<1	
<i>Rhagodia eremaea</i>		0.3	<1	

OH2123

Staff LJA **Date** 5/04/2021 **Season** P
Revisit
Type Q 20 m x 20 m
Location Old Highway
MGA Zone 50 **719368 mE** **7163010 mN** **Lat.** -25.6343 **Long.** 119.1849
Habitat Flat
Aspect N/A **Slope** N/A
Soil Type Orange sandy clay
Rock Type Ironstone, quartz
Loose Rock 2-10 % cover **Litter** <1 % cover ; <1 cm in depth
Bare ground 99 % cover **Weeds** 0 % cover
Vegetation M+ ^*Acacia aptaneura*^shrub\4\bi;G ^*Ptilotus schwartzii*^forb\1\bi
Veg. Condition Poor
Disturbance Grazing, prospecting
Fire Age >10 years
Notes Most shrubs dead



Species	WA Cons.	Height (m)	Cover (%)	Count
<i>Acacia aptaneura</i>		2	1	
<i>Eremophila incisa</i>		0.3	<1	
<i>Eremophila margarethae</i>		0.4	<1	
<i>Hibiscus burtonii</i>		0.1	<1	
<i>Marsdenia australis</i>		0.3	<1	

<i>Ptilotus obovatus</i>	0.3	<1
<i>Ptilotus schwartzii</i>	0.3	<1
<i>Sclerolaena eriacantha</i>	0.2	<1

OH2124

Staff LJA **Date** 5/04/2021 **Season** P
Revisit
Type Q 20 m x 20 m
Location Old Highway
MGA Zone 50 719016 mE 7163040 mN **Lat.** -25.6340 **Long.** 119.1814
Habitat Flat
Aspect N/A **Slope** N/A
Soil Type Orange sandy clay
Rock Type Quartz, ironstone
Loose Rock 20-50 % cover; 6-20 mm in size **Litter** <1 % cover ; <1 cm in depth
Bare ground 99 % cover **Weeds** 0 % cover
Vegetation M+ ^*Acacia aptaneura*\^shrub\4\bi;G ^*Ptilotus schwartzii*\^forb\1\bi
Veg. Condition Poor
Disturbance Grazing, prospecting
Fire Age >10 years
Notes Most shrubs dead



Species	WA Cons.	Height (m)	Cover (%)	Count
<i>Acacia aptaneura</i>		2	<1	
<i>Eremophila incisa</i>		0.3	<1	
<i>Eremophila margarethae</i>		0.3	<1	
<i>Hibiscus burtonii</i>		0.1	<1	
<i>Marsdenia australis</i>		0.5	<1	

Ptilotus schwartzii

0.3

<1

OH2125

Staff LJA **Date** 4/04/2021 **Season** P
Revisit
Type Q 20 m x 20 m
Location Old Highway
MGA Zone 50 **718524 mE** **7162591 mN** **Lat.** -25.6381 **Long.** 119.1766
Habitat Flat
Aspect N/A **Slope** N/A
Soil Type Orange sandy clay
Rock Type Mixed
Loose Rock 20-50 % cover; 6-20 mm in size **Litter** 2 % cover ; 1 cm in depth
Bare ground 95 % cover **Weeds** <1 % cover
Vegetation M+ ^*Acacia aptaneura*\^shrub\4\r;G ^*Eremophila margarethae*,^*Ptilotus obovatus*\^shrub\1\r
Veg. Condition Poor
Disturbance Cattle grazing
Fire Age >10 years

Notes



Species	WA Cons.	Height (m)	Cover (%)	Count
<i>Abutilon cryptopetalum</i>		0.3	<1	
<i>Acacia aptaneura</i>		3.5	4	
<i>Acacia fuscaneura</i>		1.5	<1	
<i>Acacia tetragonophylla</i>		2	<1	
<i>Aristida contorta</i>		0.2	<1	

<i>Digitaria brownii</i>		0.3	<1
<i>Eremophila forrestii</i>		0.5	<1
<i>Eremophila galeata</i>		2	<1
<i>Eremophila incisa</i>		0.3	<1
<i>Eremophila margarethae</i>		0.5	3
<i>Eriachne pulchella</i> subsp. <i>dominii</i>		0.1	<1
<i>Evolvulus alsinoides</i> var. <i>villosicalyx</i>		0.2	<1
<i>Hibiscus burtonii</i>		0.1	<1
<i>Iseilema membranaceum</i>		0.1	<1
<i>Perotis rara</i>		0.1	<1
<i>Portulaca oleracea</i>		0.1	<1
<i>Psyrax rigidula</i>		2	<1
<i>Ptilotus obovatus</i>		0.5	2
<i>Santalum spicatum</i>		4	1
<i>Sida picklesiana</i>	P 3	0.4	<1
<i>Sida platycalyx</i>		0.2	<1
<i>Sida</i> sp. L (A.M. Ashby 4202)		0.1	<1

OH2126

Staff LJA **Date** 5/04/2021 **Season** P
Revisit
Type Q 20 m x 20 m
Location Old Highway
MGA Zone 50 718478 mE 7163034 mN **Lat.** -25.6342 **Long.** 119.1761
Habitat Flat
Aspect N/A **Slope** N/A
Soil Type Orange loamy clay
Rock Type Quartz, ironstone
Loose Rock 50-90 % cover; 6-20 mm in size **Litter** <1 % cover ; <1 cm in depth
Bare ground 99 % cover **Weeds** 0 % cover
Vegetation M+ ^*Acacia incurvaneura*^shrub\4\r;G ^*Eremophila margarethae*^shrub\1\r
Veg. Condition Poor
Disturbance Grazing, prospecting
Fire Age >10 years
Notes Most shrubs, all grasses dead



Species	WA Cons.	Height (m)	Cover (%)	Count
<i>Acacia incurvaneura</i>		3	2	
<i>Acacia kempeana</i>		0.6	<1	
<i>Acacia tetragonophylla</i>		1	<1	
<i>Eremophila margarethae</i>		0.5	2	
<i>Hibiscus burtonii</i>		0.1	<1	

<i>Ptilotus obovatus</i>	0.6	<1
<i>Sclerolaena eriacantha</i>	0.2	<1
<i>Senna</i> sp. Meekatharra (E. Bailey 1-26)	0.8	<1

OH2127

Staff LJA **Date** 4/04/2021 **Season** P
Revisit
Type Q 20 m x 20 m
Location Old Highway
MGA Zone 50 716217 mE 7162226 mN **Lat.** -25.6418 **Long.** 119.1537
Habitat Lower-Slope
Aspect E **Slope** Very Gentle
Soil Type Orange sandy clay
Rock Type Ironstone, quartz
Loose Rock 20-50 % cover; 6-20 mm in size **Litter** 5 % cover ; 1-5 cm in depth
Bare ground 90 % cover **Weeds** <1 % cover
Vegetation U ^*Grevillea berryana*^tree\6\r;M+ ^*Acacia aptaneura*,^*Acacia craspedocarpa*^shrub\4\c;G
 ^^*Paspalidium clementii*,*Perotis rara*,*Bidens subalternans*^other grass,forb\1\r
Veg. Condition Good
Disturbance Historical grazing, prospecting
Fire Age >10 years

Notes



Species	WA Cons.	Height (m)	Cover (%)	Count
<i>Acacia aptaneura</i>		5	15	
<i>Acacia craspedocarpa</i>		5	25	
* <i>Bidens subalternans</i>		0,2	<1	
<i>Cheilanthes sieberi</i>		0.1	<1	
<i>Eremophila forrestii</i>		1.2	<1	

<i>Eriachne helmsii</i>	0.3	<1
<i>Erodium cygnorum</i>	0.1	<1
<i>Grevillea berryana</i>	6	2
<i>Hibiscus burtonii</i>	0.1	<1
<i>Monachather paradoxus</i>	0.3	<1
<i>Paspalidium clementii</i>	0.1	2
<i>Perotis rara</i>	0.1	2
<i>Psydrax suaveolens</i>	0.5	<1
<i>Ptilotus obovatus</i>	0.6	<1
<i>Ptilotus schwartzii</i>	0.3	<1
<i>Sclerolaena eriacantha</i>	0.3	<1
<i>Sida</i> sp. L (A.M. Ashby 4202)	0.1	<1
<i>Swainsona affinis</i>	0.1	<1

OH2128

Staff LJA **Date** 2/04/2021 **Season** P
Revisit
Type Q 20 m x 20 m
Location Old Highway
MGA Zone 50 718724 mE 7161504 mN **Lat.** -25.6479 **Long.** 119.1788
Habitat Flat
Aspect N/A **Slope** N/A
Soil Type Orange clay
Rock Type Quartz
Loose Rock 2-10 % cover; 20-60 mm in size **Litter** 5 % cover ; >1 cm in depth
Bare ground 90 % cover **Weeds** 1 % cover
Vegetation U+ ^*Acacia aptaneura*,^*Acacia subcontorta*\^tree\6\c;M ^*Eremophila galeata*\^shrub\3\r;G
^*Eremophila forrestii*,*Eremophila spectabilis*,*Ptilotus obovatus*\^shrub\2\r
Veg. Condition Very Good
Disturbance Historical grazing, prospecting
Fire Age >10 years
Notes Mulga grove



Species	WA Cons.	Height (m)	Cover (%)	Count
<i>Acacia aptaneura</i>		5	30	
<i>Acacia incurvaneura</i>		4	2	
<i>Acacia kempeana</i>		3	2	
<i>Acacia</i> sp.		0.4	<1	
<i>Acacia subcontorta</i>		5	15	

<i>Acacia tetragonophylla</i>		2	2
<i>*Bidens subalternans</i>		0.2	<1
<i>Cheilanthes sieberi</i>		0.2	<1
<i>Eremophila demissa</i>	P 1	0.3	<1
<i>Eremophila forrestii</i>		1	2
<i>Eremophila galeata</i>		2	2
<i>Eremophila spectabilis</i>		1	2
<i>Hibiscus burtonii</i>		0.3	<1
<i>Maireana ?planifolia</i>			<1
<i>Marsdenia australis</i>		2	<1
<i>Paspalidium clementii</i>		0.2	<1
<i>Psyrax rigidula</i>		2	<1
<i>Psyrax suaveolens</i>		1.5	<1
<i>Ptilotus obovatus</i>		1	1
<i>Santalum lanceolatum</i>		1.5	<1
<i>Senna glaucifolia</i>		0.4	<1
<i>Sida picklesiana</i>	P 3	0.6	<1

OH2129

Staff LJA **Date** 4/04/2021 **Season** P
Revisit
Type Q 20 m x 20 m
Location Old Highway
MGA Zone 50 **717632 mE** **7162734 mN** **Lat.** -25.6370 **Long.** 119.1677
Habitat Flat
Aspect N/A **Slope** N/A
Soil Type Orange brown loamy clay
Rock Type Quartz
Loose Rock <2 % cover; 6-20 mm in size **Litter** 2 % cover ; 1-5 cm in depth
Bare ground 55 % cover **Weeds** 5 % cover
Vegetation M+ ^*Acacia aptaneura*,^*Acacia aneura*^shrub\4\i;G ^^*Perotis rara*,*Eriachne pulchella* subsp. *dominii*,*Bidens subalternans*^other grass,forb\1\c
Veg. Condition Good
Disturbance Cattle grazing
Fire Age >10 years
Notes Dispersed drainage



Species	WA Cons.	Height (m)	Cover (%)	Count
<i>Abutilon cryptopetalum</i>		0.3	<1	
<i>Acacia aneura</i>		3.5	5	
<i>Acacia aptaneura</i>		3.5	10	
<i>Acacia tetragonophylla</i>		4	2	
<i>Areocleome oxalidea</i>		0.1	<1	

<i>Aristida contorta</i>	0.3	<1
<i>*Bidens subalternans</i>	0.2	5
<i>Boerhavia coccinea</i>	0.1	<1
<i>Digitaria brownii</i>	0.4	<1
<i>Eremophila galeata</i>	2	1
<i>Eriachne pulchella</i> subsp. <i>dominii</i>	0.1	6
<i>Euphorbia</i> sp.	0.1	<1
<i>Evolvulus alsinoides</i> var. <i>villosicalyx</i>	0.3	<1
<i>Fimbristylis dichotoma</i>	0.2	<1
<i>Hibiscus burtonii</i>	0.1	<1
Indeterminant spp.	1	<1
<i>Iseilema membranaceum</i>	0.1	<1
<i>Josephinia eugeniae</i>	0.1	<1
<i>Paspalidium clementii</i>	0.2	<1
<i>Perotis rara</i>	0.1	25
<i>Portulaca oleracea</i>	0.1	<1
<i>Ptilotus obovatus</i>	0.8	<1
<i>Senna glaucifolia</i>	0.1	<1
<i>Sida platycalyx</i>	0.4	<1
<i>Sida</i> sp. L (A.M. Ashby 4202)	0.3	<1
<i>Tribulus astrocarpus</i>	0.1	<1

OH2159

Staff LJA **Date** 4/04/2021 **Season** P
Revisit
Type Q 20 m x 20 m
Location Old Highway
MGA Zone 50 717270 mE 7163331 mN **Lat.** -25.6317 **Long.** 119.1640
Habitat Lower-Slope
Aspect E **Slope** Gentle
Soil Type Red brown sandy clay
Rock Type Ironstone
Loose Rock ; 60-200 mm in size **Litter** 1 % cover ; <1 cm in depth
Bare ground 90 % cover **Weeds** 0 % cover
Vegetation M+ ^*Acacia incurvaneura*\^shrub\4\r;G ^*Aluta maisonneuvei* subsp. *auriculata*\^shrub\1\r
Veg. Condition Excellent
Disturbance Old vehicle tyre track; no apparent damage to vegetation
Fire Age >10 years
Notes Most Thryptomene dead



Species	WA Cons.	Height (m)	Cover (%)	Count
<i>Acacia incurvaneura</i>		2.5	2	
<i>Acacia</i> sp.		0.2	<1	
<i>Aluta maisonneuvei</i> subsp. <i>auriculata</i>		0.5	5	
<i>Aristida holathera</i> var. <i>holathera</i>		0.3	<1	
<i>Brunonia australis</i>		0.3	<1	

<i>Eragrostis eriopoda</i>		0.3	<1
<i>Eremophila jucunda</i> subsp. <i>jucunda</i>		0.1	<1
<i>Eriachne pulchella</i> subsp. <i>dominii</i>		0.1	<1
<i>Goodenia triodiophila</i>		0.3	<1
<i>Grevillea berryana</i>		2.5	<1
<i>Hibiscus burtonii</i>		0.1	<1
<i>Indigofera fractiflexa</i> subsp. <i>augustensis</i>	P 2	0.3	<1
<i>Monachather paradoxus</i>		0.3	<1
<i>Ptilotus schwartzii</i>		0.3	<1
<i>Sida</i> sp. Golden calyces glabrous (H.N. Foote 32)		0.2	<1
<i>Synaptantha tillaeacea</i> var. <i>tillaeacea</i>			<1
<i>Tripogonella loliiformis</i>		0.1	<1

OH2160

Staff LJA **Date** 4/04/2021 **Season** P
Revisit
Type Q 20 m x 20 m
Location Old Highway
MGA Zone 50 715664 mE 7161639 mN **Lat.** -25.6472 **Long.** 119.1483
Habitat Flat
Aspect N/A **Slope** N/A
Soil Type Orange sandy clay
Rock Type Ironstone, quartz
Loose Rock 10-20 % cover; 6-20 mm in size **Litter** 5 % cover ; 1 cm in depth
Bare ground 95 % cover **Weeds** 0 % cover
Vegetation U ^*Acacia pruinocarpa*^tree\6\r;M+ ^*Acacia aptaneura*,^*Acacia caesaneura*^shrub\4\c;G
^*Eremophila spectabilis*,^*Cheilanthes sieberi*^shrub,fern\2\r
Veg. Condition Good
Disturbance Historical grazing, prospecting
Fire Age >10 years

Notes



Species	WA Cons.	Height (m)	Cover (%)	Count
<i>Acacia aptaneura</i>		3	20	
<i>Acacia caesaneura</i>		3	20	
<i>Acacia pruinocarpa</i>		6	2	
<i>Cheilanthes sieberi</i>		0.1	<1	
<i>Eragrostis eriopoda</i>		0.3	<1	

<i>Eremophila latrobei</i> subsp. <i>latrobei</i>	1.5	<1
<i>Eremophila spectabilis</i>	1.7	2
<i>Grevillea berryana</i>	3	<1
<i>Hibiscus burtonii</i>	0.3	<1
<i>Ptilotus schwartzii</i>	0.3	<1

OH2161

Staff LJA **Date** 31/03/2021 **Season** P
Revisit
Type Q 20 m x 20 m
Location Old Highway
MGA Zone 50 714510 mE 7160578 mN **Lat.** -25.6569 **Long.** 119.1370
Habitat Flat
Aspect N/A **Slope** N/A
Soil Type Orange loamy clay
Rock Type Ironstone, quartz
Loose Rock 50-90 % cover; 60-200 mm in size **Litter** <1 % cover ; <1 cm in depth
Bare ground 99 % cover **Weeds** 0 % cover
Vegetation G+ ^*Senna* sp. Meekatharra (E. Bailey 1-26), ^*Acacia pruinocarpa* ^shrub\2\r
Veg. Condition Excellent
Disturbance None obvious
Fire Age >10 years

Notes



Species	WA Cons.	Height (m)	Cover (%)	Count
<i>Acacia minyura</i>		0.5	<1	
<i>Acacia pruinocarpa</i>		0.8	1	
<i>Acacia tetragonophylla</i>		0.3	<1	
<i>Eremophila galeata</i>		1	<1	
<i>Eremophila spectabilis</i>		0.1	<1	

<i>Maireana triptera</i>	0.3	<1
<i>Psyrax latifolia</i>	0.3	<1
<i>Ptilotus obovatus</i>	0.5	<1
<i>Senna</i> sp. Meekatharra (E. Bailey 1-26)	0.6	2

OH2162

Staff LJA **Date** 2/04/2021 **Season** P
Revisit
Type Q 20 m x 20 m
Location Old Highway east
MGA Zone 50 720104 mE 7162150 mN **Lat.** **Long.**
Habitat Flat
Aspect N/A **Slope** N/A
Soil Type Orange loamy clay
Rock Type Mixed
Loose Rock 20-50 % cover; 6-20 mm in size **Litter** <1 % cover ; <1 cm in depth
Bare ground 99 % cover **Weeds** 0 % cover
Vegetation M+ ^*Acacia aptaneura*^shrub\4\r;G ^*Eremophila demissa*^shrub\1\r
Veg. Condition Degraded
Disturbance Historical soil surface disturbance, grazing
Fire Age >10 years
Notes Prolonged drought



Species	WA Cons.	Height (m)	Cover (%)	Count
<i>Acacia aptaneura</i>		2.5	2	
<i>Eremophila demissa</i>	P 1	0.3	2	
<i>Eremophila galeata</i>			<10.7	
<i>Ptilotus schwartzii</i>		0.3	<1	
<i>Senna glaucifolia</i>		0.6	<1	

OH2163

Staff LJA **Date** 5/04/2021 **Season** P
Revisit
Type Q 20 m x 20 m
Location Old Highway
MGA Zone 50 **715805 mE** **7161080 mN** **Lat.** -25.6522 **Long.** 119.1498
Habitat Crest
Aspect S **Slope** Gentle
Soil Type Red brown sandy clay
Rock Type Massive and banded ironstone, volcanics
Loose Rock 50-90 % cover; 60-200 mm in size **Litter** 2 % cover ; 1 cm in depth
Bare ground 98 % cover **Weeds** 0 % cover
Vegetation U ^*Acacia pruinocarpa*^tree\6\bi;M+ ^*Acacia aptaneura*,^*Acacia ayersiana*^shrub\4\r;G
^*Eremophila latrobei* subsp. *latrobei*,*Eremophila margarethae*,*Ptilotus obovatus*^shrub\2\r
Veg. Condition Very Good
Disturbance Cattle trail
Fire Age >10 years

Notes



Species	WA Cons.	Height (m)	Cover (%)	Count
<i>Acacia aptaneura</i>		4	6	
<i>Acacia ayersiana</i>		3	4	
<i>Acacia pruinocarpa</i>		4	<1	
<i>Acacia subcontorta</i>		2	<1	
<i>Acacia tetragonophylla</i>		1.5	<1	

<i>Eremophila jucunda</i> subsp. <i>jucunda</i>		0.6	<1
<i>Eremophila latrobei</i> subsp. <i>latrobei</i>		0.8	1
<i>Eremophila margarethae</i>		0.6	1
<i>Grevillea berryana</i>		1	<1
<i>Indigofera fractiflexa</i> subsp. <i>augustensis</i>	P 2	0.5	<1
<i>Marsdenia australis</i>		0.3	<1
<i>Ptilotus obovatus</i>		0.6	<1
<i>Ptilotus schwartzii</i>		0.2	<1
<i>Senna glaucifolia</i>		0.3	<1
<i>Sida picklesiana</i>	P 3	0.3	<1
<i>Solanum lachnophyllum</i>		0.6	<1
<i>Tribulus suberosus</i>		1	<1

APPENDIX SIX

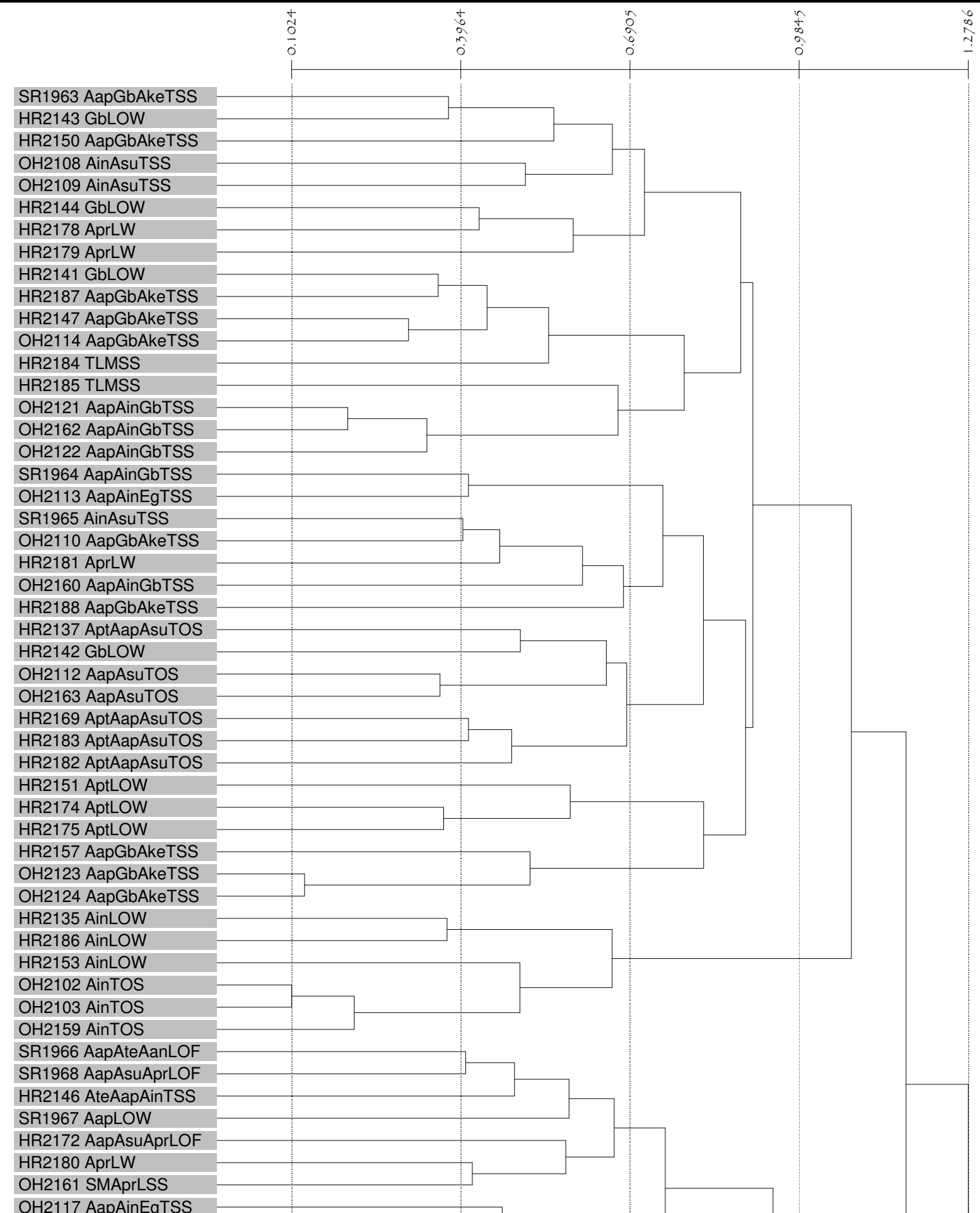
FLORISTIC ANALYSIS DENDROGRAM

Figure 6: Floristic analysis dendrogram

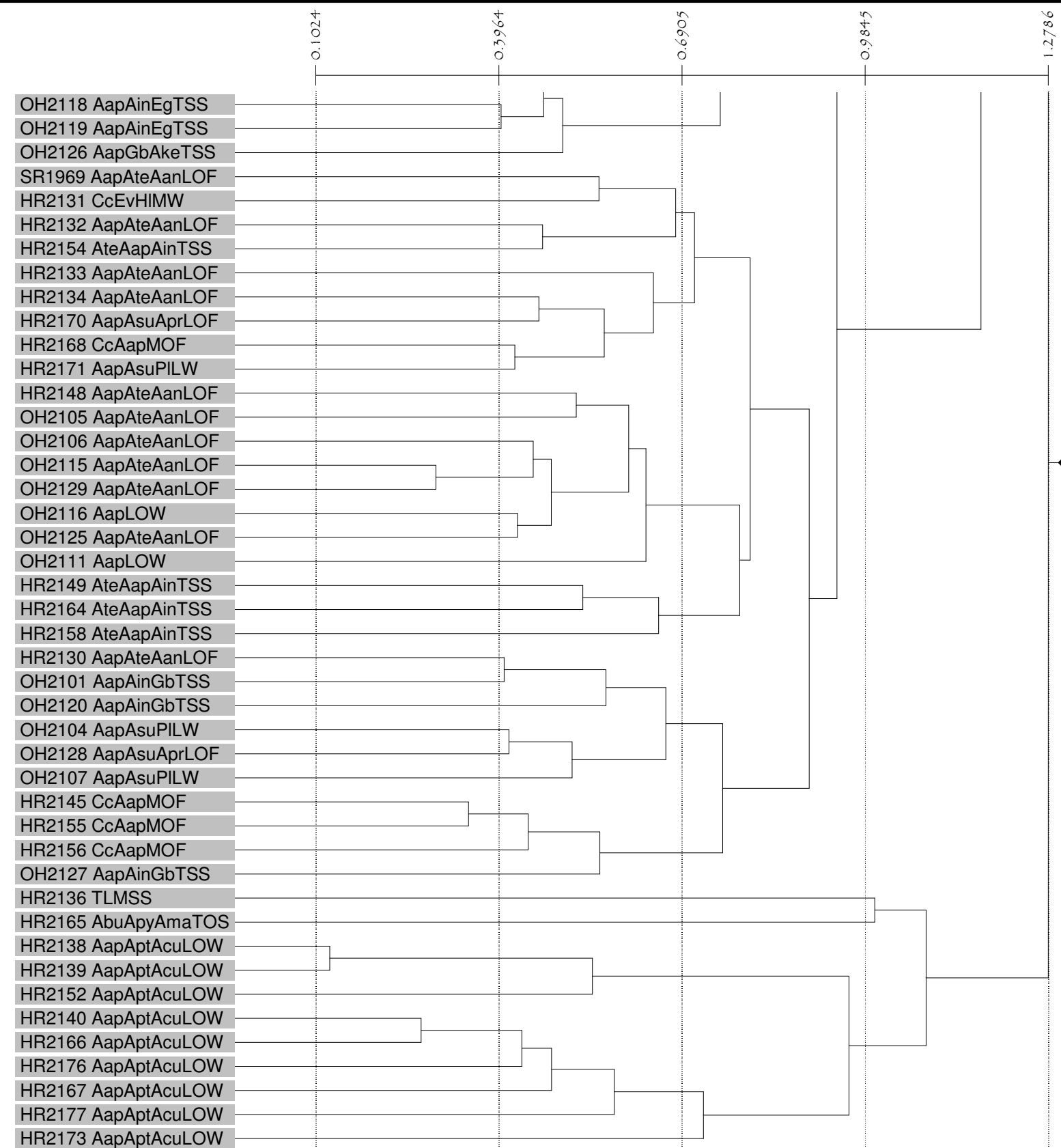
Fusion Type: Flexible UPGMA Beta = -0.10

On Association: Kulczynski Columns Created on: 11:35:32, June 30, 2021

Column Fusion Dendrogram



Column Fusion Dendrogram



ADDENDUM: OLD HIGHWAY EXTENSION SURVEY

INTRODUCTION

Due to the proximity to a bend in the road, the proposed crossing of Great Northern Highway will need to be moved for safety reasons. This necessitated a flora and vegetation survey of the area between the Old Highway survey area and the Highway, known herein as the 'extension survey area'.

METHODS

The survey was conducted on 6 August 2021. As this is not within the optimal survey season for the bioregion (EPA 2016), annual and ephemeral species were not identifiable, and that the extension area can be considered as part of the original Old Highway survey area with vegetation types being contiguous, the vegetation was described mapped and described using descriptive relevés rather than quadrats.

The entire extension survey area was traversed on foot by Lyn Atkins and Sandfire Resources' Shannon Batt, with the survey including recording conservation-listed flora where encountered. The southern part of the survey area was targeted in particular for searches as it is contiguous with areas where *Eremophila demissa* (P1) had been recorded during the survey of Old Highway.

RESULTS

VEGETATION TYPES

Fourteen descriptive relevés were recorded within the extension survey area. The vegetation types were confirmed as being the same as and contiguous with the adjacent vegetation of the Old Highway survey area. The vegetation types and their extents within the extension survey area were:

- **AapAinEgTSS**; 3.86 ha (5.25%)
- **AapAsuAprLOF** (Mulga groves); 6.63 ha (9.02%)
- **AapAteAanLOF**; 2.77 ha (3.77%)
- **AapGbAkeTSS**; 26.54 ha (36.10)
- **AapLOW**; 33.02 ha (0.94)
- not vegetated (old Main Roads borrow pit); 0.69 ha (0.94%).

Vegetation types, including locations of descriptive relevés, are shown on **Map 6**.

The dominant and characteristic species recorded from each relevé is shown in **Table 18**. The relevé data follows the maps.

Table 18: Site x characteristic and dominant species (extension survey area relevés)

Family	Species	Cons. status	OHE2101	OHE2102	OHE2103	OHE2104	OHE2105	OHE2106	OHE2107	OHE2108	OHE2109	OHE2110	OHE2111	OHE2112	OHE2113	OHE2114	Opp.
Amaranthaceae	<i>Ptilotus obovatus</i>				X	X	X	X			X	X	X	X	X	X	
	<i>Ptilotus schwartzii</i>									X		X					
Fabaceae	<i>Acacia aneura</i>			X													
	<i>Acacia aptaneura</i>		X	X		X		X	X	X		X	X		X	X	
	<i>Acacia cuspidifolia</i>		X														
	<i>Acacia incurvaneura</i>					X	X		X								
	<i>Acacia kempeana</i>													X			
	<i>Acacia pruinocarpa</i>					X					X				X		
	<i>Acacia tetragonophylla</i>										X						
	<i>Senna glaucifolia</i>										X						
Malvaceae	Malvaceae sp.					X											
Pittosporaceae	<i>Pittosporum angustifolium</i>										X						
Poaceae	<i>Eriachne</i> sp.										X						
	Poaceae sp.					X			X								
Proteaceae	<i>Grevillea berryana</i>															X	
Rubiaceae	<i>Psyrax latifolia</i>			X											X		
Scrophulariaceae	<i>Eremophila demissa</i>	P1			X												X
	<i>Eremophila forrestii</i>						X										
	<i>Eremophila galeata</i>		X			X		X	X			X					
	<i>Eremophila incisa</i>									X							
	<i>Eremophila margarethae</i>															X	
	<i>Eremophila oppositifolia</i> subsp. <i>angustifolia</i>										X						
	<i>Eremophila spectabilis</i>			X			X								X		

VEGETATION CONDITION

The vegetation condition ranged from Completely Degraded, in areas associated with the bund that was parallel to Great Northern Highway, to Very Good (**Map 7**). Overall, the vegetation was in a poorer condition than within the Old Highway survey area due to previous disturbance including having been possibly cleared in the past for prospecting or roadworks activities, and livestock grazing. Human litter was observed on occasion.

Table 19: Vegetation condition of the extension survey area

Vegetation condition	Extent (ha)	Proportion (%)
Excellent	-	-
Very Good	8.25	11.22
Good	14.86	20.22
Poor	49.15	66.87
Degraded	-	-
Completely Degraded	0.55	0.75
Not vegetated (cleared)	0.69	0.94

CONSERVATION-LISTED FLORA

Eremophila demissa (P1; **Image 1**) was recorded from 11 locations including one relevé. The number of plants recorded from within a 10 m radius circle of each point ranged from 2-34 with an average of 7.58 plants.

Most occurrences were towards the south of the extension survey area and included areas contiguous with populations recorded during the Old Highway survey. **Map 6** shows locations and estimated extents within the extension survey area.

As for Old Highway, the majority of plants (estimated 80-90%; **Image 2**) were dead indicating the population of this species is potentially far larger than the current counts and estimates. The high proportion of dead plants is likely attributable to low rainfall over many years rather than any clearly human-caused factor.



Image 1: *Eremophila demissa* flowers



Image 2: The small shrubs are mostly dead *Eremophila demissa*

Post-survey Likelihood Assessment

The extension survey area was traversed throughout by foot. Due to clear visibility up to 100 m in most cases, the traverses were at approximately 100 m (or less) spacing. Areas of dense vegetation, including Mulga groves, were individually searched for conservation-listed flora.

Based on available habitat and search effort it is highly unlikely that any TF, other P1 or P2 species occur within the extension survey area.

INTRODUCED SPECIES

No introduced species were observed during the extension area survey, however, due to dry conditions they may have been overlooked. The most likely introduced species is **Bidens subalternans* within Mulga grove vegetation type **AapAsuAprLOF**.

BOTANICAL LIMITATIONS

Table 20: Botanical limitations of the Old Highway extension survey

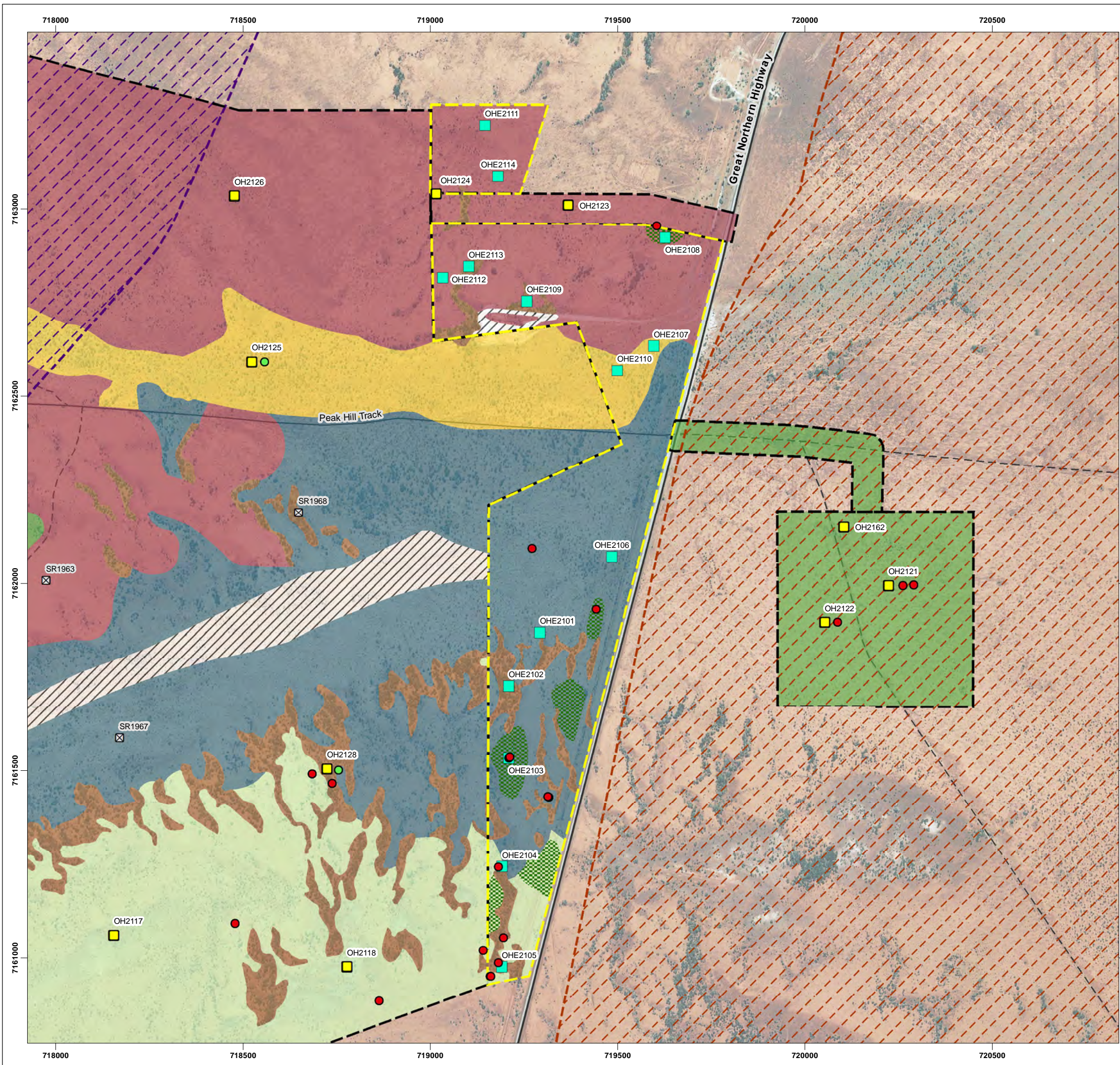
Possible limitations	Constraints (yes/no): Significant, moderate or negligible	Comment
Availability of contextual information at a regional and local scale	No	This survey was supplementary to the previous survey in April 2021 thus there was adequate contextual information.
Competence/experience of the team conducting the survey, including experience in the bioregion surveyed	No	The botanist conducting the field survey has over 30 years conducting flora and vegetation surveys over much of Western Australia.
Proportion of the flora recorded and/or collected, and any identification issues	Negligible	Due to seasonal conditions and survey timing only dominant and characteristic species were recorded from within descriptive relevés, plus conservation-listed species. Annual and ephemeral species were not present or identifiable; none would have been significant as characteristic species. No grasses were identifiable to species due to the lack of flowering material, however, this was a negligible constraint as none were of conservation significance.
Was the appropriate area fully surveyed (effort and extent)	No	Fourteen descriptive relevés were recorded. This was considered adequate to confirm that the vegetation within the extension survey area was a continuation of the vegetation within the Old Highway survey area that was immediately adjacent. The extension survey area was adequately covered to determine presence of conservation-listed flora.
Access restrictions within the survey area	No	The entire area was accessible presenting no constraints.
Survey timing, rainfall, season of survey	No	The field survey was conducted in August that is outside the primary season for survey in the Gascoyne bioregion. However, this was not considered a significant constraint as this was a confirmation survey only and the main conservation-listed flora targeted for survey (<i>Eremophila demissa</i>) was identifiable from vegetative characters.
Disturbance that may have affected the results of the survey e.g. fire, flood, clearing	No	There were no recent disturbances that would have affected the results of the survey. None of the survey area had been recently burnt.

DISCUSSION

Overall, the vegetation of the extension survey area is similar to that of the adjacent Old Highway survey area that lies immediately to the west. No vegetation representative of or similar to conservation-listed ecological communities was recorded, nor considered likely to occur. The only significant vegetation occurring within the extension survey area is Mulga groves (vegetation type **AapAsuAprLOF**) that is significant for the reasons outlined in **Section 5.2.2.1**.

Eremophila demissa (P1) was recorded from 11 locations, primarily towards the south of the extension survey area. It is unlikely that additional groups of plants occur within the extension survey area. A total of 86 individual plants were recorded, however, this is a significant under estimation as the number counted refers to representative densities rather than all individuals occurring.

It is highly unlikely that any TF, other P1 or P2 species occur within the extension survey area.



LEGEND

Old Highway Extension Survey (August 2021)

Survey Area

Relevés (Ecoscape, 2021)

Quadrats (Ecoscape, 2021)

Quadrats (Ecoscape, 2019)

Conservation Listed Flora

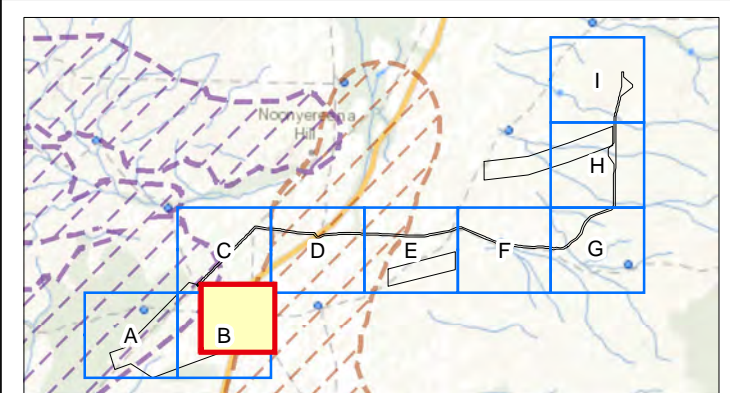
- Eremophila demissa* (P1)
- Goodenia nuda* (P4)
- Sida picklesiana* (P3)
- Eremophila demissa* population

TEC/PEC (DBCA, 2021)

- Doolgunna Calcrete
- Robinson Range BIF

Vegetation Type

- AapAinEgTSS - *Acacia aptaneura*, *Acacia incurvaneura* and *Eremophila galeata* tall sparse shrubland
- AapAinGbTSS - *Acacia aptaneura*, *Acacia incurvaneura* and *Grevillea berryana* tall sparse shrubland
- AapAsuAprLOF - *Acacia aptaneura*, *Acacia subcontorta* and *Acacia pruinocarpa* low open forest
- AapAteAanLOF - *Acacia aptaneura*, *Acacia tetragonophylla* and *Acacia aneura* low open forest
- AapGbAkeTSS - *Acacia aptaneura*, *Grevillea berryana* and *Acacia kempeana* tall sparse shrubland
- AapLOW - *Acacia aptaneura* low open woodland
- No Vegetation



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**VEGETATION TYPES,
QUADRATS AND
CONSERVATION LISTED FLORA**

**OLD HIGHWAY PROJECT
FLORA & VEGETATION SURVEY**

SANDFIRE RESOURCES

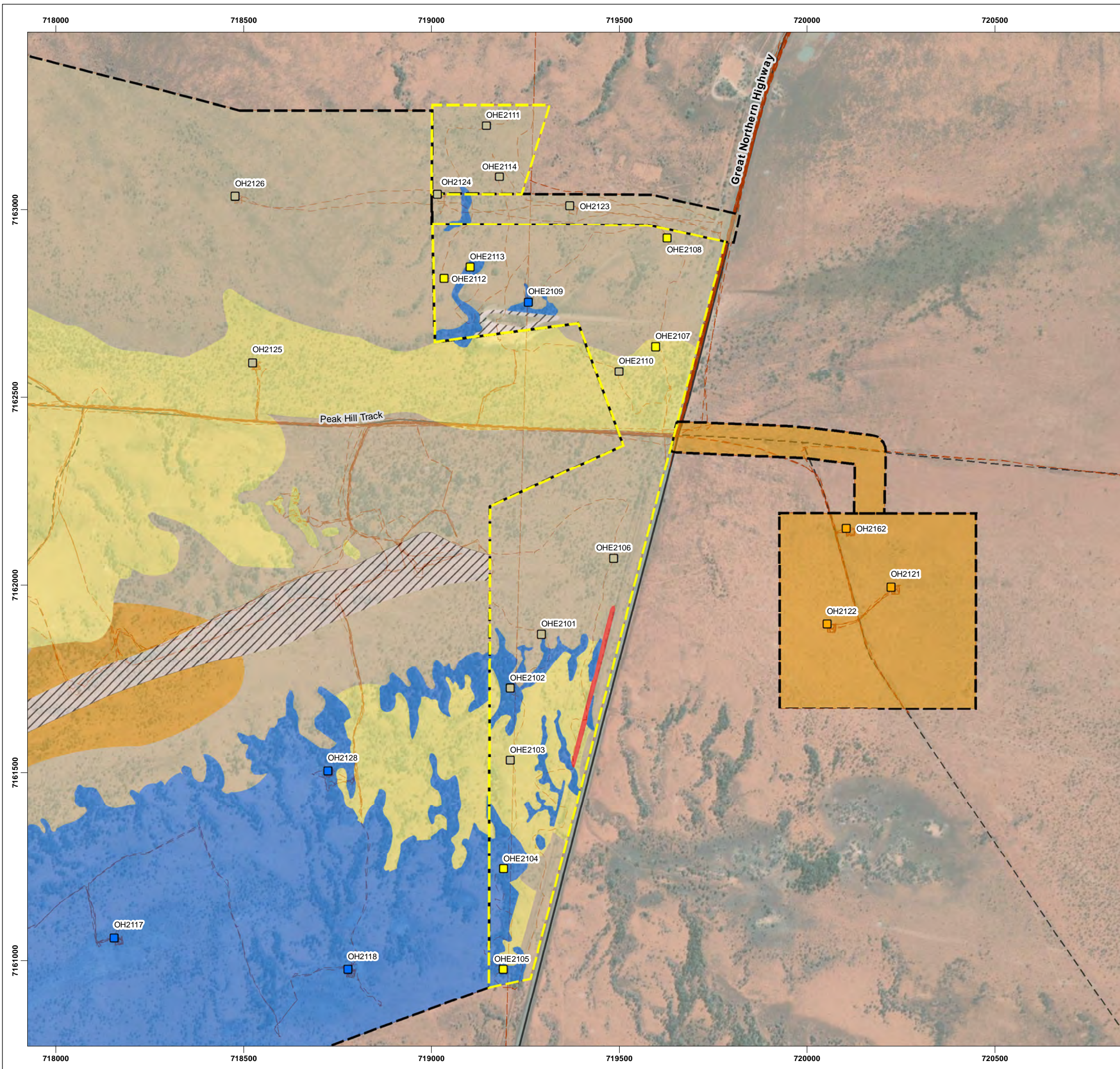
COORDINATE SYSTEM: GDA 1994 MGA ZONE 50
PROJECTION: TRANSVERSE MERCATOR
DATUM: GDA 1994
UNITS: METER

SCALE: 1:10,000 @ A3

PROJECT NO: 4622-21

REV	AUTHOR	APPROVED	DATE
0	SB	LA	23/08/2021

MAP 6



LEGEND

- Survey Area
- Survey Tracks

Quadrats - Vegetation Condition (Ecoscape, 2021)

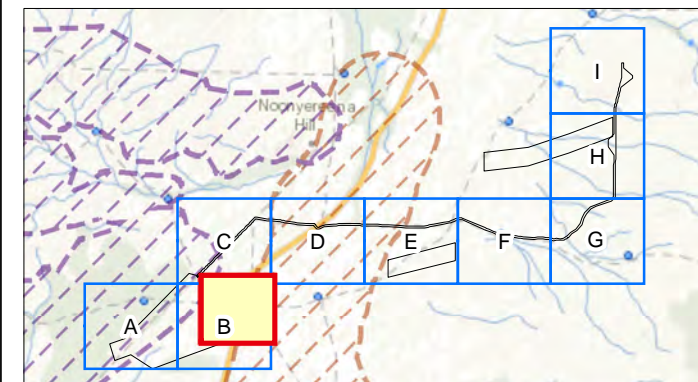
- Very Good
- Poor
- Degraded

Relevés - Vegetation Condition (Ecoscape, 2021)

- Very Good
- Good
- Poor

Vegetation Condition

- Very Good
- Good
- Poor
- Degraded
- Completely Degraded
- No vegetation



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VEGETATION CONDITION

OLD HIGHWAY PROJECT FLORA & VEGETATION SURVEY

DATASOURCES:
SOURCE DATA: QUADRATS, CONSERVATION LISTED
FLORA AND VEGETATION (ECOSCAPE, 2021)
AERIAL: ESRI BASEMAP 2020
BASEMAP: GEOSCIENCE AUSTRALIA
SERVICE LAYERS: SOURCE: ESRI, MAXAR, GEOEYE,
EARTHSTAR, GEOGRAPHICS, CNES/AIRBUS DS, USDA,
USGS, AERGRID, IGN, AND THE GIS USER COMMUNITY



COORDINATE SYSTEM: GDA 1994 MGA ZONE 50
PROJECTION: TRANSVERSE MERCATOR
DATUM: GDA 1994
UNITS: METER



PROJECT NO: 4622-21

REV	AUTHOR	APPROVED	DATE
0	SB	LA	23/08/2021

**MAP
7**

APPENDIX 2. FAUNA ASSESSMENT (ECOSCAPE 2021)

OLD HIGHWAYMINE AND HAUL ROUTE FAUNA SURVEY

Sandfire Resources

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Revision	Author	QA Reviewer	Approved	Date
Draft	Sam Rycken	LS	LS	20/07/2021
Rev1	Sam Rycken	LS	LS	6/08/2021

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Prepared for Sandfire Resources

This document should be cited as 'Ecoscape (Australia) Pty Ltd (2021) *Old Highway and Proposed Haul Route Fauna Survey*, prepared for Sandfire Resources NL

TABLE OF CONTENTS

Summary	1
Acronyms and Abbreviations	2
1 Introduction	3
1.1 Background	3
1.2 Survey Area	3
1.3 Survey requirements	4
1.4 Compliance	4
2 Desktop Assessment	6
2.1 Physical Environment	6
2.1.1 Climate	6
2.1.2 Land Systems	7
2.1.3 Wetlands and Drainage	7
2.1.4 Groundwater Dependent Ecosystems	7
2.1.5 Environmentally Sensitive Areas	7
2.1.6 Conservation lands	7
2.1.7 Land Use History	7
2.2 Biological Environment	8
2.2.1 Biogeographic Region	8
2.2.2 Pre-European Vegetation	8
2.2.3 Threatened and Priority Fauna	8
2.2.4 Fauna Habitat	10
2.3 SRE Desktop assessment	10
2.3.1 SRE Sub-categories	11
2.3.2 Database Searches	12
2.3.3 Database results	12
2.4 Previous Surveys	13
2.4.1 IBSA Data Search	13
2.4.2 Other Literature	14
3 Methods	15
3.1 Survey Aims	15
3.2 Guiding Principles	15
3.3 Fauna Field Survey	15
3.3.1 Survey Methods	15
3.3.2 Targeted Survey Methods	17
4 Field Survey Results	18
4.1 Vertebrate Fauna Survey	18
4.1.1 Fauna Habitat	18
4.1.2 Fauna Assemblage	20

4.1.3	Significant Fauna and Associated Habitat	20
4.1.4	Fauna Habitat Analysis.....	21
4.1.5	Adequacy of sampling	22
4.1.6	Fauna Survey Limitations	23
5	Discussion	25
5.1	Fauna Significance	25
5.1.1	Fauna Habitat Types	25
5.1.2	Fauna Assemblage.....	25
5.2	Conservation listed species.....	25
5.2.1	Grey Falcon	25
5.2.2	Peregrine falcon.....	25
5.2.3	Long-tailed Dunnart	26
5.2.4	Recorded Conservation-listed Species	26
5.3	Post-survey Likelihood Assessment	26
5.4	SRE Desktop Assessment.....	26
6	Conclusions.....	28
	References	29
	Maps.....	32
	Appendix One Legislative Context, Definitions and Criteria	44
	Commonwealth Environment Protection and Biodiversity Conservation Act 1999.....	44
	Western Australian Environmental Protection Act 1986	45
	Western Australian Biodiversity Conservation Act 2016	46
	Priority-listed Flora and Fauna	46
	Threatened and Priority Ecological Communities	48
	Environmentally Sensitive Areas.....	51
	Conservation Estate	51
	Appendix Two Desktop Assessment Results and Likelihood Assessments.....	52
	Appendix Three Field Survey Results.....	54
	FIGURES	
	Figure 1: Survey area location	4
	Figure 2: Rainfall and temperature data for the survey area	6
	Figure 3: Systematic trapping array consisting of pitfall traps,	16
	Figure 4: Vertebrate fauna dendrogram showing the fauna assemblage	21
	Figure 5: Vertebrate fauna diagram showing affiliation of recorded species	22
	Figure 6: Species accumulation curves from the four live trapping sites.....	23

TABLES

Table 1: Acronyms and abbreviations	2
Table 2: Land systems (DPIRD 2020).....	7
Table 3: Pre-European vegetation association representation (DBCA 2019a)	8
Table 4: Categories for likelihood of occurrence of conservation-listed fauna.....	10
Table 5: WAM SRE categories.....	11
Table 6: SRE categories used	12
Table 7: Invertebrate fauna database search details	12
Table 8: WAM combined database search results	13
Table 9: Fauna habitat types	18
Table 10: Fauna survey limitations.....	23
Table 11: EPBC Act categories for flora, fauna and ecological communities	44
Table 12: Conservation codes for Western Australian flora and fauna (DBCA 2019b).....	46
Table 13: DBCA definitions and criteria for TECs and PECs (DEC 2013)	49
Table 14: Fauna database results and likelihood assessments	52
Table 15: Excluded species and reason for exclusion.	53
Table 16: Recorded fauna species	54
Table 17: Fauna sites (GDA94, Zone 50).....	58

MAPS

Map 1: Soil landscapes.....	32
Map 2: Pre-European vegetation associations	33
Map 3: Fauna and Short-range endemic species database search results.....	34
Map 4: Fauna habitat and survey sites.....	35

SUMMARY

Sandfire Resources is targeting a small area (Old Highway and Haul Road, 1317.58 ha) to conduct a feasibility study for moving operations to this site.

Sandfire Resources has appointed Ecoscape (Australia) Ltd to conduct a detailed fauna survey of the Old Highway project area. Previously Ecoscape conducted a Flora and Vegetation survey of the area (Ecoscape 2019a).

The Level 2 survey was conducted under Department of Biodiversity, Conservation and Attractions (DBCA) Fauna Taking (Biological Assessment) Licence (BA27000410). This survey was conducted by Bruce Turner (Principal Zoologist), Hugh Osborn (Zoologist) and Sam Rycken (Zoologist) during 6-16 April 2021.

Four Level 2 systematic trapping sites were established within representative fauna habitat types in the survey area. Bird surveys were conducted consistently at these four trapping sites. In addition, opportunistic sites (sightings) and trail camera sites were established across the survey area. Habitat assessment points were established across all major habitat types within the survey area.

The desktop survey and terrestrial vertebrate fauna assessment found:

- Nineteen potential SRE invertebrate species were identified through desktop assessment database searches through WAM. None of the species has been classified as an SRE.
- Three vertebrate fauna habitat types: Drainage Line, Mulga/Mixed Acacia Shrubland and Stony Clay Plains. The Mulga/Mixed Acacia Shrubland habitat type (798.07 ha) is the most significant as it provides habitat for most species in the area and made up the largest part of the survey area apart from the Stony Clay Plains. These habitat types recorded during the survey are considered to be well represented outside the survey areas.
- Sixty-nine species were recorded from the survey area: 16 native mammals (including eight bats), six introduced mammals, 32 birds and 21 reptiles.
- The survey effort was determined to be adequate by species accumulation curve analysis returning 94-100% of trappable species richness recorded in trapping data.
- No significant fauna species were detected within the survey area.
- In addition to the species recorded, the likelihood assessment identified three significant fauna species (one EPBC listed species, one species listed under the BC Act and one species listed by DBCA as Priority) having a high likelihood to occur:
 - Grey Falcon (*Falco hypoleucos*, EPBC Act – Vulnerable)
 - Peregrine Falcon (*Falco peregrinus*, BC Act - OS)
 - Long-tailed Dunnart (*Sminthopsis longicaudata*, DBCA Priority 4)

ACRONYMS AND ABBREVIATIONS

Table 1: Acronyms and abbreviations

Acronyms	
BC Act	Western Australian <i>Biodiversity Conservation Act 2016</i>
BoM	Bureau of Meteorology
CD	Conservation Dependent (fauna; specially protected species under the Western Australian BC Act)
CR	Critically Endangered (listed under Commonwealth EPBC Act and/or Western Australian BC Act)
DAWE	Commonwealth Department of Agriculture, Water and Environment (2020-)
DBCA	Western Australian Department of Biodiversity, Conservation and Attractions
DPIRD	Western Australian Department of Primary Industries and Rural Development
DWER	Western Australian Department of Water and Environmental Regulation
EN	Endangered (listed under Commonwealth EPBC Act and/or Western Australian BC Act)
Ecoscape	Ecoscape (Australia) Pty Ltd
EP Act	Western Australian <i>Environmental Protection Act 1986</i>
EPA	Western Australian Environmental Protection Authority
EPBC Act	Commonwealth <i>Environment Protection and Biodiversity Conservation Act 1999</i>
GIS	Geographic Information System
GPS	Global Positioning System
ha	hectare/hectares
IBRA	Interim Biogeographic Regionalisation for Australia
km	kilometre/kilometres
m	metre/metres
MA	Marine species (fauna; protected under international agreements and EPBC Act)
MI	Migratory species (fauna; specially protected species under the Western Australian BC Act, also EPBC Act)
MNES	Matters of National Environmental Significance
OS	Other specially protected species (fauna; specially protected species under the Western Australian BC Act)
P; P1, P2, P3, P4, P5	Priority Flora and Fauna species rankings (P1-P4) or Priority Ecological Communities (P1-P5)
PMST	Protected Matters Search Tool (hosted by DAWE, used to search for MNES)
SoW	Scope of Work
SRE	Short Range Endemic
sp.	Species (generally referring to an unidentified taxon or when a phrase name has been applied)
subsp.	Subspecies (infrataxon)
VU	Vulnerable (listed under Commonwealth EPBC Act and/or Western Australian BC Act)
WAM	Western Australian Museum

1 INTRODUCTION

1.1 BACKGROUND

Sandfire Resources Limited (SFR) is an Australian mining company currently operating the DeGrussa Copper Mine located approximately 900 km north of Perth, between Meekatharra and Newman, in Western Australia. SFR is presently undertaking a feasibility study into a prospective mine site known as Old Highway, located approximately 18 km southwest of DeGrussa. The feasibility study is assessing the viability of connecting the Old Highway mine to the DeGrussa processing plant via an off-highway haul route. The Old Highway mine and haul route form the footprint of this fauna survey. The survey footprint intersects two Priority Ecological Communities: the Robinson Range Vegetation Complex (Banded Ironstone Formation) and Doolgunna Calcrete Groundwater Assemblage.

In 2019 Ecoscape was appointed to conduct a Reconnaissance flora and vegetation survey of the Old Highway Project area, since then the proposed disturbance envelope and haul road route between Old Highway and DeGrussa have been refined.

The Scope of Work was to undertake detailed fauna survey of the Old Highway Mine Area and Haul Route and included recording and collating sufficient information on fauna habitat and species assemblages that exist within the survey area, including;

- all sighting and evidence of fauna activity, and
- identify alternative routes (including buffers) for the proposed off highway haulage route where it intersects habitat of conservation listed fauna.

1.2 SURVEY AREA

The Old Highway Mine and Haul Route project area, known as the 'survey area' in this report, is located within the Shire of Meekatharra in the Gascoyne bioregion (**Figure 1**). The survey area is located approximately 125 km north from Meekatharra and 255 km south from Newman, corresponding with and on both sides of Great Northern Highway. The Survey area is 1317.58 ha in size and was predominantly comprised of Mulga shrubland and drainage lines occurring over stony clay plain.

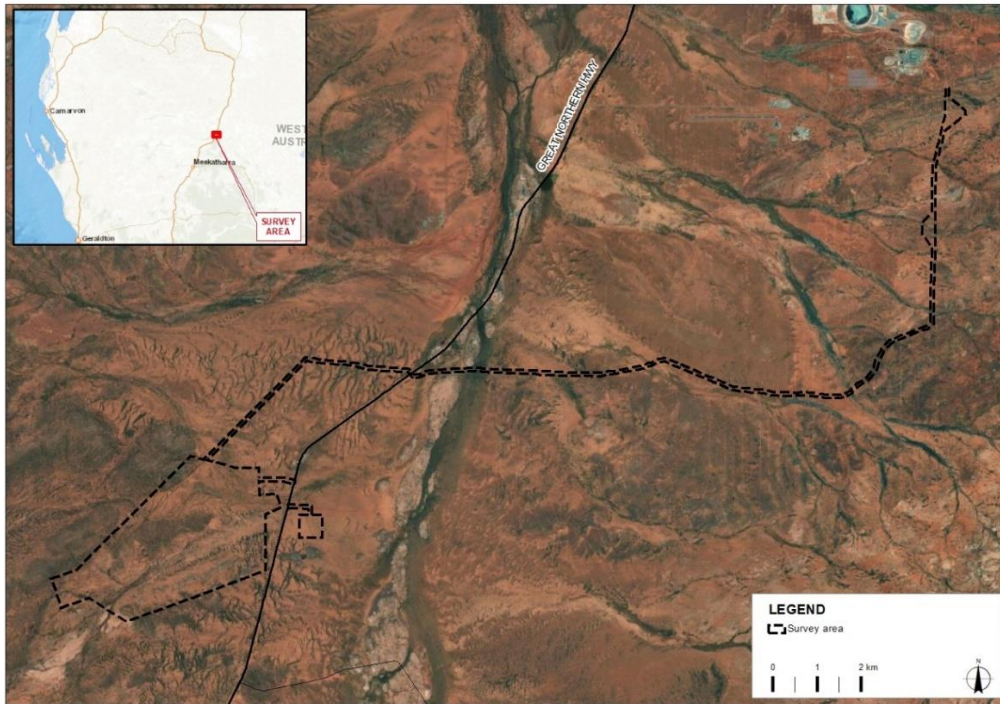


Figure 1: Survey area location

1.3 SURVEY REQUIREMENTS

The requirements of the survey were to conduct a Detailed fauna survey of the Old Highway Mine and Haul Route project area in accordance with the requirements outlined in the EPA *Technical Guidance – Terrestrial vertebrate fauna surveys for Environmental Impact Assessment* (EPA 2020a).

Detailed vertebrate fauna surveys consist of:

- installation and operation of systematic trapping sites;
- opportunistic collection and recording of fauna evidence including motion sensitive cameras (trail cameras); bat echolocation recorders and bird surveys, and
- targeted conservation significant fauna survey and habitat assessment.

The objective of the survey is to prepare a comprehensive and consolidated terrestrial vertebrate fauna and fauna habitat assessment report to support primary environmental approvals for the Project.

1.4 COMPLIANCE

This environmental assessment was conducted in accordance with Commonwealth and State legislation and guidelines:

- Commonwealth *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act)
- Western Australian *Environmental Protection Act 1986* (EP Act)
- Western Australian *Biodiversity Conservation Act 2016* (BC Act)
- Western Australian *Biodiversity Conservation Regulations 2018*
- Western Australian *Animal Welfare Act 2002*
- Department of Environment, Water, Heritage and the Arts (DEWHA 2009) *Matters of National Environmental Significance. Significant impact guidelines 1.1 - Environment Protection and Biodiversity Conservation Act 1999*
- Department of Sustainability Environment Water Population and Communities (DSEWPoC 2011a) *Survey guidelines for Australia's threatened mammals*

- DSEWPaC (DSEWPaC 2011b) *Survey guidelines for Australia's threatened reptiles*
- DEWHA (DEWHA 2010a) *Survey guidelines for Australia's threatened bats*
- DEWHA (DEWHA 2010b) *Survey guidelines for Australia's threatened birds*
- Threatened Species Scientific Committee (TSSC 2005) *Commonwealth Listing Advice on Northern Quoll (Dasyurus hallucatus)*
- Commonwealth of Australia (2016) *EPBC Act referral guidelines for the endangered Northern Quoll Dasyurus hallucatus*
- Department of Parks and Wildlife (2017) *Interim Guideline for Preliminary Surveys of Night Parrot (Pezoporus occidentalis) in Western Australia*
- TSSC (2016) *Conservation Advice Pezoporus occidentalis*.

Summaries of the main Acts under which this assessment was conducted, and related criteria and definitions, are available in **Appendix One**.

As well as those listed above, the assessment complied with Environmental Protection Authority (EPA) requirements for environmental survey and reporting in Western Australia, as outlined in:

- EPA (2020a) *Technical Guidance – Terrestrial vertebrate fauna surveys for environmental impact assessment*, known herein as the Fauna Technical Guidance
- EPA (2020b) *Statement of Environmental Principles, Factors and Objectives*.

Additional details (definitions and criteria) relevant to these works are available in **Appendix One**.

2 DESKTOP ASSESSMENT

2.1 PHYSICAL ENVIRONMENT

2.1.1 CLIMATE

The Old Highway survey area experiences a hot arid desert climate. According to the Köppen-Geiger climate classification, (Class BWh) the annual rainfall is generally less than 200 mm, or the region loses more water via evapotranspiration than it receives as rain; generally a result of hot, sunny weather without significant cloud (Peel, Finlayson & McMahon 2007). The mean average temperature exceeds 18°C, and summer temperatures are frequently over 40°C.

The closest Bureau of Meteorology (BoM) station with long term records is Neds Creek (BoM 2021, station number 7103 operating since 1947) located approximately 44 km east of the survey area. The mean annual rainfall is 235.5 mm, with 51.35% falling during the summer months (January to March).

The closest BoM station with long term temperature records is Meekatharra Airport (BoM 2021, station number 7045 operating since 1950) located approximately 134 km southwest from the survey area. January is the hottest month with a mean maximum temperature of 42.1°C and minimum of 34.1°C. June is the coldest month with a mean maximum of 23.3°C and minimum of 15.1°C.

Figure 2 shows the average rainfall and temperatures of the survey area, with rainfall for the six months preceding the field survey.

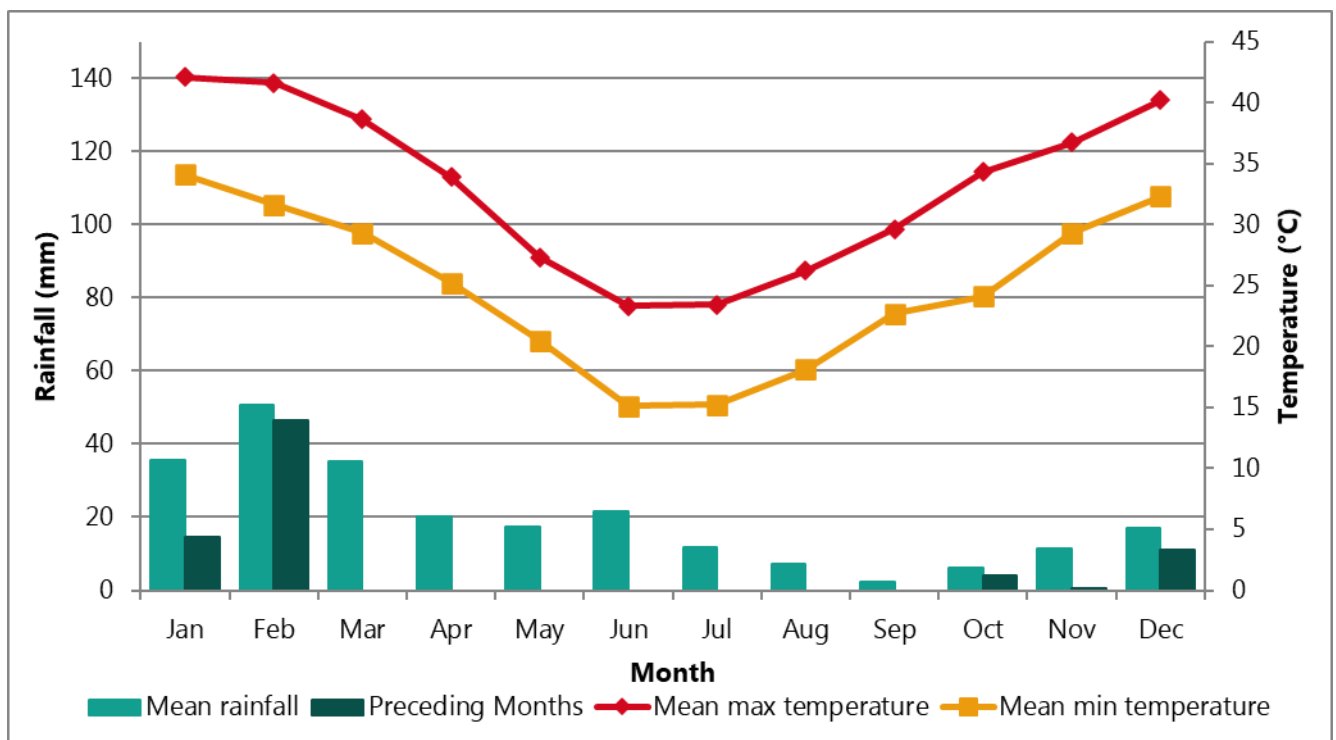


Figure 2: Rainfall and temperature data for the survey area

2.1.2 LAND SYSTEMS

According to the Department of Primary Industries and Rural Development (DPIRD 2020) soil landscape mapping, the following land systems intersect the survey area

Table 2 and Map 1).

Table 2: Land systems (DPIRD 2020)

Mapping unit	Land system	Description	Extent (ha)	%
293Be	Beasley System	Low ridges, hills and lateritised residuals above stony footslopes and broad, stony lower plains supporting scattered mulga and snakewood shrublands.	25.82	1.96
293Ho	Horseshoe System	Gently undulating stony plains and low rounded hills with partially saline drainage foci and alluvial tracts supporting <i>Acacia</i> and <i>Eremophila</i> tall shrublands, and chenopod low shrublands.	454.0	34.47
293Pe	Peak Hill System	Rugged, sinuous ranges and rounded hills of banded ironstone and hematitic shale, supporting stunted mulga and cottonbush shrublands.	1.12	0.09
295Fr	Frederick System	Hardpan wash plains with broad, reticulate mulga groves and wanderrie banks supporting acacia tall shrublands with grassy understorey.	141.81	10.77
295Tr	Three River System	Hardpan plains and minor sandy banks supporting sparse mulga shrublands.	681.72	51.75
295Wa	Warri System	Low calcrete platforms and plains supporting mulga and cassia shrublands and minor chenopod low shrublands.	12.76	0.97

2.1.3 WETLANDS AND DRAINAGE

The survey area is located in the Gascoyne River catchment (Landgate 2020). The survey area does not directly intersect any water features except for two non-perennial / intermittent minor drainage lines which are tributaries of the Gascoyne River South.

2.1.4 GROUNDWATER DEPENDENT ECOSYSTEMS

The Groundwater Dependent Ecosystems Atlas (Australian Government & Bureau of Meteorology 2020) indicates that there is a small portion of the survey area that is considered as having a medium potential for terrestrial GDEs to occur, with an IDE likelihood of 3 (low). The majority of the survey area is considered to have low potential for terrestrial GDEs to occur (IDE likelihood of 1).

2.1.5 ENVIRONMENTALLY SENSITIVE AREAS

The survey area does not directly intersect any ESAs. The two closest ESAs are situated 75 km to the north and 105 km to the east of the survey area, respectively. The closest ESA is associated with Collier Range National Park.

2.1.6 CONSERVATION LANDS

The survey area does not directly intersect any lands of conservation interest. Collier Range National Park is the closest conservation land (75km north) but is unlikely to be impacted by the proposal.

2.1.7 LAND USE HISTORY

Dominant land uses in the region include grazing (84.2%), Aboriginal (3.37%) and Crown reserves (9.76%) (DAWE 2020). The survey area shows evidence of pastoral and mining activity. The survey area is intersected by one major sealed road (Great Northern Highway) at one location.

2.2 BIOLOGICAL ENVIRONMENT

2.2.1 BIOGEOGRAPHIC REGION

Biogeographic regions are delineated on the basis of similar climate, geology, landforms, vegetation, and fauna assemblage and are defined in the Interim Biogeographical Regionalisation for Australia (IBRA) (DWAE 2020).

The survey area is located in the Gascoyne IBRA region in the Augustus subregion (Gas3), described as:

Rugged low Proterozoic sedimentary and granite ranges divided by broad flat valleys. Also includes the Narryera Complex and Bryah Basin of the Proterozoic Capricorn Orogen (on northern margin of the Yilgarn Craton), as well as the Archaean Marymia and Sylvania Inliers. Although the Gascoyne River System provides the main drainage of this subregion, it is also the headwaters of the Ashburton and Fortescue Rivers. There are extensive areas of alluvial valley-fill deposits. Mulga woodland with Triodia occur on shallow stony loams on rises, while the shallow earthy loams over hardpan on the plains are covered by Mulga parkland. A desert climate with bimodal rainfall. The subregional area for GAS3 is 10,687,739ha.

2.2.2 PRE-EUROPEAN VEGETATION

During the 1970s, John Beard and associates conducted a systematic survey of native vegetation, describing the vegetation systems in Western Australia at a scale of 1:250 000 in the south-west and at a scale of 1:1 000 000 in less developed areas.

Beard's vegetation maps attempted to depict the native vegetation as it was presumed to be at the time of settlement and is known as the pre-European vegetation type and extent. Beard's vegetation maps have since been developed in digital form by Shepherd, Beeston & Hopkins (2002) and updated by DPIRD (2019). Extents are updated every two years by DBCA (2019). This mapping indicates that the survey area intersects two pre-European vegetation units:

- Association 18: Low woodland (Mulga Acacia aneura and associated species)
- Association 29: Sparse low woodland (Mulga Acacia aneura), discontinuous in scattered groups.

The pre-European vegetation association/s identified from the survey area (DPIRD 2019) and their pre-European and current extents are listed in **Table 3** and shown on **Map 2**.

Table 3: Pre-European vegetation association representation (DBCA 2019a)

Region	Vegetation association	Original extent (ha)	Current extent (ha)	% remaining
Western Australia	18	19,892,306.46	19,843,148.07	99.75
	29	7,903,991.45	7,898,973.24	99.94
IBRA biogeographic region (Gascoyne)	18	3,273,579.72	3,271,339.12	99.93
	29	3,802,459.63	3,799,635.88	99.93
IBRA biogeographic sub-region (Augustus)	18	2,425,858.38	2,424,368.49	99.94
	29	2,188,768.66	2,185,968.53	99.87
LGA (Shire of Meekatharra)	18	3,117,900.46	3,111,264.68	99.79
	29	2,854,683.44	2,851,596.18	99.89

2.2.3 THREATENED AND PRIORITY FAUNA

Combined database search results for threatened and priority fauna are incorporated into **Table 14** in **Appendix Two** and are displayed on **Map 3**. Species identified by these database searches that are excluded from the field survey and further assessments (including likelihood assessments) are listed in **Table 15** along with the reason for their exclusion (e.g. marine species whose habitat does not occur within the survey area, invertebrates are not within the scope of the survey). Such excluded species are not further referenced in this document.

2.2.3.1 EPBC-listed Threatened Fauna

The *Protected Matters Search Tool* (PMST) search (DAWE 2021, search reference NR0JAJ using a 50 km buffer), identified the following as having been recorded or having potential to occur within the search area buffer:

- 2 mammals: 2 'species or species habitat may occur within area'.
- 6 birds: 3 'species or species habitat likely to occur within area', 3 'species or species habitat may occur within area'.

2.2.3.2 NatureMap

NatureMap (DBCA 2007-2021) is maintained collaboratively by the DBCA and the WAM. These records represent a combination of vouchered museum specimens and records obtained via the Fauna Survey Returns Database which are maintained by the DBCA.

The *NatureMap* search identified 202 vertebrate fauna species that have been recorded within the applied 40 km buffer area. Of these, six (two mammals and four birds) are conservation-listed.

2.2.3.3 DBCA Database Search

A search of the DBCA databases was conducted (search reference: 2020/000669#6630) using a 100 km buffer around central coordinates provided (25° 38' 52" S and 119° 09' 58" E). Nine conservation-listed species were identified as having previously been recorded from within the search area buffer, consisting of seven mammals and two bird species.

2.2.3.4 Threatened and Priority Fauna Likelihood Assessment

The likelihood of conservation-listed fauna species, as identified by the database and literature searches, occurring within the survey area was assessed using the following criteria:

- suitability of habitat types likely to be present within the survey area
- distance between previous record of conservation-listed species and the survey area
- frequency and number of records in the region
- date of record of conservation-listed species (recent or historical)
- the record is naturally occurring (not from a sanctuary or translocated population).

The following were also taken into consideration during the assessment:

- sufficiency of information
- behavioural and ecological characteristics such as cryptic behaviours, size, and mobility of species
- record certainty.

The categories of likelihood of occurrence (**Table 4**) were assessed using the above criteria. The following considerations are made:

- 25 years is herein nominated as 'recent'.
- Less than 50 km in this table is an example of 'close proximity'.
- 'Very low' distance would be equal to or a bit less than maximum search buffer.

Table 4: Categories for likelihood of occurrence of conservation-listed fauna

Likelihood	Category
Recorded	Species recorded within the survey area within a reasonable timeframe (0-25 years).
High	Species recorded in close proximity to the survey area (<50 km) within the past 25 years. Suitable habitat occurs within the survey area.
Medium	Species historically recorded in close proximity (<50 km) to the survey area but more than 25 years ago. However, suitable habitat may exist within the survey area.
Low	Species not recorded in the proximity of the survey area (<50 km) or rarely recorded within 75 km of the survey area. Suitable habitat unlikely to occur within the survey area.
Very Low	Species not recorded by multiple surveys/databases within 75 km of the survey area and suitable habitat does not occur within the survey area, however, species or suitable habitat is listed as potentially occurring in the wider region

The likelihood of species occurring within the survey area are provided (**Table 14** in **Appendix Two**). Two species were assessed as having a High likelihood of occurring within the survey area:

- *Sminthopsis longicaudata* (Long-tailed Dunnart)
- *Dasyercus blythi* (Brush-tailed Mulgara).

Likelihood of occurrence does not take into consideration factors such as frequency that a species occurs (or may occur), the duration that such species occupies (or may occupy) the survey area or dependence on habitat or resources within the survey area. Highly mobile species potentially only occur within (or for birds, overflying) the survey area for very brief periods and/or on very infrequent intervals. If a previous observation included in the database search records corresponds with this event it is listed as 'recorded'; if such a transient visitation is possible in the future, the likelihood of such species occurring is likely listed as 'high'.

Following the field survey, when actual survey area characteristics were better understood and the level of survey effort was considered, the likelihood of occurrence was re-evaluated. The post-survey likelihood is also incorporated into this table and discussed further (**Section 5.3**). This includes an indication of dependence of species on the habitat and resources available within the survey area.

2.2.4 FAUNA HABITAT

Ecoscape (2019a) recorded six habitat types within a distance of 140km north of the survey area (just north of Collier Range National Park).

- Low stony Hills/Hillslopes
- Mulga/Mixed Acacia shrubland
- Stony clay plain
- Stony Hummock grassland
- Sandy Hummock grassland
- Drainage line

None of these habitats was considered appropriate for any of the conservation listed species, with the exception of Hummock grasslands considered suitable for Brush-tailed Mulgara.

2.3 SRE DESKTOP ASSESSMENT

The SRE status of taxa is based on categories developed by the WAM (**Table 5**). These categories are used by taxonomists and consultants to describe the SRE status of taxa collected from the study area. The classifications are based on knowledge of the taxa (species or genus), distribution (if known) and the

representation of records in collections. Under the precautionary principle, taxa may be classed as potential SRE where there are information gaps.

Table 5: WAM SRE categories

	Taxonomic Certainty	Taxonomic Uncertainty
Distribution < 10 000 km ²	Confirmed SRE <ul style="list-style-type: none"> • A known distribution of <10 000km². • The taxonomy is well known. • The group is well represented in collections and/ or via comprehensive sampling 	Potential/Likely SRE <ul style="list-style-type: none"> • Patchy sampling has resulted in incomplete knowledge of the geographic distribution of the group. • We have incomplete taxonomic knowledge. • The group is not well represented in collections. • This category is most applicable to situations where there are gaps in our knowledge of the taxon.
Distribution > 10 000 km ²	Widespread (not an SRE) <ul style="list-style-type: none"> • A known distribution of >10 000km². • The taxonomy is well known. • The group is well represented in collections and/ or via comprehensive sampling. 	Sub-categories for this SRE designation are outlined below

2.3.1 SRE SUB-CATEGORIES

If a taxon is determined to be a 'Potential SRE', the following sub-categories will further elucidate this status.

A. Data Deficient:

Insufficient data available to determine SRE status.

Factors that fall under this category include:

- lack of geographic information
- lack of taxonomic information
- the group may be poorly represented in collections
- the individuals sampled (e.g. juveniles) may prevent identification to species level.

B. Habitat Indicators:

- habitat data is indicative (surrogate) of SRE status
- habitat is associated with SRE taxa (and vice versa).

C. Morphology Indicators:

- a suite of morphological characters are characteristic of SRE taxa
- morphological characters are known to be associated with SRE taxa and vice versa.

D. Molecular Evidence:

- molecular work has been undertaken on this taxon (or a close relative) and it may reveal patterns congruent or incongruent with SRE status.

E. Research & Expertise:

- previous research and/ or WAM expertise elucidates taxon SRE status
- expert knowledge held within the WAM.

Table 6: SRE categories used

SRE category	Criteria	Typical representatives
Confirmed	Confirmed or almost certainly SRE; taxonomy of the group is well known (but not necessarily published); group well represented in collections, in particular from the region in question; high levels of endemism in documented species; inference is often possible from immature specimens.	<i>Antichiropus</i> millipedes (Paradoxosomatidae); scorpions in the genus <i>Aops</i> (Urodacidae)
Likely	Taxonomically poorly resolved group; unusual morphology for the group (i.e. some form of troglomorphy); often singleton in survey and few, if any, regional records.	Opiliones in the genus <i>Dampetrus</i> ; some pseudoscorpions (<i>Synsphyronus</i>) and slaters (Philosciidae); araneomorph spiders in the genus <i>Karaops</i> (Selenopidae)
Potential	Taxonomically poorly resolved group; often common in certain microhabitats in SRE surveys (i.e. litter dwellers), but no other regional records; congeners often widespread.	Many mygalomorph spiders; some centipedes (Cryptopidae; Geophilomorpha)
Widespread/Not SRE	Taxonomically well resolved (but often not published) and demonstrated wide distribution (i.e. > 10,000 km ²)	Many spiders (not mygalomorphs), centipedes or some scorpions (<i>Cercophonius sulcatus</i>)

All females and juveniles of species that cannot be identified to species level are required to be treated as 'potential SRE' under the precautionary principle. In addition, all likely, potential, and unknown SREs should be treated as confirmed SREs under the precautionary principle (Section 4a of the Western Australian EP Act).

2.3.2 DATABASE SEARCHES

Three WAM databases were accessed for previous records of potential SRE species (Table 7).

Table 7: Invertebrate fauna database search details

Database	Custodian	Search Details
Arachnida/ Myriapoda	Western Australian Museum	Search area polygon: North-western corner- -25.483872 °S, 119.041062 °E South-eastern corner- -25.764906 °S, 119.370818 °E Search reference: 4621-21 Date: 27/04/2021
Mollusca	Western Australian Museum	Search area polygon: North-western corner- -25.483872 °S, 119.041062 °E South-eastern corner- -25.764906 °S, 119.370818 °E Search reference: 4621-21 Date: 27/04/2021
Crustacea	Western Australian Museum	Search area polygon: North-western corner- -25.483872 °S, 119.041062 °E South-eastern corner- -25.764906 °S, 119.370818 °E Search reference: 4621-21 Date: 27/04/2021

2.3.3 DATABASE RESULTS

Database searches returned a total of 19 terrestrial invertebrate species (**Table 8**) that may occur within the survey area:

- 9 spider species including two of the infraorder Mygalomorphae (Trapdoor Spiders)
- 6 scorpion species
- 2 pseudoscorpion species
- 1 centipede species
- 1 troglodyte isopod species.

None are currently regarded as short-range endemic and are categorised as potential SRE species (**Table 6**). The records are presented on **Map 3**.

Table 8: WAM combined database search results

Regno	Family	Genus	Species	Form	Date
99671	Anamidae	<i>Kwonkan</i>	`MYG164`	Trapdoor Spider	13/11/2009
75377	Araneidae	<i>Araneus</i>	<i>psittacina</i>	Orb Spider	21/08/1989
99681	Idiopidae	<i>Gaius</i>	<i>villosus</i>	Trapdoor Spider	14/11/2009
99682	Lycosidae	<i>Hoggicosa</i>	<i>bicolor</i>	Wolf Spider	15/11/2009
77335	Lycosidae	<i>Venator</i>	`sp. (VWF159)`	Wolf Spider	5/08/2006
109834	Salticidae	<i>Cytaa</i>	`sp.`	Jumping Spider	21/08/1989
22450	Sparassidae	<i>Neosparassus</i>		Huntsman Spider	21/08/1989
22451	Sparassidae	<i>Neosparassus</i>		Huntsman Spider	21/08/1989
100062	Zodariidae			Ant Spider	6/11/2009
99687	Olpidae	<i>Indolpium</i>		Pseudoscorpion	9/11/2009
100063	Olpidae	<i>Indolpium</i>		Pseudoscorpion	6/11/2009
88763	Scolopendridae	<i>Scolopendra</i>	<i>laeta</i>	Centipede	15/07/2007
99695	Buthidae	<i>Isometroides</i>		Spider hunting Scorpion	6/11/2009
99992	Buthidae	<i>Lychas</i>	<i>annulatus</i>	Scorpion	6/11/2009
99694	Buthidae	<i>Lychas</i>	`Meeka`	Scorpion	6/11/2009
99699	Buthidae	<i>Lychas</i>	`Meeka`	Scorpion	6/11/2009
99994	Buthidae	<i>Lychas</i>	`Meeka`	Scorpion	6/11/2009
99700	Urodacidae	<i>Urodacus</i>	`sp. indet. (juvenile)`	Scorpion	6/11/2009
51640	Armadiillidae	<i>Troglarmadillo</i>	`sp. ISO008`	Troglifauna Isopod	-

The database records are 12 years of age or older and are most likely a result of targeted surveys. Information pertaining to the habitat preferences for these potential SRE species is limited and broad. It is therefore possible that habitat exists within the survey area that could support the listed species, as a precautionary assessment. The level of disturbance to habitat caused by roaming cattle, exploration activities and fire regimes is likely to impact on potential SRE species presence to some level. A targeted survey is necessary to determine impact and their presence.

There was a single troglifauna record indicating a belowground sampling event.

2.4 PREVIOUS SURVEYS

Five previous surveys were identified as having been conducted in areas corresponding with the survey area or sufficiently close to provide contextual information.

2.4.1 IBSA DATA SEARCH

The Department of Water and Environmental Regulation's (DWER's) *Index of Biodiversity Surveys for Assessments (IBSA)* Portal (DWER 2021) was searched for recent environmental surveys in the vicinity of the survey area.

The search, conducted on 3/06/2021, identified four environmental surveys that have been conducted within 150 km of the survey area. Three of these listings did not have data accessible for review (i.e. contained metadata only). The following documents had relevance to the current survey:

- Eco Logical (2019) Billabong Gold Flora and Fauna Survey. Detailed and targeted flora survey and level 1 fauna survey (approx. 30km from survey area)
- Maia (2020) Labouchere Survey Area. Level 1 Reconnaissance and Targeted Flora Survey (approx. 100km from survey area)
- Ecoscape (2019b). Butcherbird Manganese Project -Flora and Vegetation assessment. Reconnaissance and detailed flora and vegetation survey (approx. 140km from survey area)
- Ecoscape (2019c). Butcherbird Manganese Project -Fauna assessment. Level 1 Fauna, Level 2 and targeted terrestrial fauna and short-range endemic (SRE) survey (approx. 140km from survey area)
- Enviroworks Consulting (2011) Flora, Vegetation and Fauna habitat survey Butcher Bird Exploration Area (approx. 140km from survey area).

2.4.2 OTHER LITERATURE

No other documents have been located that provide contextual information for this assessment.

3 METHODS

3.1 SURVEY AIMS

The aims of the Detailed fauna survey were to:

- assess the likelihood of occurrence of any of the conservation-listed species within the survey area through:
 - Desktop study
 - Trapping of fauna and species evidence (trapping grids, camera traps, ultrasonic recorders)
 - Observational data (Bird surveys, tracks/scats, and traces)
 - Habitat assessments
- assess the habitat types located within the survey area
- identify possible alternative routes for the old highway haulage route if it intersects with potential habitat for any of the conservation listed species.

3.2 GUIDING PRINCIPLES

The fauna and fauna habitat survey was conducted as a detailed survey according to the Fauna Technical Guidance (EPA 2020a). The EPA recommends a detailed survey:

- should be conducted to gather quantitative data on species, assemblages, and habitats
- requires a comprehensive survey design including at least two survey phases
- is conducted during the appropriate season of maximum activity of relevant fauna
- uses techniques to maximise the likelihood that a survey will detect the majority of species that occur
- uses techniques that are quantitative and standardised
- includes at least one trapping site per habitat type to permit analysis and comparison of data.

Targeted surveys were also conducted to gather information on significant fauna and/or habitats.

3.3 FAUNA FIELD SURVEY

The methods utilised during the field survey followed those outlined in the Fauna Technical Guidance (EPA 2020a) conducted as a detailed survey. Conservation criteria used in this assessment are included in **Table 11** in **Appendix One** and **Table 12** in **Appendix One**. Survey method details are outlined below.

3.3.1 SURVEY METHODS

A detailed fauna survey requires a comprehensive methodology to gather quantitative data for as many suites of species as possible, from all habitat types. The methods incorporated into this survey were:

- **Reptiles and Amphibians:** microhabitats favoured by reptiles and amphibians were actively searched, including raking of leaf litter and soil in favoured habitats, searching in rock pile and under and inside fallen timber.
- **Birds:** all bird species opportunistically observed inside the survey area were recorded. Daily 20 minute surveys (520 hours in total) were conducted at each systematic trapping location by an experienced ornithologist. Surveys were conducted during optimal periods of bird detectability (early morning and late afternoon) as per Birdlife Australia standard methodology.
- **Mammals:** mammals observed during the above surveys and opportunistically were recorded. Tracks, scats, and other traces of mammals were noted and identified where possible.
- **Targeted Fauna Searches:** habitat that may support conservation-listed or otherwise significant fauna species potentially occurring in the survey area (as identified by database searches) were targeted during the survey. Specific details are provided below.

- **Trail Cameras:** Reconyx Hyperfire HC 500 trail cameras were deployed at significant fauna species sites and within habitat considered likely to be suitable for conservation-listed fauna species. Cameras were left *in situ* for seven nights.
- **Bats:** Bat echolocation recording units [Wildlife Acoustics Songmeter SM4 fitted with an ultrasonic microphone SMX-U1, one unit per trapping grid] were deployed to capture bat species present within the survey area. Bat recorders were left *in situ* for seven nights. Bat call analysis was completed by Dr Kyle Armstrong of Specialised Zoological.
- **Systematic Trapping Grids**, consisting of:
 - 20 L bucket: these are dug into the ground and act as pitfall traps. A 10 m-long, 30 cm-high fence was passed across the top of the pit to direct fauna into it. Trapping grids comprised 10 such traps.
 - Fraser-type funnel traps: similar to yabby traps, these were placed at the ends of each fence to capture fauna that do not readily fall into pit traps (20 per trapping grid). All funnel traps were covered by industrial insulation shades to reduce the likelihood of animals suffering from exposure.
 - Elliott traps: medium size aluminium box traps were baited with 'universal bait' (a mix of oats, peanut butter, and sardines) to attract and capture small mammals (10 per trapping grid) and re-baited every second day or as needed. All Elliott traps were shaded to reduce the likelihood of animals suffering from exposure.
 - Cage traps: large Sheffield wire-frame box traps, also baited with 'universal bait', to capture medium-sized mammals (two per trapping grid). All cage traps were covered by hessian shades to reduce the likelihood of animals suffering from exposure.

Trapping grid design is indicated in **Figure 3**.

Overhead View of Trapping Grid

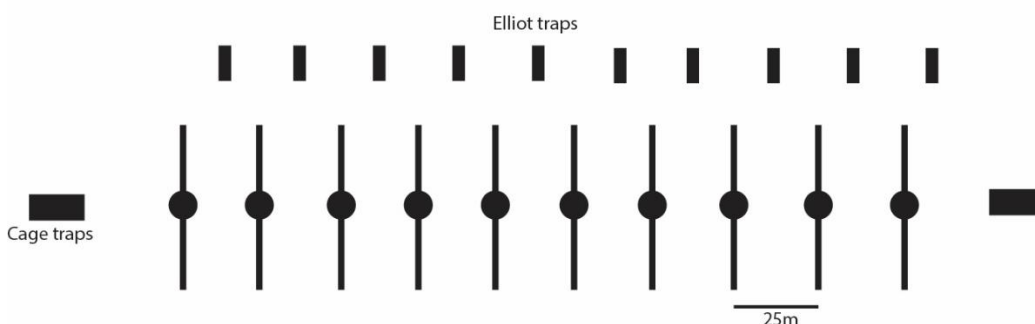


Diagram of arrangement of traps

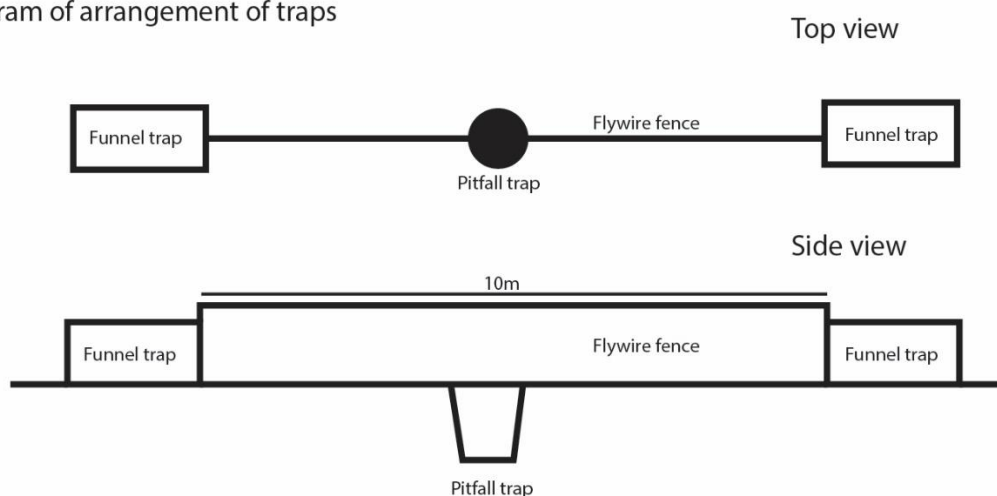


Figure 3: Systematic trapping array consisting of pitfall traps, Fraser-type funnel traps, Elliott traps and cage traps

3.3.1.1 Fauna Habitat Assessment

The fauna habitats present within the survey areas were identified and mapped. Fauna habitats were described as an area which is distinguishable from its surrounding area by its landform, vegetation and fauna assemblage occupying the area. In addition, its likelihood to harbour specialised fauna species which are not found in adjacent areas was taken into consideration.

The following information was used to identify and map all fauna habitats within the survey area:

- previous fauna habitat mapping
- land systems
- vegetation type and condition mapping
- aerial imagery
- landforms
- soil characteristics
- fauna assemblage information.

The composition and characteristics of each fauna habitat type was recorded, including noting suitability for various fauna suites or conservation-listed species. Habitat types were delineated in the field and digitised upon return from the field survey.

3.3.2 TARGETED SURVEY METHODS

Targeted species-specific surveys were not incorporated in the scope of this survey, however, we make note of a few species of conservation interest below as these were described in the desktop study to potentially occur within a certain radius of the survey area.

3.3.2.1 Greater Bilby Survey Methods

Greater Bilby (*Macrotis lagotis*; EPBC Act VU)

Although the PMST report indicated that Greater Bilby (*Macrotis lagotis*) may occur within 50km of the survey area, the survey area did not comprise suitable habitat for this species.

3.3.2.2 Malleefowl Survey Methods

Malleefowl (*Leipoa ocellata*; EPBC Act VU)

Although the PMST report indicated that Malleefowl (*Leipoa ocellata*) is likely to occur within 50km of the survey area, the survey area did not comprise suitable habitat for this species.

3.3.2.3 Shield-backed Trapdoor Spider

Shield-backed Trapdoor Spider (*Idiosoma nigrum* EPBC Act VU)

The survey did not include short-range endemic invertebrates however we make note that although burrows were found and photographed, no spiders were collected. Presence was inferred based on burrow morphology.

4 FIELD SURVEY RESULTS

4.1 VERTEBRATE FAUNA SURVEY

The fauna survey was conducted by Bruce Turner (Principal Zoologist), Hugh Osborn (Zoologist) and Sam Rycken (Zoologist) during 8/04/2021 – 15/04/2021. The survey was conducted in accordance with the requirements for a detailed survey as outlined in the Fauna Technical Guidance (EPA 2020a). The survey also complied with the conditions of *Fauna Taking (Biological Assessment) Licence* Number BA27000410.

The entire site was traversed by vehicle and on foot and all habitats were assessed for quality and capability of supporting both locally common and significant fauna species.


4.1.1 FAUNA HABITAT



Three fauna habitat types were recorded within the survey area (**Table 9**):

- Mulga/Mixed Acacia shrubland
- Stony clay plains and low ridges (gibber/boulders)
- Drainage Line (occurring at several locations throughout the survey area)

The quality of each habitat type was based on the field surveyor's experience and takes into consideration the level of disturbance to habitats from weeds, the amount of native vegetation, vegetation cover (density) and the context of the habitat with the surrounding landscape. Twenty-five habitat assessment sites are listed in **Table 17** in **Appendix Three**.

Table 9: Fauna habitat types

Habitat type	Description	Photograph
Mulga/Mixed Acacia shrubland	<p>The Mulga/Mixed Acacia shrubland covers a large part of the survey area and is dominated by clay loam plains. It comprises medium height, moderately dense Mulga species (<i>Acacia</i> spp.) over other mixed shrub species. Grass cover is variable and includes various weeds.</p> <p>Extent: 798.07 ha; 60.56%</p>	

Habitat type	Description	Photograph
Stony clay plains and ridges (gibber/boulders)	<p>The stony clay plains and ridges habitat type is widespread throughout the survey area and consisted of clay-loam plains often with scattered gravel/gibber and even boulders at a few sites. Mulga shrubs and other mixed shrubs were sparsely dotted across this habitat type. Grass cover was extremely sparse to non-existent.</p> <p>Extent: 314.94 ha; 23.9%</p>	
Drainage Line	<p>Drainage lines occurred at various points throughout the survey area, they comprised eucalypt woodland consisting of Mulga (<i>Acacia</i> spp.) and tall white gum trees (<i>Corymbia</i> spp.) over mixed shrubs and grasses. This habitat type predominantly occurred on clay/sandy soils.</p> <p>Extent: 154.8 ha; 11.75%</p>	
Cleared	<p>Not habitat</p> <p>Extent: 49.92 ha; 3.79%</p>	

Mulga/Mixed Acacia shrubland (798.07 ha)

Mulga/Mixed Acacia shrubland occurred across the survey area covering a total of 60.56% of the combined survey extents (1,317.73 ha) (**Map 4**). This habitat type consists of clay-loam plains with a vegetation cover comprising moderately dense Mulga woodland (*Acacia* spp.) over mixed shrubs and grasses/weeds. Habitat features consist predominantly of banded Mulga groves with higher densities of wood and leaf litter associated with these features.

Terrestrial fauna and bird assemblages of this habitat consist of generalist species commonly associated with this type of woodland within the Gascoyne region. Commonly recorded species include *Ctenotus pantherinus*, *C. helenae*, *C. leonhardii*, *Gehyra variegata*, *Lucasium stenodactylum*, *Strophurus wellingtonae* and *Ctenophorus isolepis*. In addition, due to the occurrence of tree hollows, arboreal hollow specialists such as *Egernia depressa* and *Varanus caudolineatus* can be found as well. Mulga groves are known to support bird species such as Red-capped Robin, Chestnut-rumped Thornbill, Crested Bellbird, White-browed Babbler, Mulga Parrot and Zebra Finch.

No EPBC listed threatened fauna are specifically associated with this habitat type within the Augustus IBRA sub-region. The Peregrine Falcon (*Falco peregrinus*; OS - BC Act) may utilise this habitat type for foraging purposes and has been recorded within the vicinity of the survey area (4.6 km). Long-tailed Dunnart (*Sminthopsis longicaudata*; DBCA Priority 4) are known to occupy similar habitat types within the wider Gascoyne and southern Pilbara region and occur within the DBCA database search as having been recorded

in the vicinity of the survey area (20 km). Brush-tailed Mulgara (*Dasycercus blythi*; DBCA Priority 4) may utilise the Mulga/ Mixed Acacia shrubland, however, as no *Triodia basedowii* (spinifex) is found within the survey area its occurrence is deemed unlikely.

The Mulga/Mixed Acacia shrubland does provide habitat for SRE species such as Trapdoor Spiders (infraorder Mygalomorphae) and Scorpions (order Scorpiones) in association with leaf litter beds (although not covered within this survey design).

Stony clay plains and ridges (314.94 ha)

The dominant habitat type occurring within the survey area is the Stony clay plain and associated ridges of similar composition and structure that occur at the western and eastern edges of the survey area. This habitat type is predominantly comprised of clay-loam plains often with gravel/ gibber to stones. Vegetation consists of sparsely spread-out mulga and other mixed shrubs over extremely sparse to non-existent grasses/weeds.

Terrestrial vertebrate fauna associated with this habitat type include commonly recorded species such as *Varanus gouldii*, *Ctenotus leonhardii*, *Ctenophorus isolepis*, and *Gehyra variegata*. Bird species typically recorded within this habitat type include commonly encountered species such as Crested Pigeon and Torresian Crow.

According to the DBCA database search results, the Peregrine Falcon (*Falco peregrinus*; OS - BC Act) has been previously recorded in the vicinity (4.6 km) of the survey area and might be opportunistically recorded whilst foraging although nesting is unlikely. Brush-tailed Mulgara (*Dasycercus blythi*; DBCA Priority 4) is known to move through this habitat type in transit to areas of more suitable habitat though is unlikely to be resident due to the lack of dense ground stratum vegetation (e.g. *Triodia basedowii*) and disturbance caused by trampling by roaming cattle.

Drainage line (154.8 ha)

The Drainage line habitat type occurs at several points throughout the survey area and is defined by semi-closed woodland consisting of tall trees (*Corymbia* spp.) and Mulga (*Acacia* spp.) over mixed shrubs and grasses/weeds on clay/loamy soil.

Terrestrial fauna and bird assemblages for this habitat type are similar to the Mulga/Mixed Acacia shrubland habitat that lie adjacent and consist of generalist species commonly occurring in these habitats. Similar to the Mulga/Mixed Acacia shrubland habitat, this habitat type allows for arboreal specialists such as *Egernia depressa* and *Varanus caudolineatus* and *Hirundo nigricans*. Higher bird species abundance (i.e., passerine birds) is likely associated with this habitat type.

4.1.2 FAUNA ASSEMBLAGE

Sixty-nine vertebrate fauna species were recorded during the survey (**Table 16 in Appendix Three**), consisting of:

- 16 mammals (6 introduced)
- 32 birds
- 21 reptiles/amphibians

Survey sites are listed in **Table 17 Appendix Three and displayed on Maps 4A to 4I**.

4.1.3 SIGNIFICANT FAUNA AND ASSOCIATED HABITAT

No significant fauna species were observed during the field survey, significant species were recorded within the DBCA database search and are taken into consideration in the Discussion.

4.1.4 FAUNA HABITAT ANALYSIS

A hierarchical cluster and a non-metric Multidimensional Scaling (NMDS) of the systematic trapping data from the four trap sites spread across the different habitat types within the Old Highway survey area was performed to understand the similarity between the habitat types.

Figure 4 shows the results from the analysis of terrestrial data (mammals, reptiles) in the form of a hierarchic cluster dendrogram. Sites SFG1 and SFG2 were most strongly related in terms of faunal assemblage. These sites are both of the Mulga/Mixed *Acacia* shrubland habitat type (Mulga grove). Most of the terrestrial fauna species were recorded at these sites as this habitat occurs more widely in the survey area compared to the drainage lines. This trend is most evident within **Figure 5** which shows the Non-parametric Multidimensional Scaling (NMDS) diagram.

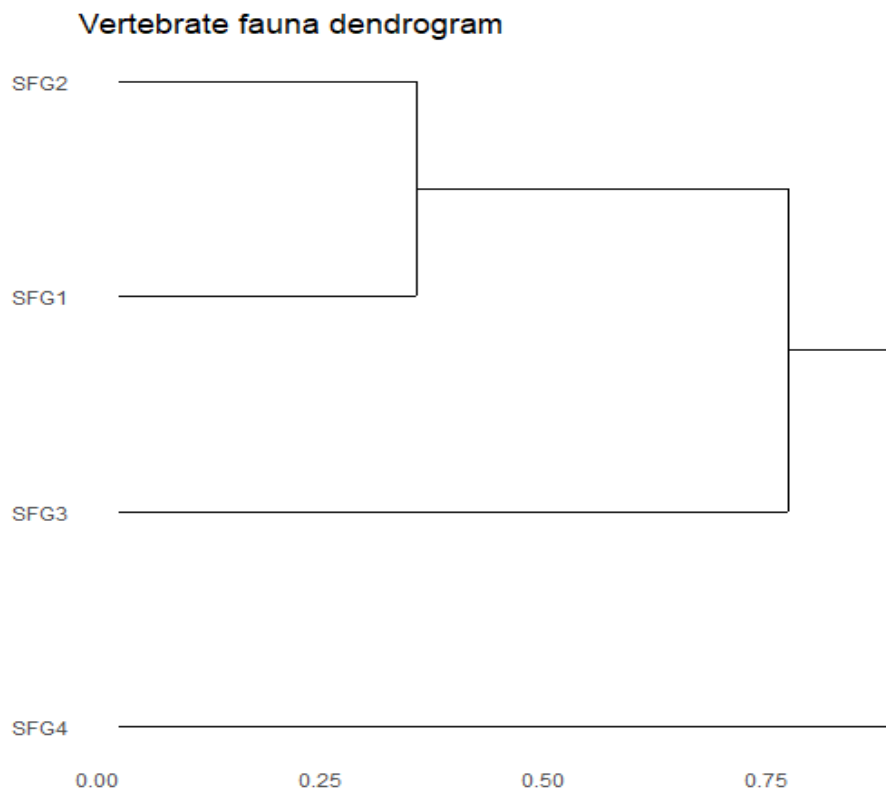


Figure 4: Vertebrate fauna dendrogram showing the fauna assemblage for all systematic trapping sites within the Old Highway survey area

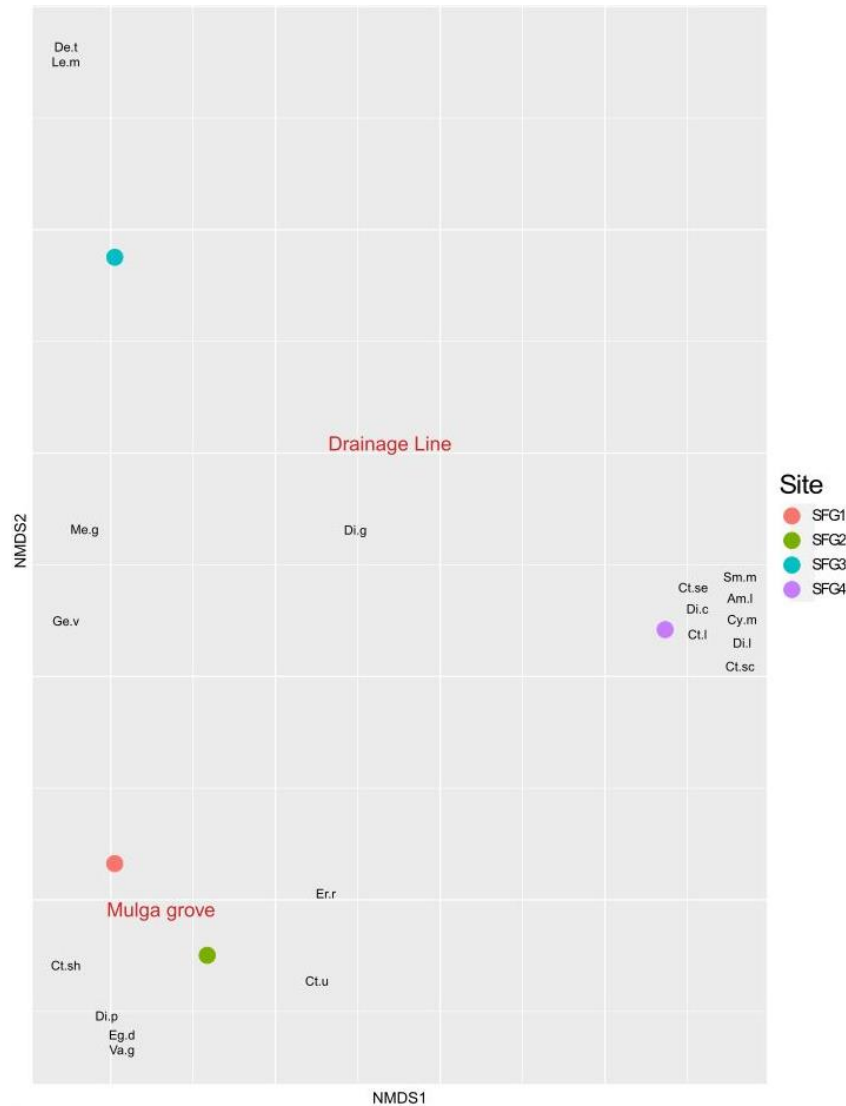


Figure 5: Vertebrate fauna diagram showing affiliation of recorded species at the systematic trapping sites to their recoded habitat within the Old Highway survey area. Large dots represent trapping site, while large red text represents habitat type. Small black text represents individual species

4.1.5 ADEQUACY OF SAMPLING

To determine survey adequacy for terrestrial vertebrate fauna, all systematic (trapping) data was combined to produce sample-based species accumulation curves (A. obvs) (**Figure 6**). Species richness was predicted using Chao1 and ACE richness curves. Total number of species trapped across the four systematic trapping sites within the survey area was 19. The randomised species accumulation curve (S.obvs) appears to be nearing the curve asymptote suggesting appropriate sampling effort was invested to record a large proportion of trappable species present. The Chao1 species richness indicator predicted a total of 18 species to be present across all survey sites and the ACE species richness indicator predicted 19 species. These results suggest 94.7-100% of trappable species richness was recorded in trapping data.

Both species richness curves estimated a similar number of species to the recorded species number for all sites and we can therefore conclude that sampling effort was adequate.

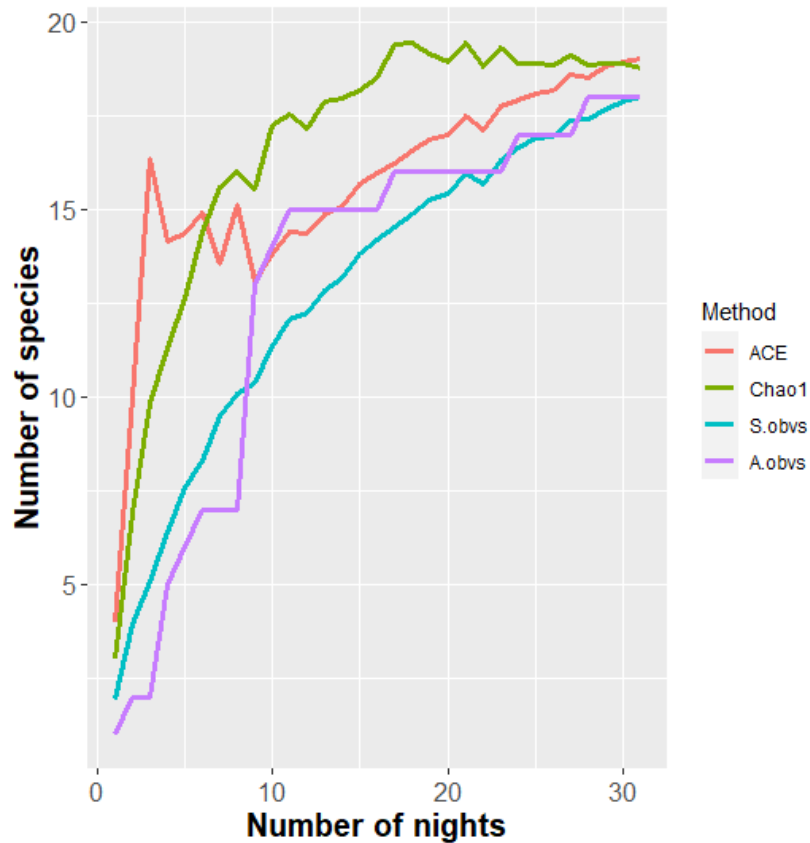


Figure 6: Species accumulation curves from the four live trapping sites located within the Old Highway survey area. The purple line represents species accumulation curve based on the actual sequence of species recorded through time (A.obvs). The blue represents a randomized species accumulation curve (S. obvs). The green line represents a Chao1 species richness curve. The red line represents an Abundance-based Coverage Estimator (ACE) richness curve

4.1.6 FAUNA SURVEY LIMITATIONS

No significant survey limitations were encountered during the level 2 assessment of the survey area (Old Highway and Haul Road) (**Table 10**). All habitat sites were defined and assessed for suitability for use by significant fauna.

Table 10: Fauna survey limitations

Possible limitations	Constraints (yes/no): Significant, moderate or negligible	Comment
Availability of data and information		
Competency/experience of the survey team, including bioregion experience	No	All key field survey staff were experienced with the fauna survey methods used and with the identification of Gascoyne fauna and fauna habitat
Scope of survey e.g. excluded fauna groups	No	All faunal groups included within the survey scope were adequately sampled and no sampling methods were constrained due to external factors.
Timing, weather, season	No	The survey was conducted in April with moderate temperatures and rainfall throughout the survey period and were considered not to effect sampling effort. Rainfall was quite high in February and January, and we therefore did not consider

Possible limitations	Constraints (yes/no): Significant, moderate or negligible	Comment
		the detection of Night parrots and bats to be less effective
Disturbances that may have affected results	No	No significant disturbances were observed that could negatively affect survey results.
Proportion of fauna identified, recorded, or collected	No	The majority of fauna species that are expected to occur within the Survey Area were recorded during the Level 2 survey completed within the Survey Area. This however did not include any species associated predominantly with <i>Triodia basedowii</i> (spinifex) as it did not occur within the survey area.
Adequacy of survey intensity and proportion of survey achieved	No	All habitat types within the survey area were surveyed through trapping grids and opportunistic/active searches.
Access	No	No access restrictions were encountered. All habitat types were able to be assessed throughout the survey area and a suitable geographic spread of site locations was achieved.
Data and analysis issues including sampling biases	No	No data analysis issues were encountered and sampling bias was removed through strict trapping protocols across the different habitat types and the training and experience of the key field staff.

5 DISCUSSION

5.1 FAUNA SIGNIFICANCE

5.1.1 FAUNA HABITAT TYPES

Twenty-five habitat assessment points were taken within the combined survey area to assess its fauna habitat. Habitat assessment sites are listed in **Table 17** in **Appendix Three** and displayed on **Maps 4A to 4I**.

Three fauna habitat types were recorded during the field survey (**Section 4.1.1**):

- Mulga/Mixed Acacia shrubland (798.07 ha)
- Stony clay plain (314.94 ha)
- Drainage Line (154.8 ha)

The habitat types recorded for this survey were typical for the Augustus IBRA sub-region. No Hummock Grassland habitat was found within the Survey area. This habitat type represents potential habitat for Brush-tailed Mulgara (DBCA Priority 4) as well as other significant fauna species that were identified in the wider region by DBCA database records, such as the Greater Bilby (EPBC Act Vulnerable). Greater Bilby habitat is defined as hummock grasslands with an overstorey of *Melaleuca* and *Acacia* species (DSEWPaC 2011a). Although Malleefowl was recorded within the DBCA database, the habitat types recorded within the survey area were not deemed suitable for this species.

5.1.2 FAUNA ASSEMBLAGE

Sixty-nine vertebrate fauna species were recorded during the field survey (**Section 4.1.2**). No fauna species listed under any category of the EPBC Act 1999 were recorded in the study area.

Sampling adequacy analysis indicated that 95-100% of predicted species richness was achieved by the trapping survey indicating that survey effort was adequate and an accurate reflection of the existing fauna species assemblage for the survey area.

5.2 CONSERVATION LISTED SPECIES

The likelihood of conservation significant fauna to occur within the study area is assessed and summarised in **Appendix Two**. A total of three species; one EPBC listed species, one species listed under the BC Act and one species listed by DBCA as Priority having a high likelihood to occur within the study area. These species are as follows:

- Grey Falcon (*Falco hypoleucos*, EPBC Act – Vulnerable)
- Peregrine Falcon (*Falco peregrinus*, BC Act - OS)
- Long-tailed Dunnart (*Sminthopsis longicaudata*, DBCA - Priority 4).

5.2.1 GREY FALCON

Distribution of the Grey Falcon comprises most of the mainland of Australia, and its habitat is attributed to Acacia shrubland and inland drainage systems. Nesting occurs predominantly along tree-lined watercourses. The species hunts other birds for food and is known to hunt out in more treeless areas in winter. As no watercourses occurred within the survey area it was deemed unlikely for this species to nest within the survey area, however it is possible for this species to pass through the area at certain times of year (Olsen & Olsen 1986).

No Grey Falcons were recorded during the field survey.

5.2.2 PEREGRINE FALCON

Peregrine Falcons are widespread, although low in numbers, and are habitat generalists (grasslands, woodlands, tall structures) (Atlas of Living Australia 2021) thus may occur in any area, particularly young birds

that are not yet breeding. However, the lack of rocky cliffs or significant rocky outcrops preferred for breeding (Simpson & Day 2004) indicates that this species is unlikely to be resident in the survey area.

No Peregrine Falcons were recorded during the field survey.

5.2.3 LONG-TAILED DUNNART

The Long-tailed Dunnart's distribution overlaps with the survey area and the species are known to occur within rocky and stony landscapes comprising low open Mulga woodland over hummock grassland and shrubs. The lack of consistent grassland and shrubs indicate that the habitat occurring within the survey area might not be ideal for long-tailed Dunnarts (Pavey 2006) and the disturbance caused by cattle trampling is also a contributing factor.

No Long-tailed Dunnarts were recorded during the field survey.

5.2.4 RECORDED CONSERVATION-LISTED SPECIES

No conservation listed species were recorded during the surveying period within the survey area. The sampling effort was deemed sufficient as the derived species accumulation curves indicate (**Figure 6**). The survey area did not include suitable habitat for the conservation listed species previously recorded by DBCA within the survey area.

5.3 **POST-SURVEY LIKELIHOOD ASSESSMENT**

The post-survey likelihood assessment is incorporated into **Table 14** in **Appendix Two**.

Conservation-listed fauna species identified during the desktop assessment as having a High or Medium likelihood of occurring that were not recorded during the field survey are discussed below with respect to each species' habitat requirements, taking into consideration the findings of the field survey and survey effort.

High Likelihood Species

Grey Falcon – EPBC status (VU)

As per above, the likelihood of recording this species within the survey area was changed from High to Low considering the habitat within the survey area indicated that the species would only occur as a vagrant species.

Peregrine Falcon – BC status (OS)

Similar to the Grey Falcon, no ideal nesting habitat occurred within the survey area for this species. Therefore, the possibility of this species to seasonally occur within the survey area as resident was deemed to be Low.

Long-tailed Dunnart – DBCA status (P4)

As per above, the post-survey likelihood for this species was changed from High to Medium as the habitat occurring within the survey area was suspected to be not ideal for this species.

5.4 **SRE DESKTOP ASSESSMENT**

The desktop investigation identified 19 records of potential SRE species occurring within the previous 25 years outside of the survey area (**Table 8** and **Map 3**). The likelihood of these potential SRE species occurring is assumed to be possible as little is known of preferred habitats and the level of impact from trampling and fire is also unknown, however several Trapdoor Spider burrows were observed within the trapping grids during the survey.

Short-range endemic invertebrate species are characterised by having naturally small distributions (<10 000 km²), poor dispersal powers, confinement to discontinuous or rare habitats, highly seasonal activity patterns and low levels of fecundity (EPA 2016a; Harvey 2002). The widespread aridification of Australia has resulted in fragmented and isolated invertebrate populations that have in turn evolved into distinct species within these relictual and discontinuous habitats. The following sheltered and often mesic habitats may support SRE species, as defined by the Technical Guidance (EPA 2016a):

- slopes with south-west facing aspects
- vine thickets
- deep gorges
- boulder piles
- isolated hills and other landforms
- vegetated gullies
- freshwater habitats/ drainage systems.

The survey area is exposed to climatic extremes and does not support the sheltered habitats typically favoured by many potential SRE taxa. The habitat types recorded within the survey area are well represented within the greater Augustus sub-region, further decreasing the likelihood that the survey area hosts SRE species.

The likelihood of occurrence based on this desk top assessment is assessed as potential (**Table 6**). Currently the species identified through the database searches are not considered SRE species, the species records returned by database search indicate species distributions that are less than 10,000 km², according to the WA Museum. They have not been individually assessed to confirm whether or not they are SRE (pers. Comm. Dr Mark Harvey WAM).

6 CONCLUSIONS

The relevant conclusions of the terrestrial vertebrate fauna assessment of the Old Highway and Haul Route survey areas are as follows:

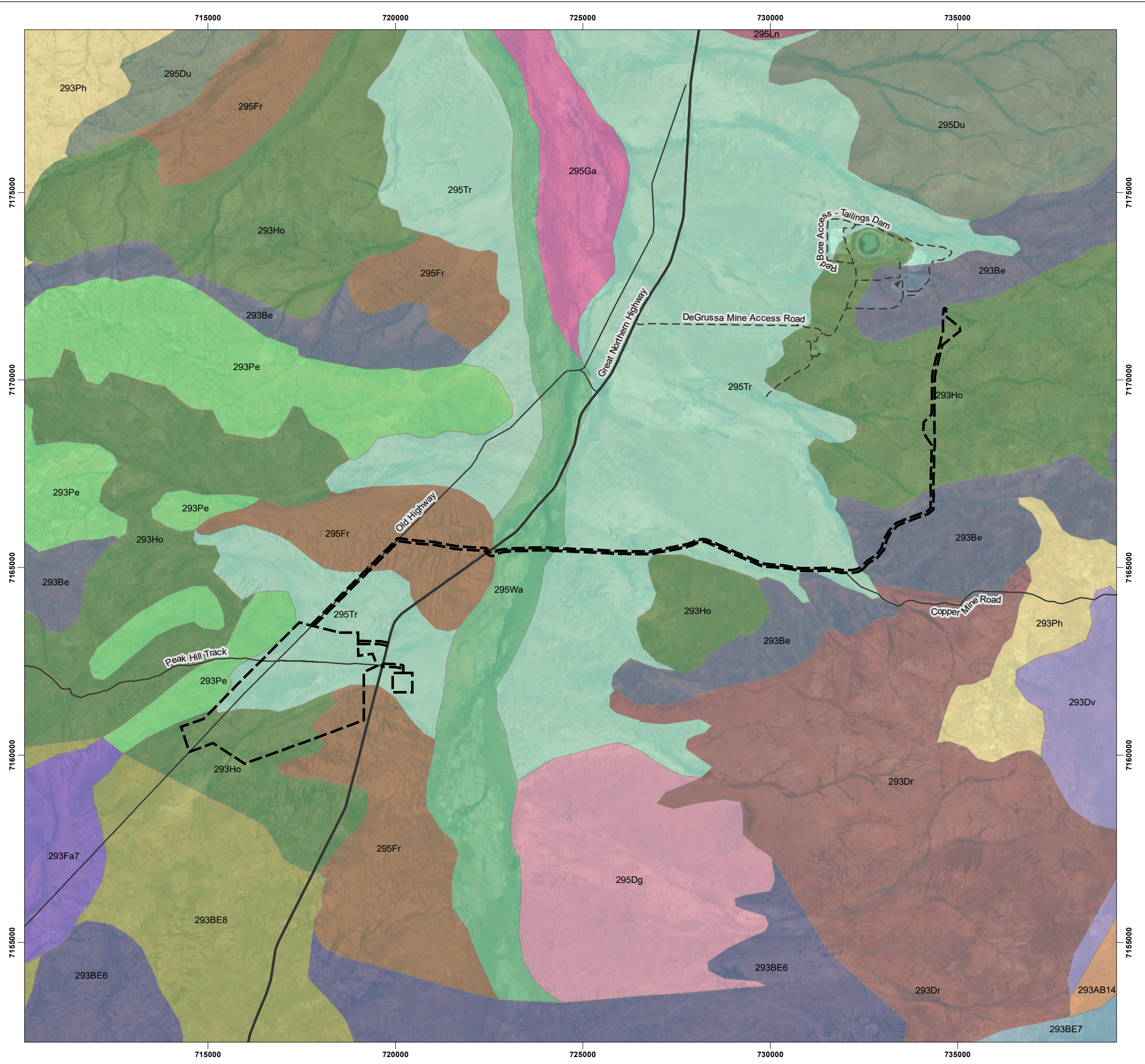
- the survey methods used were consistent with:
 - *Environmental Factor Guideline: Terrestrial Fauna* (EPA 2016b)
 - *EPA Technical Guidance – Terrestrial Fauna Survey* (EPA 2020a)
 - guidelines for Australia's threatened birds, bats, mammals, and reptiles.
- the fauna habitats recorded during this survey are not restricted to the survey area
- three habitat types were identified within the combined survey areas; Drainage Line, Mulga / mixed Acacia shrubland and Stoney Clay Plains. These habitat types recorded during the survey are considered to be well represented outside the survey areas.
- sixty-nine species were recorded from the combined survey areas. Sixteen species of native mammals, six species of introduced mammal, 32 species of bird, 20 species of reptile and 1 amphibian species.
- eight Bats were recorded across the combined survey areas. Results of the bat assessment did not record any species of significance.
- no significant fauna species were detected during the fauna surveys within the survey area (Old Highway/Haul Road).
- in addition to the species recorded, the likelihood assessment identified three significant fauna species (one EPBC listed species, one species listed under the BC Act and one species listed by DBCA as Priority) having a high likelihood to occur:
 - i) Grey Falcon (*Falco hypoleucos*, EPBC Act – Vulnerable)
 - ii) Peregrine Falcon (*Falco peregrinus*, BC Act - OS)
 - iii) Long-tailed Dunnart (*Sminthopsis longicaudata*, DBCA Priority 4).

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LEGEND

Survey Area

Soil Landscapes that intersect with the Survey Area

293Be - Low ridges, hills and lateritised residuals above stony footslopes and broad, stony lower plains supporting scattered mulga and snakewood shrublands.

293Ho - Gently undulating stony plains and low rounded hills with partially saline drainage foci and alluvial tracts supporting acacia and eremophila tall shrublands, and chenopod low shrublands .

293Pe - Rugged, sinuous ranges and rounded hills of banded ironstone and hematitic shale, supporting stunted mulga and cottonbush shrublands.

295Fr - Hardpan wash plains with broad, reticulate mulga groves and wanderrie banks supporting acacia tall shrublands with grassy understorey.

295Tr - Hardpan plains and minor sandy banks supporting sparse mulga shrublands.

295Wa - Low calcrete platforms and plains supporting mulga and cassia shrublands and minor chenopod low shrublands.

DATASOURCES :
SOURCE DATA: SOIL LANDSCAPE MAPPING BEST AVAILABLE (DPIRD, 2018)
AERIAL: ESRI BASEMAP 2020
BASEMAP: GEOSCIENCE AUSTRALIA
SERVICE LAYERS: SOURCE: ESRI, MAXAR, GEOEYE, EARTHSTAR GEOGRAPHICS, CNES/AIRBUS DS, USDA, USGS, AEROGRIID, IGN, AND THE GIS USER COMMUNITY

LAND SYSTEMS
OLD HIGHWAY PROJECT
FAUNA SURVEY

COORDINATE SYSTEM: GDA 1994 MGA ZONE 50
PROJECTION: TRANSVERSE MERCATOR
DATUM: GDA 1994
UNITS: METER

0

2

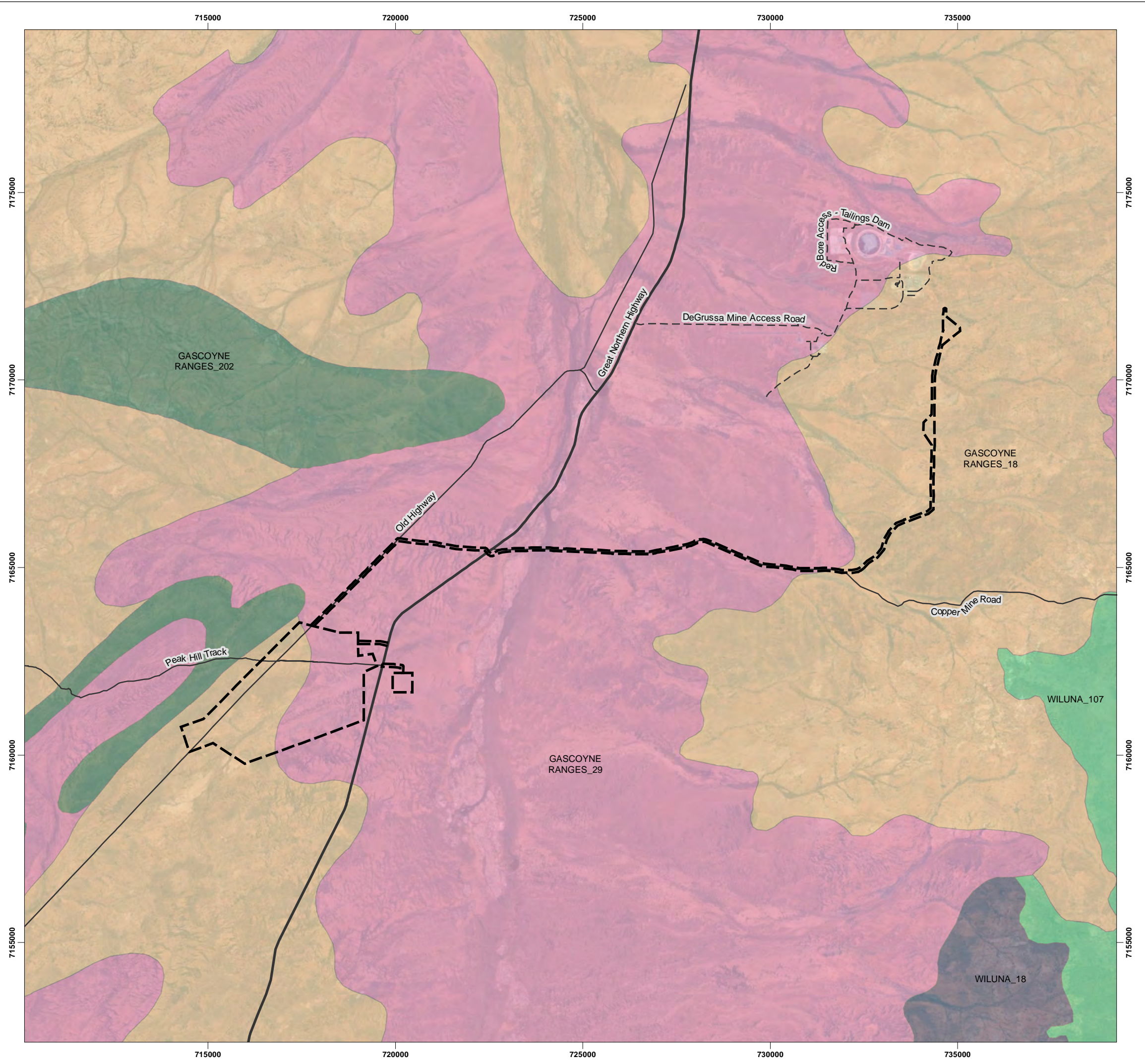
4 km

SCALE: 1:100,000 @ A3

PROJECT NO: 4622-21

REV	AUTHOR	APPROVED	DATE
0	SB	BT	30/06/2021

MAP
1



LEGEND

Survey Area

Pre-European Vegetation

GASCOYNE RANGES_18 - Low woodland; mulga (*Acacia aneura*)

GASCOYNE RANGES_202 - Shrublands; mulga and *Acacia quadrimarginea* scrub

GASCOYNE RANGES_29 - Sparse low woodland; mulga, discontinuous in scattered groups

WILUNA_107 - Hummock grasslands, shrub steppe; mulga and *Eucalyptus kingsmillii* over hard spinifex

WILUNA_18 - Low woodland; mulga (*Acacia aneura*)

DATASOURCES :
SOURCE DATA: PRE-EUROPEAN VEGETATION - WA NVIS COMPLIANT VERSION (DPIRD, 2019)
AERIAL: ESRI BASEMAP 2020
BASEMAP: GEOSCIENCE AUSTRALIA
SERVICE LAYERS: SOURCE: ESRI, MAXAR, GEOEYE, EARTHSTAR GEOGRAPHICS, CNES/AIRBUS DS, USDA, USGS, AERGRID, IGN, AND THE GIS USER COMMUNITY

PRE EUROPEAN VEGETATION ASSOCIATIONS

OLD HIGHWAY PROJECT FAUNA SURVEY

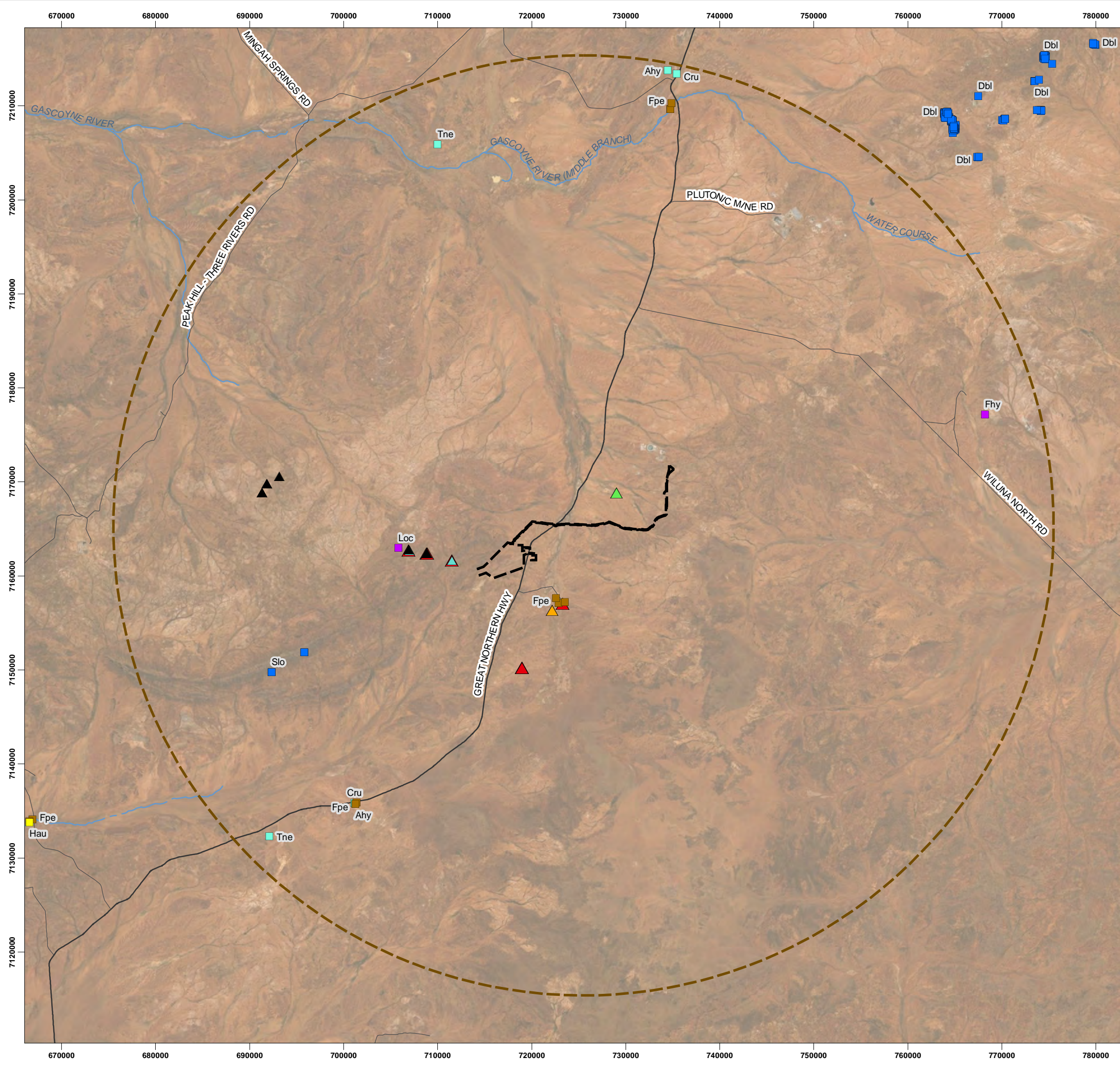
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PROJECTION: TRANSVERSE MERCATOR
DATUM: GDA 1994
UNITS: METER

SCALE: 1:100,000 @ A3
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PROJECT NO: 4622-21

REV	AUTHOR	APPROVED	DATE
0	SB	BT	30/06/2021

MAP
2



LEGEND

Survey Area

50 km Buffer

Conservation Listed Fauna (DBCA, 2021)

Vulnerable

Migratory Species

Other Specially Protected

Priority 2

Priority 4

Short-range Endemic species (WAM, 2021)

Order

Araneae

Isopoda

Pseudoscorpiones

Scolopendrida

Scorpiones

LABEL	NAME	CLASS	WA Cons Status
Ahy	<i>Actitis hypoleucos</i>	BIRD	MI
Cac	<i>Calidris acuminata</i>	BIRD	MI
Cru	<i>Calidris ruficollis</i>	BIRD	MI
Dbl	<i>Dasyercus blythi</i>	MAMMAL	P4
Fhy	<i>Falco hypoleucos</i>	BIRD	VU
Fpe	<i>Falco peregrinus</i>	BIRD	OS
Hau	<i>Hypseleotris aurea</i>	FISH	P2
Loc	<i>Leipoa ocellata</i>	BIRD	VU
Slo	<i>Sminthopsis longicaudata</i>	MAMMAL	P4
Tne	<i>Tringa nebularia</i>	BIRD	MI

DATASOURCES:

SOURCE DATA: PRE-EUROPEAN VEGETATION - WA NVIS COMPLIANT VERSION (DPIRD, 2019)

AERIAL: ESRI BASEMAP 2020

BASEMAP: GEOSCIENCE AUSTRALIA

SERVICE LAYERS: SOURCE: ESRI, MAXAR, GEOEYE, EARTHSTAR GEOGRAPHICS, CNES/AIRBUS DS, USDA, USGS, AEROGRIID, IGN, AND THE GIS USER COMMUNITY

CONSERVATION LISTED FAUNA

DBCA DATABASE

SEARCH RESULTS

OLD HIGHWAY PROJECT

FAUNA SURVEY

COORDINATE SYSTEM: GDA 1994 MGA ZONE 50

PROJECTION: TRANSVERSE MERCATOR

DATUM: GDA 1994

UNITS: METER

N

0

2

4

6

8

10

12

14 km

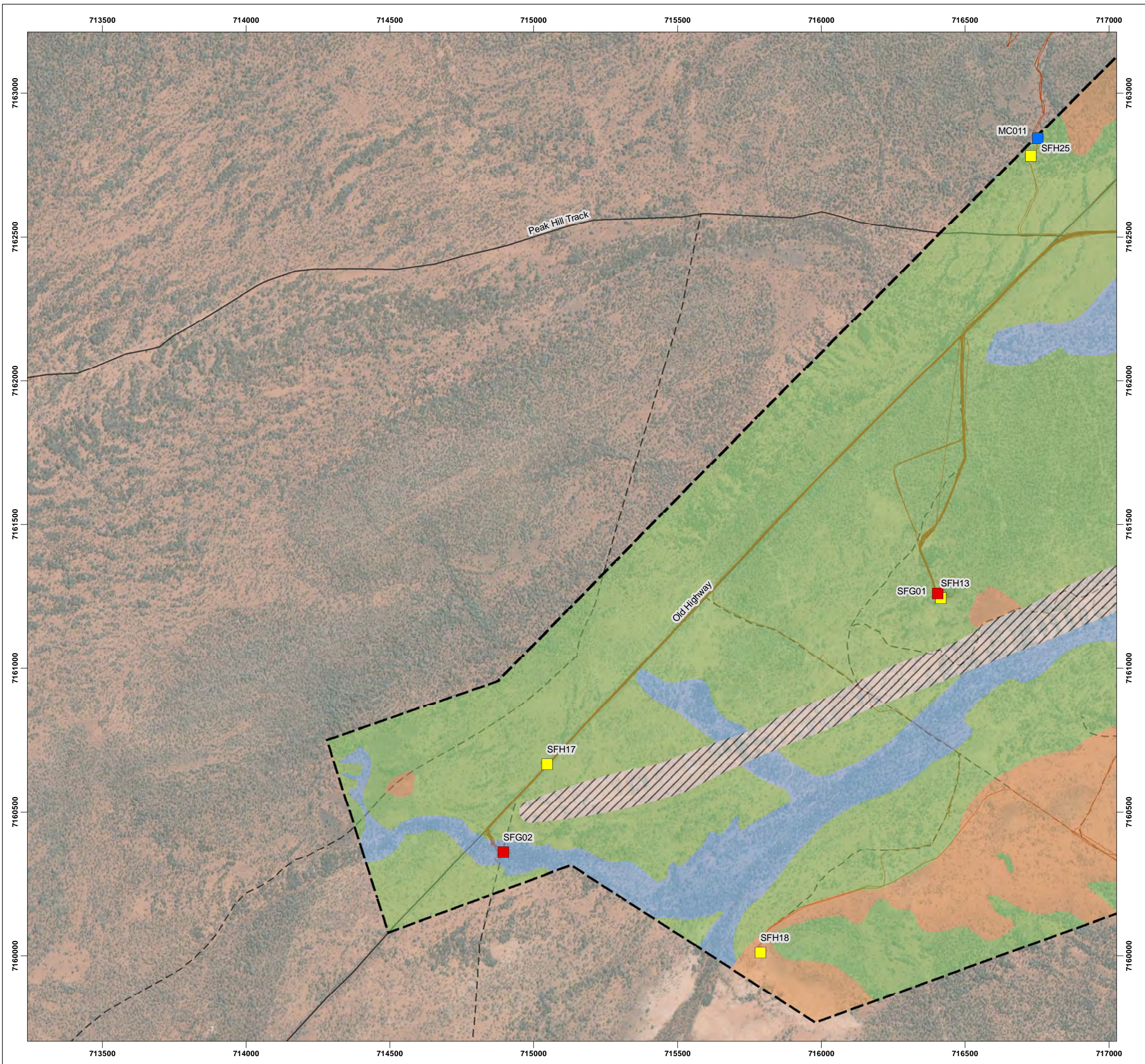
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PROJECT NO: 4622-21

REV	AUTHOR	APPROVED	DATE
0	SB	BT	30/06/2021

MAP

3



LEGEND
 Survey Area
 Survey Tracks
Fauna Sites
 Habitat Assessment Point
 Trail Camera
 Trap Grid
Fauna Habitat
 Drainage Line
 Mulga/Mixed Acacia shrubland
 Stony clay plains and ridges (gibber/boulders)
 Cleared

DATASOURCES:
SOURCE DATA: SURVEY TRACKS, FAUNA SITES, FAUNA HABITAT (ECOSCAPE, 2021)
AERIAL: ESRI BASEMAP 2020
BASEMAP: GEOSCIENCE AUSTRALIA
SERVICE LAYERS: SOURCE: ESRI, MAXAR, GEOEYE, EARTHSTAR GEOGRAPHICS, CNES/AIRBUS DS, USDA, USGS, AEROGRIID, IGN, AND THE GIS USER COMMUNITY

**FAUNA HABITAT &
FAUNA ASSESSMENT SITES**

**OLD HIGHWAY PROJECT
FLORA & VEGETATION SURVEY**

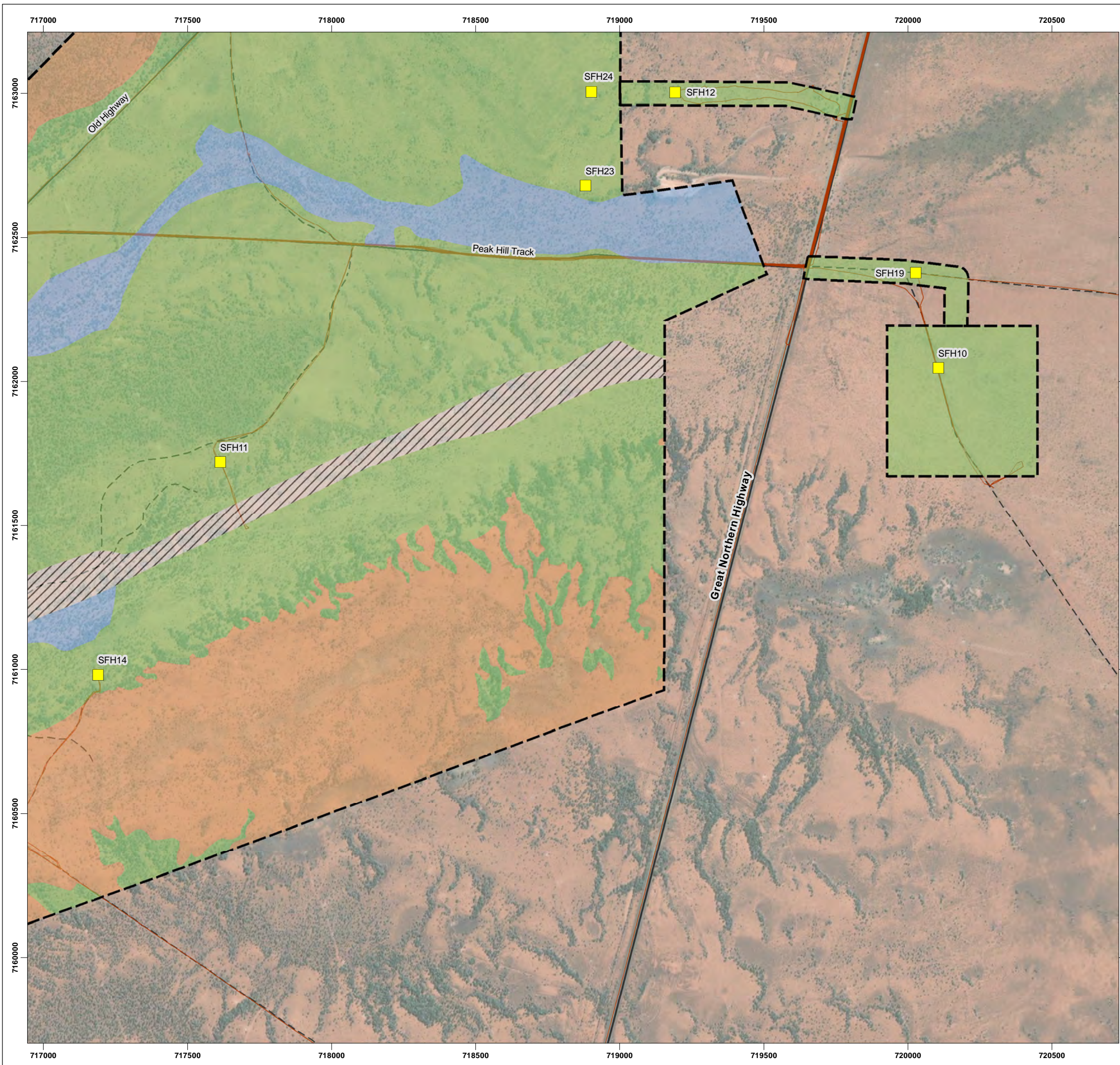
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PROJECTION: TRANSVERSE MERCATOR
DATUM: GDA 1994
UNITS: METER

SCALE: 1:13,000 @ A3
0 200 400 m

PROJECT NO: 4621-21

REV	AUTHOR	APPROVED	DATE
0	SB	BT	14/07/2021

**MAP
4A**



LEGEND
 Survey Area
 Survey Tracks
Fauna Sites
 Habitat Assessment Point
Fauna Habitat
 Drainage Line
 Mulga/Mixed Acacia shrubland
 Stony clay plains and ridges (gibber/boulders)
 Cleared

DATASOURCES:
 SOURCE DATA: SURVEY TRACKS, FAUNA SITES, FAUNA HABITAT (ECOSCAPE, 2021)
 AERIAL: ESRI BASEMAP 2020
 BASEMAP: GEOSCIENCE AUSTRALIA
 SERVICE LAYERS: SOURCE: ESRI, MAXAR, GEOEYE, EARTHSTAR GEOGRAPHICS, CNES/AIRBUS DS, USDA, USGS, AEROGRIID, IGN, AND THE GIS USER COMMUNITY

FAUNA HABITAT & FAUNA ASSESSMENT SITES

OLD HIGHWAY PROJECT FLORA & VEGETATION SURVEY

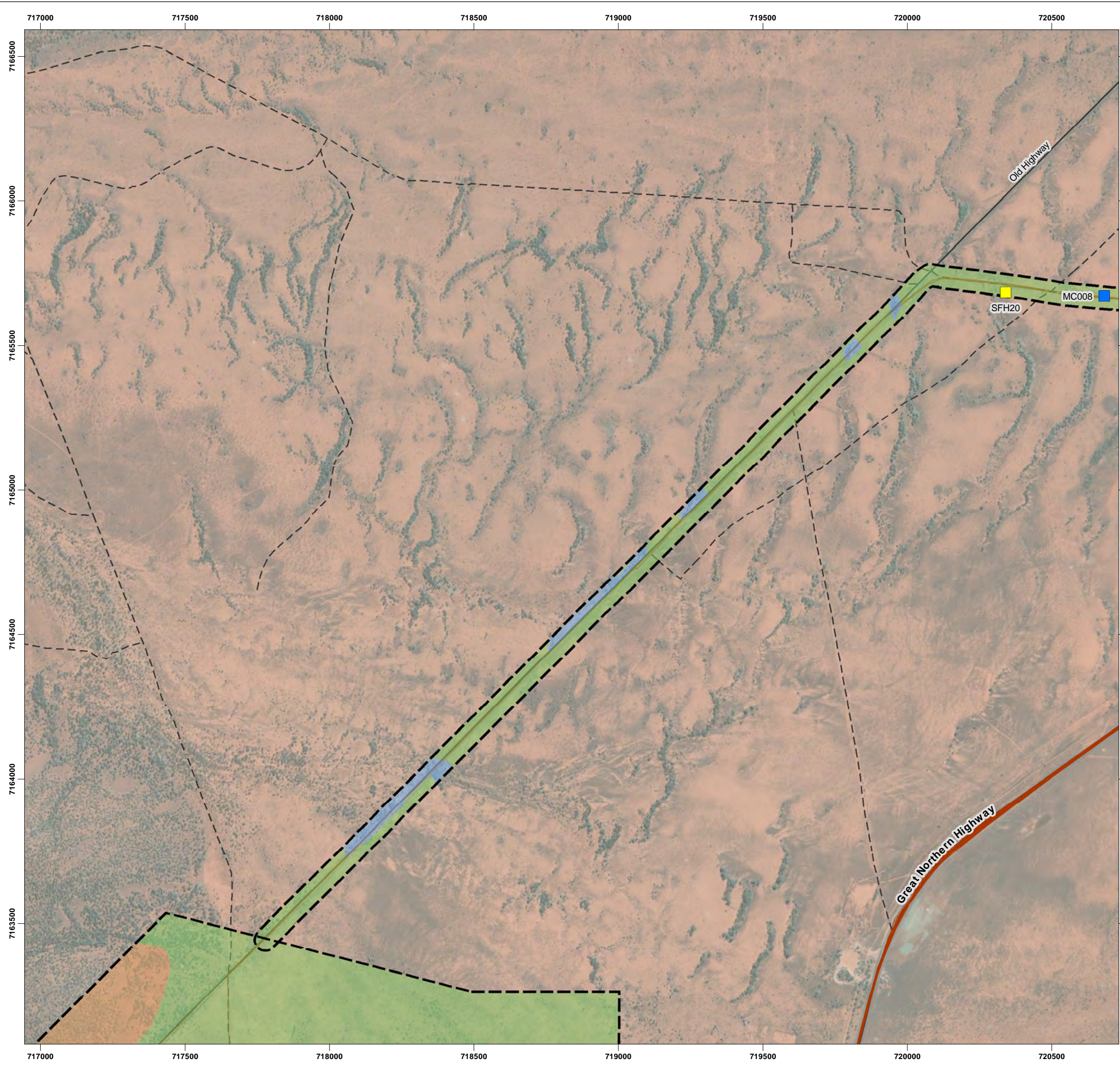
COORDINATE SYSTEM: GDA 1994 MGA ZONE 50
 PROJECTION: TRANSVERSE MERCATOR
 DATUM: GDA 1994
 UNITS: METER

SCALE: 1:13,000 @ A3
 0 200 400 m



PROJECT NO: 4621-21

REV	AUTHOR	APPROVED	DATE
0	SB	BT	14/07/2021



MAP
4B






LEGEND

-  Survey Area
-  Survey Tracks

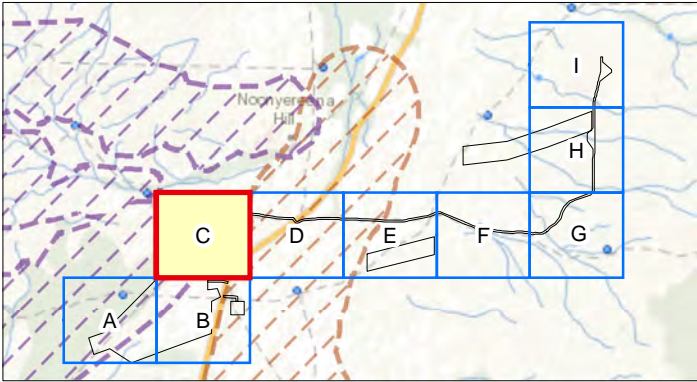
Fauna Sites

-  Habitat Assessment Point
-  Trail Camera

Fauna Habitat

-  Drainage Line
-  Mulga/Mixed Acacia shrubland
-  Stony clay plains and ridges (gibber/boulders)

DATASOURCES:
SOURCE DATA: SURVEY TRACKS, FAUNA SITES, FAUNA HABITAT (ECOSCAPE, 2021)
AERIAL: ESRI BASEMAP 2020
BASEMAP: GEOSCIENCE AUSTRALIA
SERVICE LAYERS: SOURCE: ESRI, MAXAR, GEOEYE, EARTHSTAR GEOGRAPHICS, CNES/AIRBUS DS, USDA, USGS, AEROGRIID, IGN, AND THE GIS USER COMMUNITY



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**FAUNA HABITAT &
FAUNA ASSESSMENT SITES**

**OLD HIGHWAY PROJECT
FLORA & VEGETATION SURVEY**



COORDINATE SYSTEM: GDA 1994 MGA ZONE 50
PROJECTION: TRANSVERSE MERCATOR
DATUM: GDA 1994
UNITS: METER



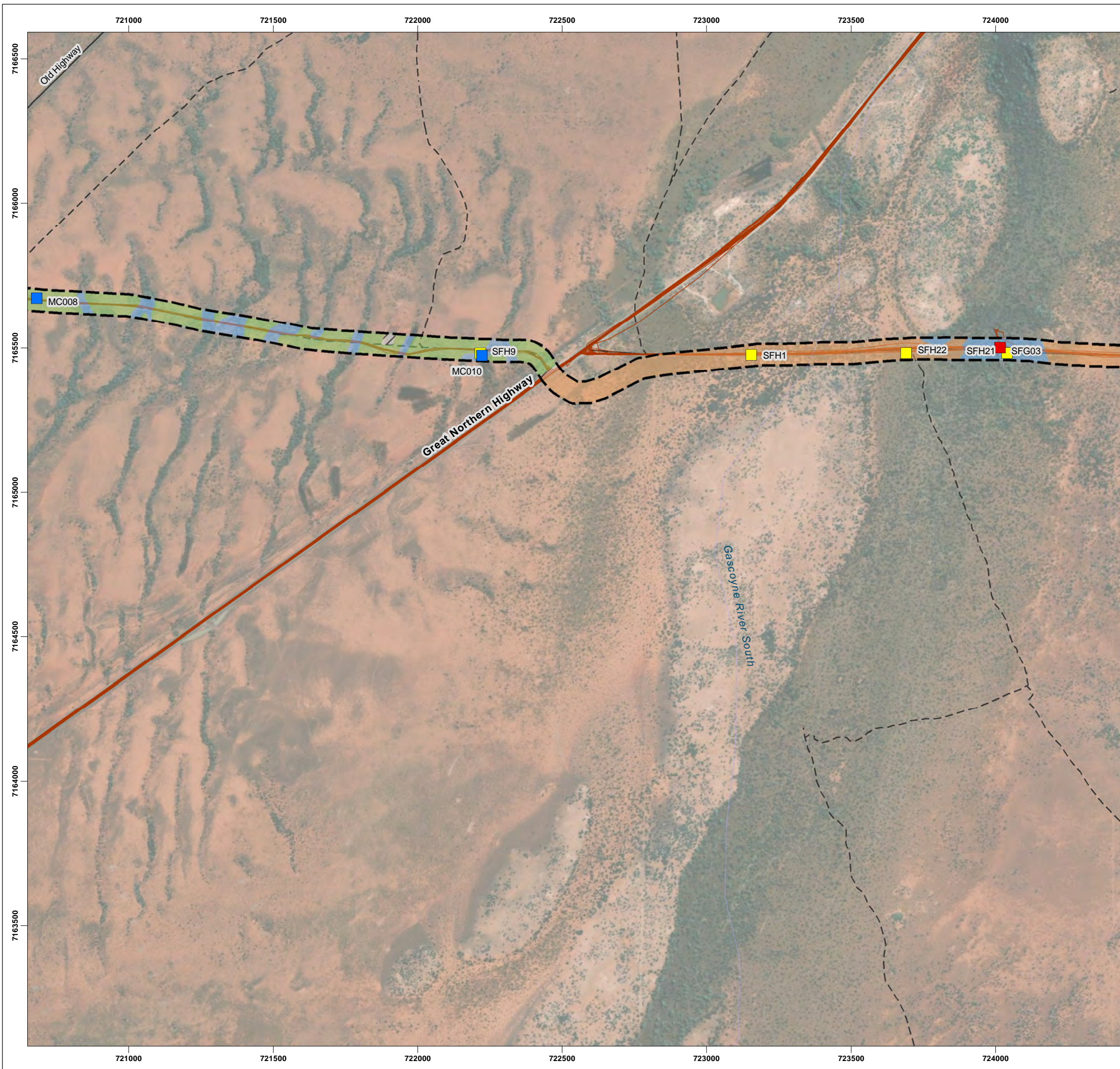
SCALE: 1:13,000 @ A3



PROJECT NO: 4621-21

REV	AUTHOR	APPROVED	DATE
0	SB	BT	14/07/2021

**MAP
4C**



LEGEND

Survey Area

Survey Tracks

Fauna Sites

Habitat Assessment Point

Trail Camera

Trap Grid

Fauna Habitat

Drainage Line

Mulga/Mixed Acacia shrubland

Stony clay plains and ridges (gibber/boulders)

Cleared

DATASOURCES:

SOURCE DATA: SURVEY TRACKS, FAUNA SITES, FAUNA HABITAT (ECOSCAPE, 2021)
AERIAL: ESRI BASEMAP 2020
BASEMAP: GEOSCIENCE AUSTRALIA
SERVICE LAYERS: SOURCE: ESRI, MAXAR, GEOEYE, EARTHSTAR GEOGRAPHICS, CNES/AIRBUS DS, USDA, USGS, AEROGRIID, IGN, AND THE GIS USER COMMUNITY

FAUNA HABITAT & FAUNA ASSESSMENT SITES

**OLD HIGHWAY PROJECT
FLORA & VEGETATION SURVEY**

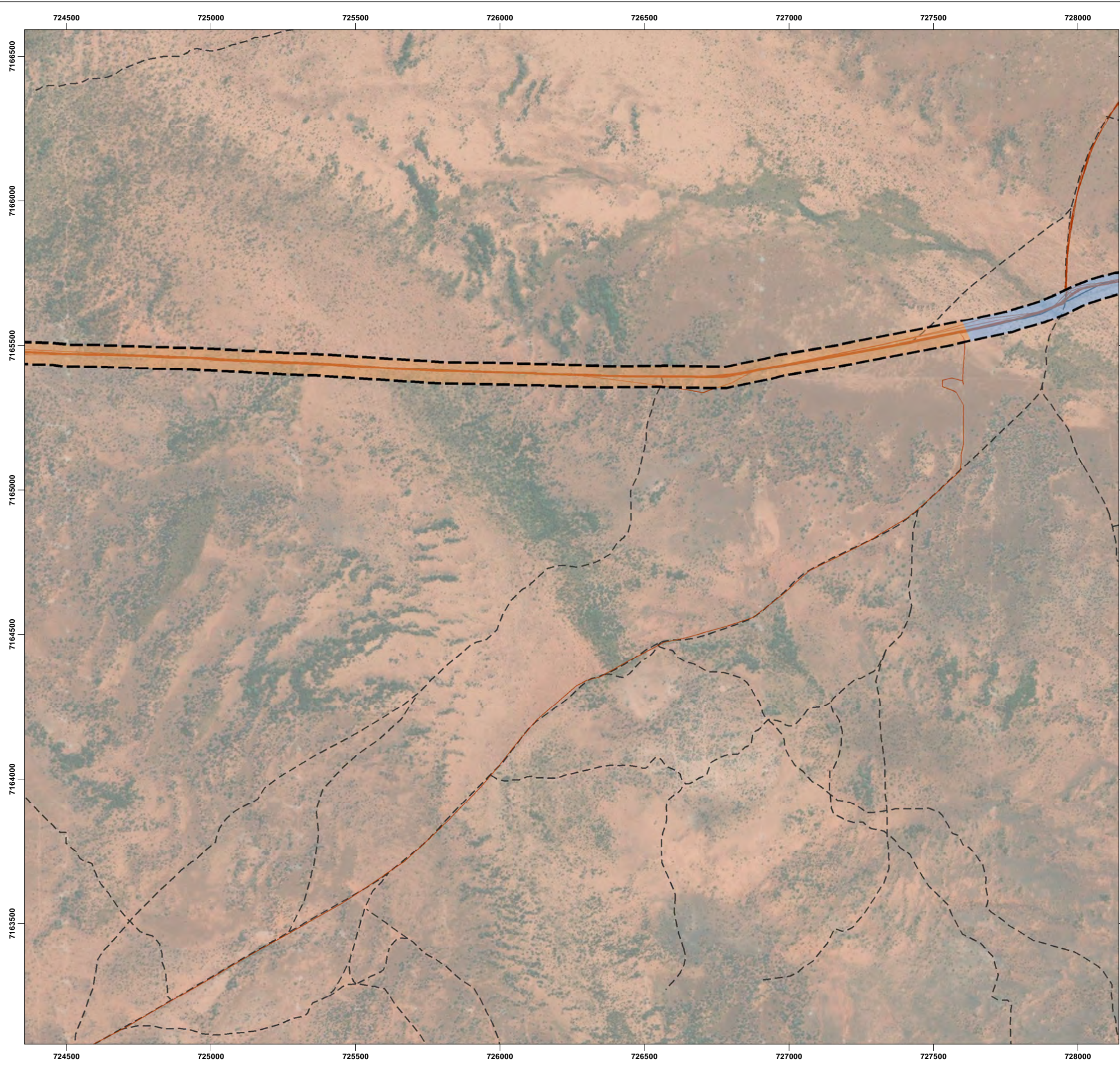
COORDINATE SYSTEM: GDA 1994 MGA ZONE 50
PROJECTION: TRANSVERSE MERCATOR
DATUM: GDA 1994
UNITS: METER

SCALE: 1:13,000 @ A3
0 200 400 m





PROJECT NO: 4621-21

REV	AUTHOR	APPROVED	DATE
0	SB	BT	14/07/2021

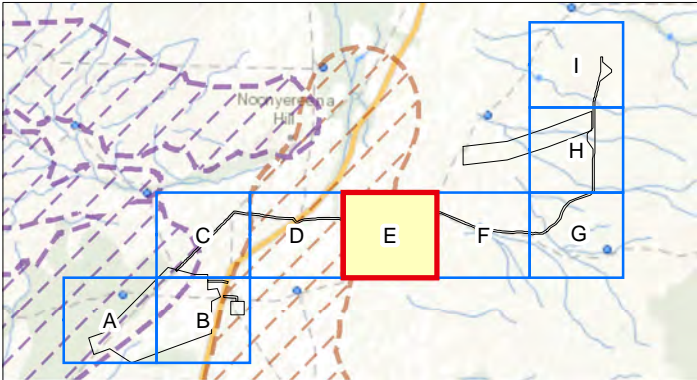
MAP
4D



LEGEND

-  Survey Area
-  Survey Tracks
- Fauna Habitat**
 -  Drainage Line
 -  Stony clay plains and ridges (gibber/boulders)

DATASOURCES:
SOURCE DATA: SURVEY TRACKS, FAUNA SITES, FAUNA HABITAT (ECOSCAPE, 2021)
AERIAL: ESRI BASEMAP 2020
BASEMAP: GEOSCIENCE AUSTRALIA
SERVICE LAYERS: SOURCE: ESRI, MAXAR, GEOEYE, EARTHSTAR GEOGRAPHICS, CNES/AIRBUS DS, USDA, USGS, AEROGRIID, IGN, AND THE GIS USER COMMUNITY




FAUNA HABITAT &
FAUNA ASSESSMENT SITES

OLD HIGHWAY PROJECT
FLORA & VEGETATION SURVEY



COORDINATE SYSTEM: GDA 1994 MGA ZONE 50
PROJECTION: TRANSVERSE MERCATOR
DATUM: GDA 1994
UNITS: METER



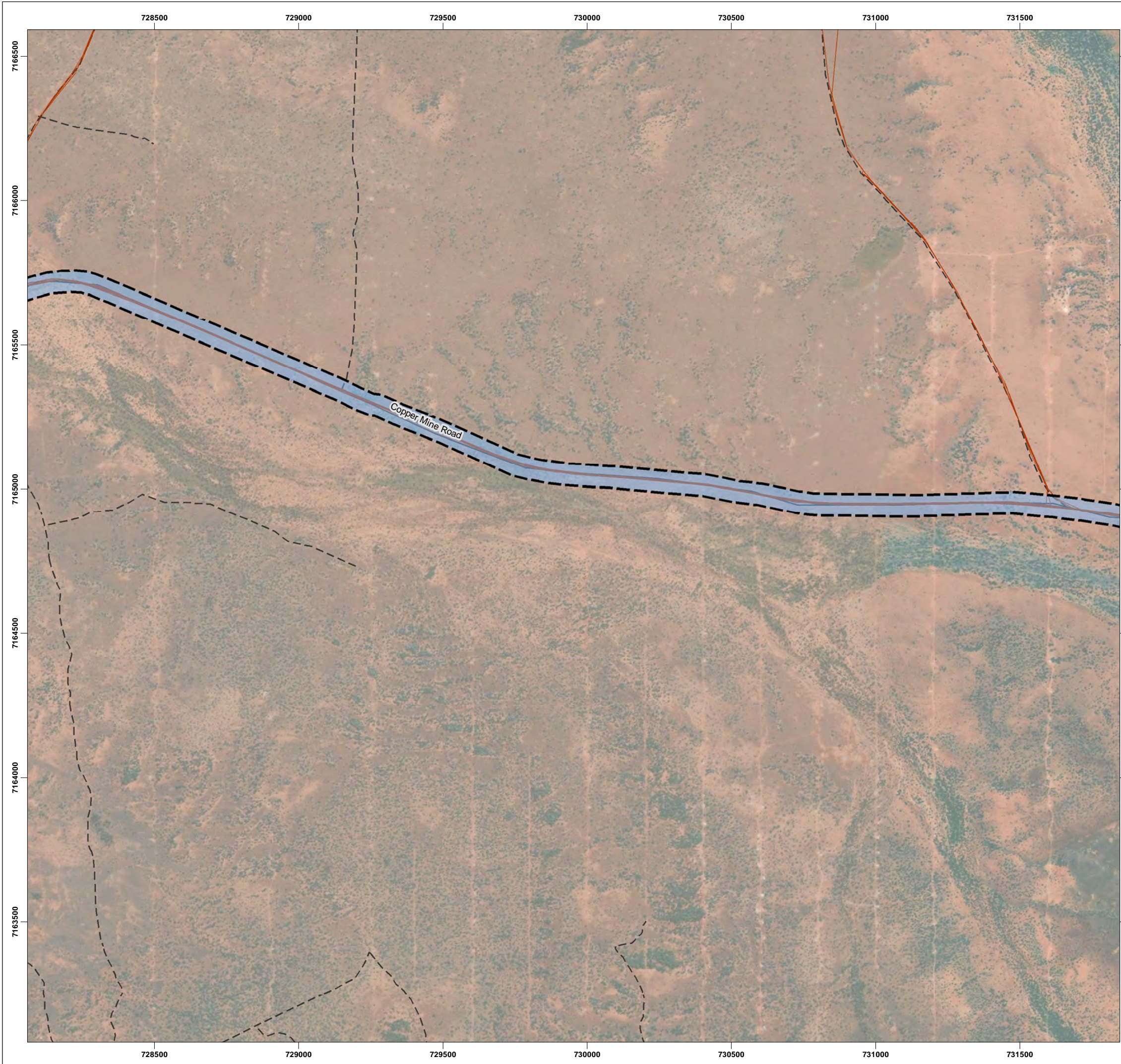
SCALE: 1:13,000 @ A3

0 200 400 m

PROJECT NO: 4621-21

REV	AUTHOR	APPROVED	DATE
0	SB	BT	14/07/2021

MAP
4E



LEGEND
 Survey Area
 Survey Tracks
Fauna Habitat
 Drainage Line

DATASOURCES:
SOURCE DATA: SURVEY TRACKS, FAUNA SITES, FAUNA HABITAT (ECOSCAPE, 2021)
AERIAL: ESRI BASEMAP 2020
BASEMAP: GEOSCIENCE AUSTRALIA
SERVICE LAYERS: SOURCE: ESRI, MAXAR, GEOEYE, EARTHSTAR GEOGRAPHICS, CNES/AIRBUS DS, USDA, USGS, AEROGRIID, IGN, AND THE GIS USER COMMUNITY

FAUNA HABITAT & FAUNA ASSESSMENT SITES

**OLD HIGHWAY PROJECT
FLORA & VEGETATION SURVEY**

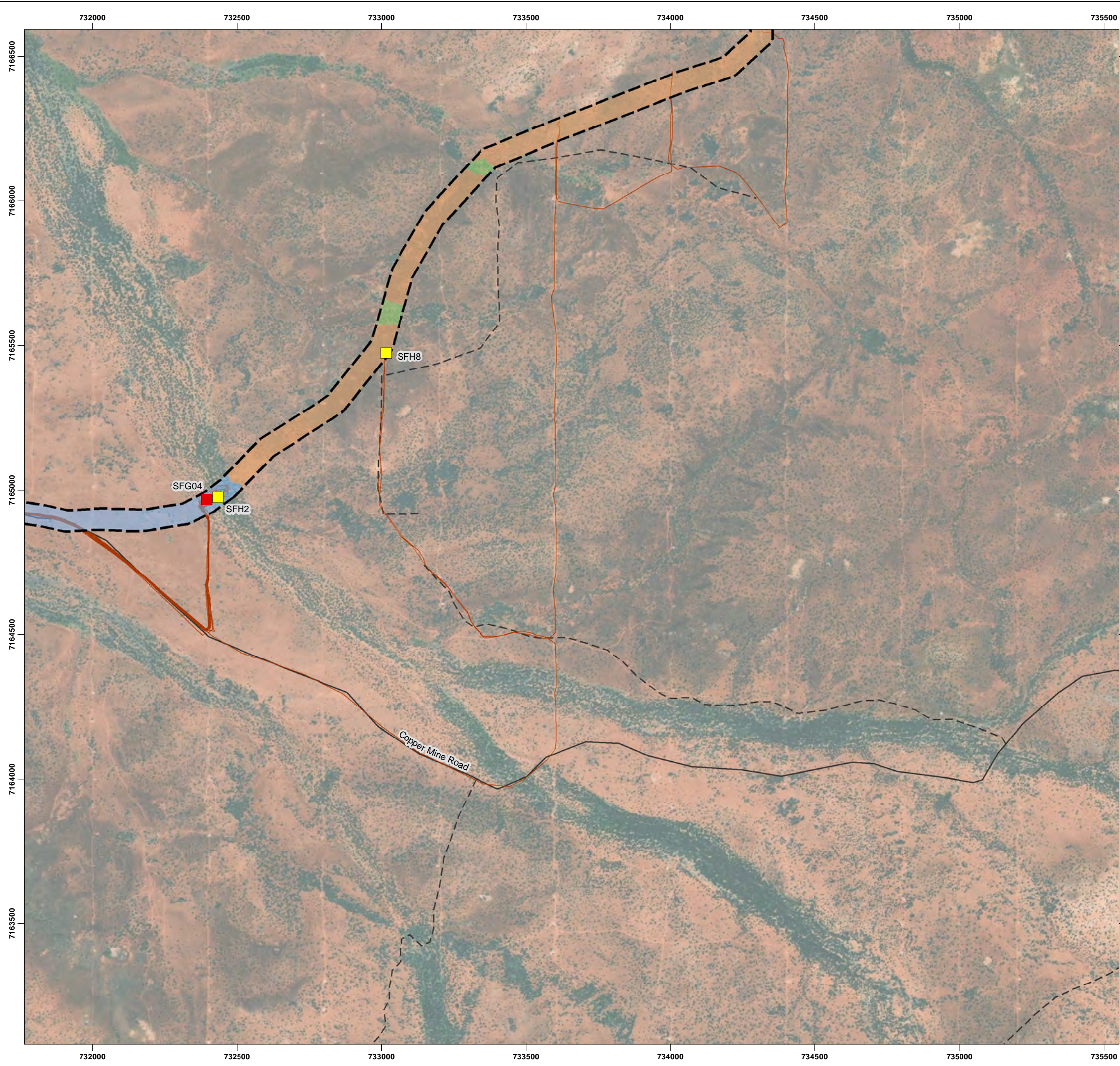
COORDINATE SYSTEM: GDA 1994 MGA ZONE 50
PROJECTION: TRANSVERSE MERCATOR
DATUM: GDA 1994
UNITS: METER

SCALE: 1:13,000 @ A3
0 200 400 m

PROJECT NO: 4621-21

REV	AUTHOR	APPROVED	DATE
0	SB	BT	14/07/2021

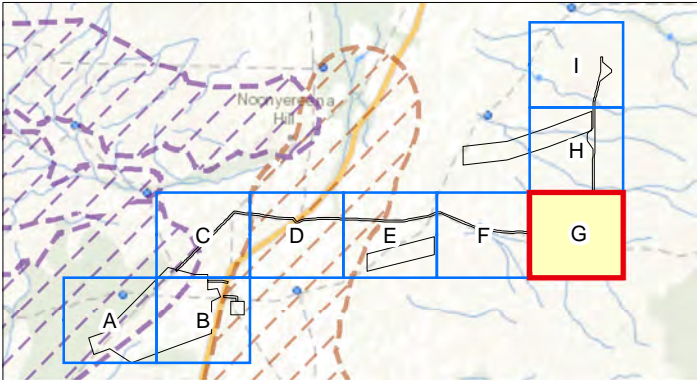
MAP
4F



LEGEND

- Survey Area
- Survey Tracks
- Fauna Sites**
 - Habitat Assessment Point
 - Trap Grid
- Fauna Habitat**
 - Drainage Line
 - Mulga/Mixed Acacia shrubland
 - Stony clay plains and ridges (gibber/boulders)

DATASOURCES:
SOURCE DATA: SURVEY TRACKS, FAUNA SITES, FAUNA HABITAT (ECOSCAPE, 2021)
AERIAL: ESRI BASEMAP 2020
BASEMAP: GEOSCIENCE AUSTRALIA
SERVICE LAYERS: SOURCE: ESRI, MAXAR, GEOEYE, EARTHSTAR GEOGRAPHICS, CNES/AIRBUS DS, USDA, USGS, AEROGRIID, IGN, AND THE GIS USER COMMUNITY



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**FAUNA HABITAT &
FAUNA ASSESSMENT SITES**

**OLD HIGHWAY PROJECT
FLORA & VEGETATION SURVEY**



COORDINATE SYSTEM: GDA 1994 MGA ZONE 50
PROJECTION: TRANSVERSE MERCATOR
DATUM: GDA 1994
UNITS: METER



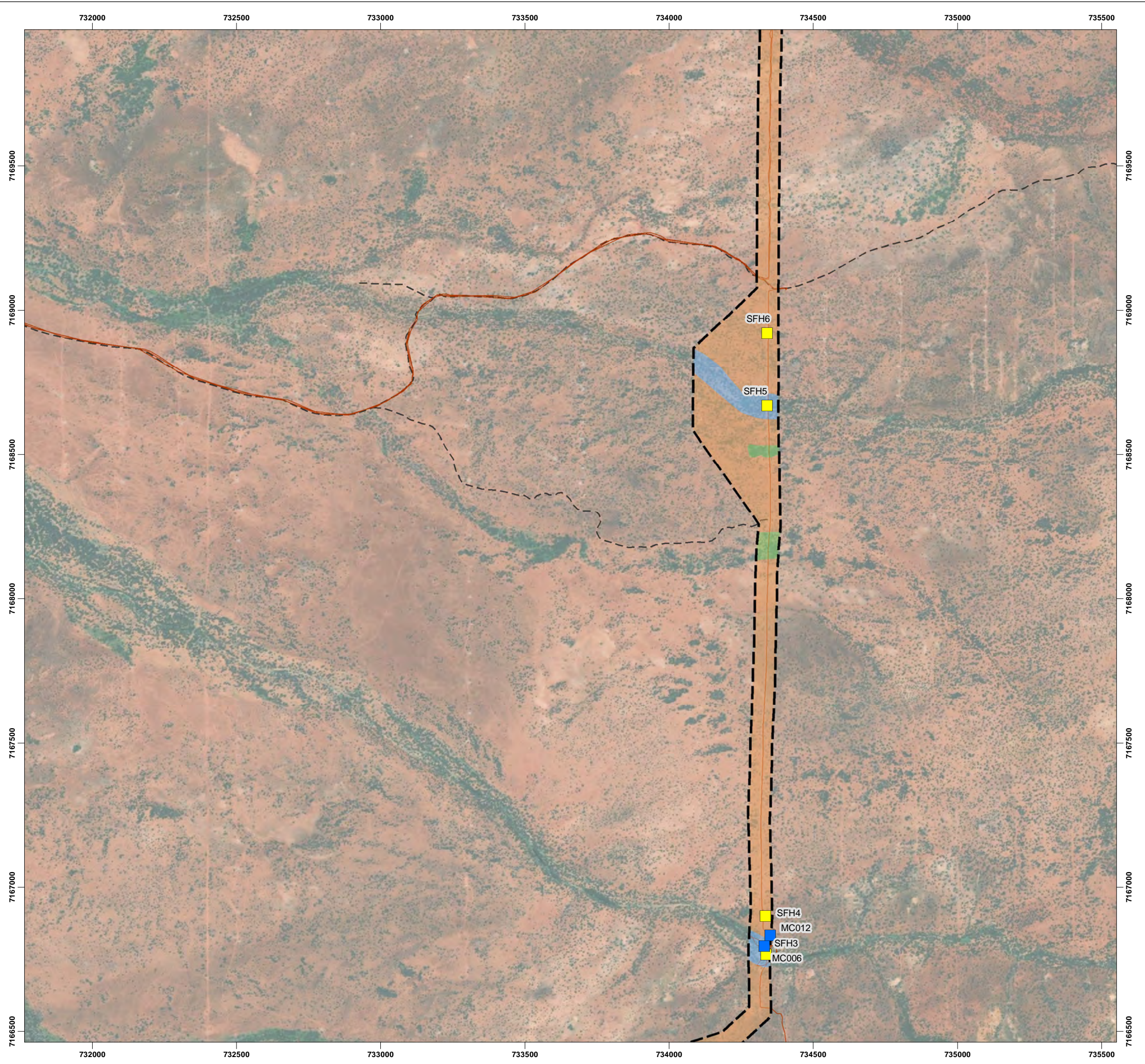
SCALE: 1:13,000 @ A3



PROJECT NO: 4621-21

REV	AUTHOR	APPROVED	DATE
0	SB	BT	14/07/2021

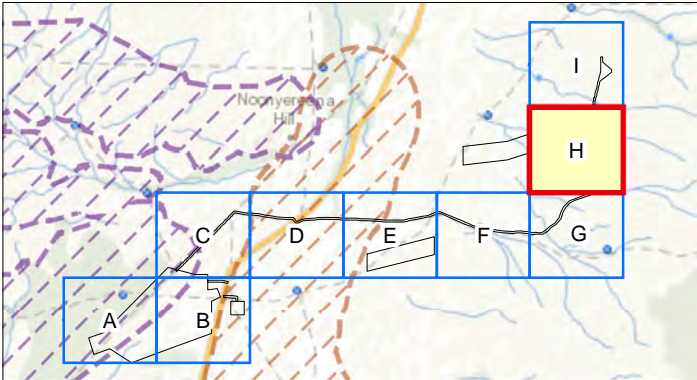
**MAP
4G**



LEGEND

- Survey Area
- Survey Tracks
- Fauna Sites**
 - Habitat Assessment Point
 - Trail Camera
- Fauna Habitat**
 - Drainage Line
 - Mulga/Mixed Acacia shrubland
 - Stony clay plains and ridges (gibber/boulders)

DATASOURCES:
SOURCE DATA: SURVEY TRACKS, FAUNA SITES, FAUNA HABITAT (ECOSCAPE, 2021)
AERIAL: ESRI BASEMAP 2020
BASEMAP: GEOSCIENCE AUSTRALIA
SERVICE LAYERS: SOURCE: ESRI, MAXAR, GEOEYE, EARTHSTAR GEOGRAPHICS, CNES/AIRBUS DS, USDA, USGS, AEROGRIID, IGN, AND THE GIS USER COMMUNITY



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**FAUNA HABITAT &
FAUNA ASSESSMENT SITES**

**OLD HIGHWAY PROJECT
FLORA & VEGETATION SURVEY**



COORDINATE SYSTEM: GDA 1994 MGA ZONE 50
PROJECTION: TRANSVERSE MERCATOR
DATUM: GDA 1994
UNITS: METER



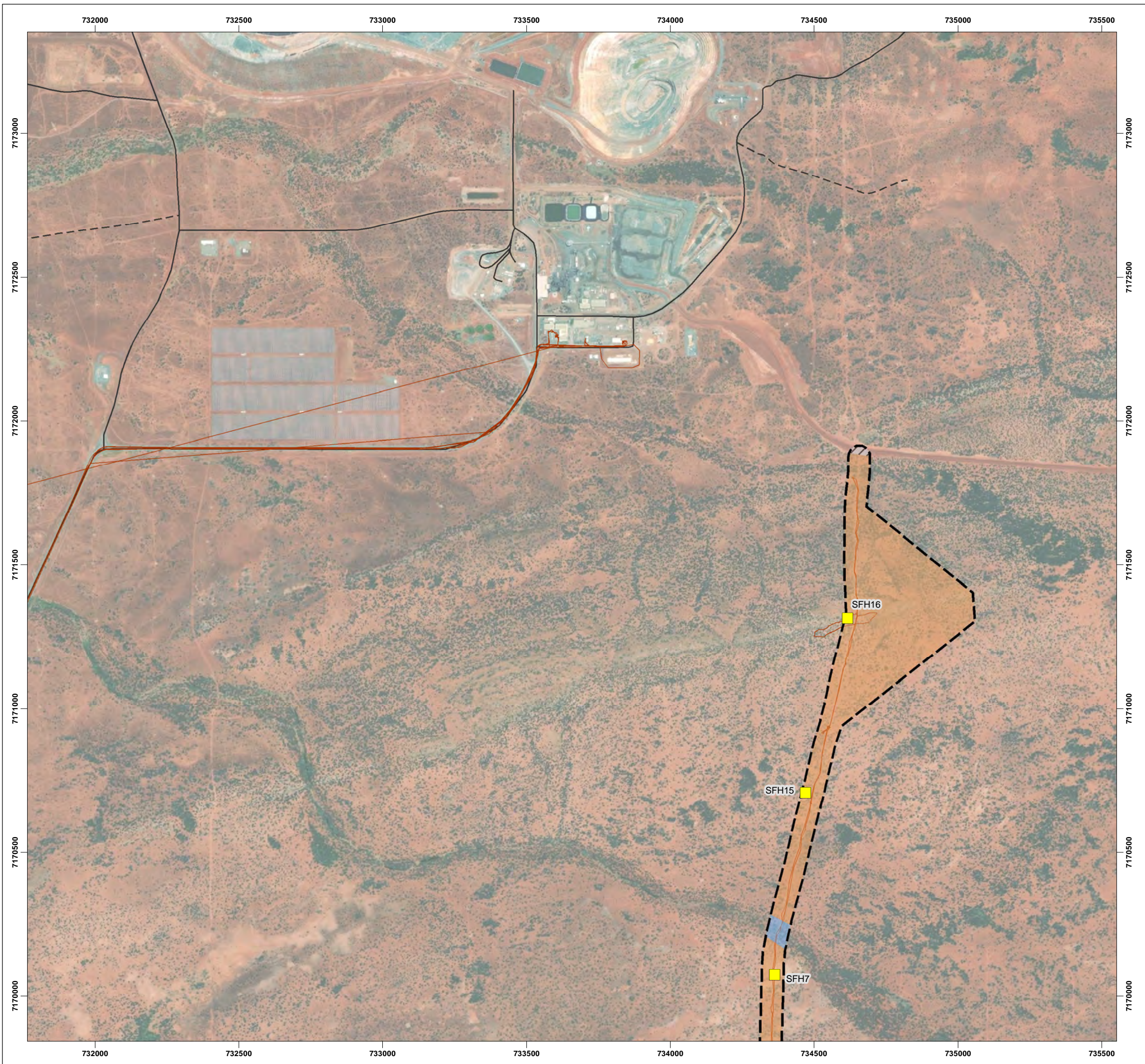
SCALE: 1:13,000 @ A3



PROJECT NO: 4621-21

REV	AUTHOR	APPROVED	DATE
0	SB	BT	14/07/2021

**MAP
4H**



LEGEND
 Survey Area
 Survey Tracks
Fauna Sites
 Habitat Assessment Point
Fauna Habitat
 Drainage Line
 Stony clay plains and ridges (gibber/boulders)
 Cleared

DATASOURCES:
SOURCE DATA: SURVEY TRACKS, FAUNA SITES, FAUNA HABITAT (ECOSCAPE, 2021)
AERIAL: ESRI BASEMAP 2020
BASEMAP: GEOSCIENCE AUSTRALIA
SERVICE LAYERS: SOURCE: ESRI, MAXAR, GEOEYE, EARTHSTAR GEOGRAPHICS, CNES/AIRBUS DS, USDA, USGS, AEROGRIID, IGN, AND THE GIS USER COMMUNITY

**FAUNA HABITAT &
FAUNA ASSESSMENT SITES**

**OLD HIGHWAY PROJECT
FLORA & VEGETATION SURVEY**

COORDINATE SYSTEM: GDA 1994 MGA ZONE 50
PROJECTION: TRANSVERSE MERCATOR
DATUM: GDA 1994
UNITS: METER

SCALE: 1:13,000 @ A3
0 200 400 m

PROJECT NO: 4621-21

REV	AUTHOR	APPROVED	DATE
0	SB	BT	14/07/2021

**MAP
41**

APPENDIX ONE LEGISLATIVE CONTEXT, DEFINITIONS AND CRITERIA

COMMONWEALTH ENVIRONMENT PROTECTION AND BIODIVERSITY CONSERVATION ACT 1999

The EPBC Act is a legal framework to protect and manage matters of national environmental significance (MNES) including important flora, fauna, ecological communities, and heritage areas listed under the Act.

Threatened taxa (flora and fauna) are protected under the EPBC Act, which lists species and ecological communities that have been assessed as meeting the criteria to be listed as Critically Endangered, Endangered, Vulnerable, Conservation Dependant, Extinct, or Extinct in the Wild, as detailed in **Table 11**.

Threatened Ecological Communities protected under the EPBC Act are categorised as Critically Endangered, Endangered or Vulnerable, also detailed in this table.

Migratory species subject to international agreements are also protected under the EPBC Act. The definition of a migratory species under the Act follows that prescribed by the Convention on the Conservation of Migratory Species of Wild Animals (Bonn Convention) (Department of the Environment 2021):

Migratory species are the entire population or any geographically separate part of the population of any species or lower taxon of wild animals, a significant proportion of whose members cyclically and predictably cross one or more national jurisdictional boundaries.

Species listed by the following international agreements are currently protected under the EPBC Act:

- Convention on the Conservation of Migratory Species of Wild Animals (Bonn Convention)
- China-Australia Migratory Bird Agreement (CAMBA)
- Japan-Australia Migratory Bird Agreement (JAMBA)
- Republic of Korea-Australia Migratory Bird Agreement (ROKAMBA).

Table 11: EPBC Act categories for flora, fauna and ecological communities

Category	Threatened species	Threatened Ecological Communities
Extinct	A native species is eligible to be included in the extinct category at a particular time if, at that time, there is no reasonable doubt that the last member of the species has died.	n/a
Extinct in the wild	A native species is eligible to be included in the extinct in the wild category at a particular time if, at that time: (a) it is known only to survive in cultivation, in captivity or as a naturalised population well outside its past range; or (b) it has not been recorded in its known and/or expected habitat, at appropriate seasons, anywhere in its past range, despite exhaustive surveys over a time frame appropriate to its life cycle and form.	n/a
Critically Endangered (CE)	A native species is eligible to be included in the <i>critically endangered</i> category at a particular time if, at that time, it is facing an extremely high risk of extinction in the wild in the immediate future, as determined in accordance with the prescribed criteria.	An ecological community is eligible to be included in the <i>critically endangered</i> category at a particular time if, at that time, it is facing an extremely high risk of extinction in the wild in the immediate future, as determined in accordance with the prescribed criteria
Endangered (EN)	A native species is eligible to be included in the <i>endangered</i> category at a particular time if, at that time: (a) it is not critically endangered; and (b) it is facing a very high risk of extinction in the wild in the near future, as determined in accordance with the prescribed criteria.	An ecological community is eligible to be included in the <i>endangered</i> category at a particular time if, at that time: (a) it is not critically endangered; and (b) it is facing a very high risk of extinction in the wild in the near future, as determined in accordance with the prescribed criteria.

Category	Threatened species	Threatened Ecological Communities
Vulnerable (VU)	A native species is eligible to be included in the <i>vulnerable</i> category at a particular time if, at that time: (a) it is not critically endangered or endangered; and (b) it is facing a high risk of extinction in the wild in the medium term future, as determined in accordance with the prescribed criteria.	An ecological community is eligible to be included in the <i>vulnerable</i> category at a particular time if, at that time: (a) it is not critically endangered or endangered; and (b) it is facing a high risk of extinction in the wild in the medium term future, as determined in accordance with the prescribed criteria.
Conservation Dependent	A native species is eligible to be included in the conservation dependent category at a particular time if, at that time: (a) the species is the focus of a specific conservation program the cessation of which would result in the species becoming vulnerable, endangered or critically endangered; or (b) the following subparagraphs are satisfied: (i) the species is a species of fish; (ii) the species is the focus of a plan of management that provides for management actions necessary to stop the decline of, and support the recovery of, the species so that its chances of long-term survival in nature are maximised; (iii) the plan of management is in force under a law of the Commonwealth or of a State or Territory; (iv) cessation of the plan of management would adversely affect the conservation status of the species.	n/a

WESTERN AUSTRALIAN ENVIRONMENTAL PROTECTION ACT 1986

The Western Australian EP Act was created to provide for an Environmental Protection Authority (the EPA) that has the responsibility for:

- prevention, control and abatement of pollution and environmental harm
- conservation, preservation, protection, enhancement and management of the environment
- matters incidental to or connected with the above.

The EPA is responsible for providing the guidance and policy under which environmental assessments are conducted. It conducts environmental impact assessments (based on the information provided by the proponent), initiates measures to protect the environment and provides advice to the Minister responsible for environmental matters.

WESTERN AUSTRALIAN BIODIVERSITY CONSERVATION ACT 2016

The Western Australian BC Act provides for the conservation, protection and ecologically sustainable use of biodiversity and biodiversity components in Western Australia.

Threatened species (both flora and fauna) and ecological communities that meet the categories listed within the BC Act are protected under this legislation and require authorisation by the Minister to take or disturb. These are known as Threatened Flora, Threatened Fauna and Threatened Ecological Communities. The conservation categories of Critically Endangered, Endangered and Vulnerable are detailed in **Table 12**; these categories align with those of the EPBC Act. Some State-listed threatened species and ecological communities are provided with additional protection as they are also listed under the Commonwealth EPBC Act (see **Table 11** for conservation status category descriptions).

The most recent Western Australian flora and fauna listings were published in the Government Gazette on 11 September 2018 (Government of Western Australia 2018a).

PRIORITY-LISTED FLORA AND FAUNA

Flora are listed as PF where populations are geographically restricted or threatened by local processes, or where there is insufficient information to formally assign them to TF categories. Whilst PF are not specifically listed in the BC Act, some may qualify as being of special conservation interest and thereby have a greater level of protection than unlisted species.

There are three categories covering Western Australian-listed TF and four categories covering PF species which are outlined in **Table 12**. PF for Western Australia are regularly reviewed by the DBCA whenever new information becomes available, with species status altered or removed from the list when data indicates that they no longer meet these requirements.

Conservation significant fauna species are listed by the DBCA as Priority Fauna where populations are geographically restricted or threatened by local processes, or where there is insufficient information to formally assign them to threatened fauna categories. Whilst Priority Fauna are not specifically listed in the BC Act, these have a greater level of significance than other native species. The categories covering Priority Fauna species are outlined in **Table 12**.

Flora and fauna species may be listed as being of special conservation interest if they have a naturally low population, have a restricted natural range, are subject to or recovering from a significant population decline or reduction of range or are of special interest, and the Minister considers that taking may result in depletion of the species. Migratory species and those subject to international agreement are also listed under the Act. These are known as 'specially protected species' in the BC Act.

Table 12: Conservation codes for Western Australian flora and fauna (DBCA 2019b)

Conservation Codes for Western Australian Flora and Fauna	
Threatened, Extinct and Specially Protected fauna or flora ¹ are species ² which have been adequately searched for and are deemed to be, in the wild, threatened, extinct or in need of special protection, and have been gazetted as such.	
The Wildlife Conservation (Specially Protected Fauna) Notice 2018 and the Wildlife Conservation (Rare Flora) Notice 2018 have been transitioned under regulations 170, 171 and 172 of the Biodiversity Conservation Regulations 2018 to be the lists of Threatened, Extinct and Specially Protected species under Part 2 of the Biodiversity Conservation Act 2016.	
Categories of Threatened, Extinct and Specially Protected fauna and flora are:	
T	<p>Threatened species</p> <p>Listed by order of the Minister as Threatened in the category of critically endangered, endangered or vulnerable under section 19(1), or is a rediscovered species to be regarded as threatened species under section 26(2) of the <i>Biodiversity Conservation Act 2016</i> (BC Act).</p> <p>Threatened fauna is that subset of 'Specially Protected Fauna' listed under schedules 1 to 3 of the <i>Wildlife Conservation (Specially Protected Fauna) Notice 2018</i> for Threatened Fauna.</p> <p>Threatened flora is that subset of 'Rare Flora' listed under schedules 1 to 3 of the <i>Wildlife Conservation (Rare Flora) Notice 2018</i> for Threatened Flora.</p> <p>The assessment of the conservation status of these species is based on their national extent and ranked according to their level of threat using IUCN Red List categories and criteria as detailed below.</p>

Conservation Codes for Western Australian Flora and Fauna	
CR	<p>Critically endangered species</p> <p>Threatened species considered to be “facing an extremely high risk of extinction in the wild in the immediate future, as determined in accordance with criteria set out in the ministerial guidelines”.</p> <p>Listed as critically endangered under section 19(1)(a) of the BC Act in accordance with the criteria set out in section 20 and the ministerial guidelines. Published under schedule 1 of the <i>Wildlife Conservation (Specially Protected Fauna) Notice 2018</i> for critically endangered fauna or the <i>Wildlife Conservation (Rare Flora) Notice 2018</i> for critically endangered flora.</p>
EN	<p>Endangered species</p> <p>Threatened species considered to be “facing a very high risk of extinction in the wild in the near future, as determined in accordance with criteria set out in the ministerial guidelines”.</p> <p>Listed as endangered under section 19(1)(b) of the BC Act in accordance with the criteria set out in section 21 and the ministerial guidelines. Published under schedule 2 of the <i>Wildlife Conservation (Specially Protected Fauna) Notice 2018</i> for endangered fauna or the <i>Wildlife Conservation (Rare Flora) Notice 2018</i> for endangered flora.</p>
VU	<p>Vulnerable species</p> <p>Threatened species considered to be “facing a high risk of extinction in the wild in the medium-term future, as determined in accordance with criteria set out in the ministerial guidelines”.</p> <p>Listed as vulnerable under section 19(1)(c) of the BC Act in accordance with the criteria set out in section 22 and the ministerial guidelines. Published under schedule 3 of the <i>Wildlife Conservation (Specially Protected Fauna) Notice 2018</i> for vulnerable fauna or the <i>Wildlife Conservation (Rare Flora) Notice 2018</i> for vulnerable flora.</p>
<p>Extinct species</p> <p>Listed by order of the Minister as extinct under section 23(1) of the BC Act as extinct or extinct in the wild.</p>	
EX	<p>Extinct species</p> <p>Species where “there is no reasonable doubt that the last member of the species has died”, and listing is otherwise in accordance with the ministerial guidelines (section 24 of the BC Act).</p> <p>Published as presumed extinct under schedule 4 of the <i>Wildlife Conservation (Specially Protected Fauna) Notice 2018</i> for extinct fauna or the <i>Wildlife Conservation (Rare Flora) Notice 2018</i> for extinct flora.</p>
EW	<p>Extinct in the wild species</p> <p>Species that “is known only to survive in cultivation, in captivity or as a naturalised population well outside its past range; and it has not been recorded in its known habitat or expected habitat, at appropriate seasons, anywhere in its past range, despite surveys over a time frame appropriate to its life cycle and form”, and listing is otherwise in accordance with the ministerial guidelines (section 25 of the BC Act).</p> <p>Currently there are no threatened fauna or threatened flora species listed as extinct in the wild. If listing of a species as extinct in the wild occurs, then a schedule will be added to the applicable notice.</p>
<p>Specially protected species</p> <p>Listed by order of the Minister as specially protected under section 13(1) of the BC Act. Meeting one or more of the following categories: species of special conservation interest; migratory species; cetaceans; species subject to international agreement; or species otherwise in need of special protection.</p> <p>Species that are listed as threatened species (critically endangered, endangered or vulnerable) or extinct species under the BC Act cannot also be listed as Specially Protected species.</p>	
MI	<p>Migratory species</p> <p>Fauna that periodically or occasionally visit Australia or an external Territory or the exclusive economic zone; or the species is subject of an international agreement that relates to the protection of migratory species and that binds the Commonwealth; and listing is otherwise in accordance with the ministerial guidelines (section 15 of the BC Act).</p> <p>Includes birds that are subject to an agreement between the government of Australia and the governments of Japan (JAMBA), China (CAMBA) and The Republic of Korea (ROKAMBA), and fauna subject to the <i>Convention on the Conservation of Migratory Species of Wild Animals</i> (Bonn Convention), an environmental treaty under the United Nations Environment Program. Migratory species listed under the BC Act are a subset of the migratory animals that are known to visit Western Australia, protected under the international agreements or treaties, excluding species that are listed as Threatened species.</p> <p>Published as migratory birds protected under an international agreement under schedule 5 of the <i>Wildlife Conservation (Specially Protected Fauna) Notice 2018</i>.</p>
CD	<p>Species of special conservation interest (conservation dependent fauna)</p> <p>Fauna of special conservation need being species dependent on ongoing conservation intervention to prevent it becoming eligible for listing as threatened, and listing is otherwise in accordance with the ministerial guidelines (section 14 of the BC Act).</p> <p>Published as conservation dependent fauna under schedule 6 of the <i>Wildlife Conservation (Specially Protected Fauna) Notice 2018</i>.</p>
OS	<p>Other specially protected species</p> <p>Fauna otherwise in need of special protection to ensure their conservation, and listing is otherwise in accordance with the ministerial guidelines (section 18 of the BC Act).</p> <p>Published as other specially protected fauna under schedule 7 of the <i>Wildlife Conservation (Specially Protected Fauna) Notice 2018</i>.</p>

Conservation Codes for Western Australian Flora and Fauna	
P	<p>Priority species</p> <p>Possibly threatened species that do not meet survey criteria, or are otherwise data deficient, are added to the Priority Fauna or Priority Flora Lists under Priorities 1, 2 or 3. These three categories are ranked in order of priority for survey and evaluation of conservation status so that consideration can be given to their declaration as threatened fauna or flora.</p> <p>Species that are adequately known, are rare but not threatened, or meet criteria for near threatened, or that have been recently removed from the threatened species or other specially protected fauna lists for other than taxonomic reasons, are placed in Priority 4. These species require regular monitoring.</p> <p>Assessment of Priority codes is based on the Western Australian distribution of the species, unless the distribution in WA is part of a contiguous population extending into adjacent States, as defined by the known spread of locations.</p>
1	<p>Priority 1: Poorly-known species</p> <p>Species that are known from one or a few locations (generally five or less) which are potentially at risk. All occurrences are either: very small; or on lands not managed for conservation, e.g. agricultural or pastoral lands, urban areas, road and rail reserves, gravel reserves and active mineral leases; or otherwise under threat of habitat destruction or degradation. Species may be included if they are comparatively well known from one or more locations but do not meet adequacy of survey requirements and appear to be under immediate threat from known threatening processes. Such species are in urgent need of further survey.</p>
2	<p>Priority 2: Poorly-known species</p> <p>Species that are known from one or a few locations (generally five or less), some of which are on lands managed primarily for nature conservation, e.g. national parks, conservation parks, nature reserves and other lands with secure tenure being managed for conservation. Species may be included if they are comparatively well known from one or more locations but do not meet adequacy of survey requirements and appear to be under threat from known threatening processes. Such species are in urgent need of further survey.</p>
3	<p>Priority 3: Poorly-known species</p> <p>Species that are known from several locations, and the species does not appear to be under imminent threat, or from few but widespread locations with either large population size or significant remaining areas of apparently suitable habitat, much of it not under imminent threat. Species may be included if they are comparatively well known from several locations but do not meet adequacy of survey requirements and known threatening processes exist that could affect them. Such species are in need of further survey.</p>
4	<p>Priority 4: Rare, Near Threatened and other species in need of monitoring</p> <p>(a) Rare. Species that are considered to have been adequately surveyed, or for which sufficient knowledge is available, and that are considered not currently threatened or in need of special protection but could be if present circumstances change. These species are usually represented on conservation lands.</p> <p>(b) Near Threatened. Species that are considered to have been adequately surveyed and that are close to qualifying for vulnerable but are not listed as Conservation Dependent.</p> <p>(c) Species that have been removed from the list of threatened species during the past five years for reasons other than taxonomy.</p>
<p>¹ The definition of flora includes algae, fungi and lichens.</p> <p>² Species includes all taxa (plural of taxon - a classificatory group of any taxonomic rank, e.g. a family, genus, species or any infraspecific category i.e. subspecies or variety, or a distinct population).</p>	

THREATENED AND PRIORITY ECOLOGICAL COMMUNITIES

Western Australian TECs are protected under the BC Act and are categorised much like those of the EPBC Act. Western Australian definitions and criteria for TECs are shown in **Table 13**.

Currently described TECs are listed on the DBCA website, with the most recent list endorsed by the Minister for Environment in June 2018 (DBCA 2018).

DBCA also maintains a list of Priority Ecological Communities (PECs). PECs include potential TECs that do not meet survey criteria, or that are not adequately defined. They are not protected under legislation but are taken into consideration as part of the environmental approvals process.

Currently described PECs are listed on the DBCA website, with the most recent list dated 20 March 2021 (Species and Communities Program, DBCA 2021). Definitions and criteria for PECs are shown in **Table 13**.

Table 13: DBCA definitions and criteria for TECs and PECs (DEC 2013)

Criteria	Definition
Threatened Ecological Communities	
Presumed Totally Destroyed (PD)	<p>An ecological community that has been adequately searched for but for which no representative occurrences have been located. The community has been found to be totally destroyed or so extensively modified throughout its range that no occurrence of it is likely to recover its species composition and/or structure in the foreseeable future.</p> <p>An ecological community will be listed as presumed totally destroyed if there are no recent records of the community being extant and either of the following applies (A or B):</p> <ul style="list-style-type: none"> A. Records within the last 50 years have not been confirmed despite thorough searches of known or likely habitats or B. All occurrences recorded within the last 50 years have since been destroyed
Critically Endangered (CR)	<p>An ecological community that has been adequately surveyed and found to have been subject to a major contraction in area and/or that was originally of limited distribution and is facing severe modification or destruction throughout its range in the immediate future, or is already severely degraded throughout its range but capable of being substantially restored or rehabilitated.</p> <p>An ecological community will be listed as Critically Endangered when it has been adequately surveyed and is found to be facing an extremely high risk of total destruction in the immediate future. This will be determined on the basis of the best available information, by it meeting any one or more of the following criteria (A, B or C):</p> <ul style="list-style-type: none"> A. The estimated geographic range, and/or total area occupied, and/or number of discrete occurrences since European settlement have been reduced by at least 90% and either or both of the following apply (i or ii): <ul style="list-style-type: none"> i. geographic range, and/or total area occupied and/or number of discrete occurrences are continuing to decline such that total destruction of the community is imminent (within approximately 10 years); ii. modification throughout its range is continuing such that in the immediate future (within approximately 10 years) the community is unlikely to be capable of being substantially rehabilitated. B. Current distribution is limited, and one or more of the following apply (i, ii or iii): <ul style="list-style-type: none"> i. geographic range and/or number of discrete occurrences, and/or area occupied is highly restricted and the community is currently subject to known threatening processes which are likely to result in total destruction throughout its range in the immediate future (within approximately 10 years); ii. there are very few occurrences, each of which is small and/or isolated and extremely vulnerable to known threatening processes; iii. there may be many occurrences but total area is very small and each occurrence is small and/or isolated and extremely vulnerable to known threatening processes. C. The ecological community exists only as highly modified occurrences that may be capable of being rehabilitated if such work begins in the immediate future (within approximately 10 years).
Endangered (EN)	<p>An ecological community that has been adequately surveyed and found to have been subject to a major contraction in area and/or was originally of limited distribution and is in danger of significant modification throughout its range or severe modification or destruction over most of its range in the near future.</p> <p>An ecological community will be listed as Endangered when it has been adequately surveyed and is not Critically Endangered but is facing a very high risk of total destruction in the near future. This will be determined on the basis of the best available information by it meeting any one or more of the following criteria (A, B, or C):</p> <ul style="list-style-type: none"> A. The geographic range, and/or total area occupied, and/or number of discrete occurrences have been reduced by at least 70% since European settlement and either or both of the following apply (i or ii): <ul style="list-style-type: none"> i. the estimated geographic range, and/or total area occupied and/or number of discrete occurrences are continuing to decline such that total destruction of the community is likely in the short term future (within approximately 20 years); ii. modification throughout its range is continuing such that in the short term future (within approximately 20 years) the community is unlikely to be capable of being substantially restored or rehabilitated. B. Current distribution is limited, and one or more of the following apply (i, ii or iii): <ul style="list-style-type: none"> i. geographic range and/or number of discrete occurrences, and/or area occupied is highly restricted and the community is currently subject to known threatening processes which are likely to result in total destruction throughout its range in the short term future (within approximately 20 years); ii. there are few occurrences, each of which is small and/or isolated and all or most occurrences are very vulnerable to known threatening processes; iii. there may be many occurrences but total area is small and all or most occurrences are small and/or isolated and very vulnerable to known threatening processes. <p>The ecological community exists only as very modified occurrences that may be capable of being substantially restored or rehabilitated if such work begins in the short-term future (within approximately 20 years).</p>

Criteria	Definition
Vulnerable (VU)	<p>An ecological community that has been adequately surveyed and is found to be declining and/or has declined in distribution and/or condition and whose ultimate security has not yet been assured and/or a community that is still widespread but is believed likely to move into a category of higher threat in the near future if threatening processes continue or begin operating throughout its range.</p> <p>An ecological community will be listed as Vulnerable when it has been adequately surveyed and is not Critically Endangered or Endangered but is facing a high risk of total destruction or significant modification in the medium to long-term future. This will be determined on the basis of the best available information by it meeting any one or more of the following criteria (A, B or C):</p> <ul style="list-style-type: none"> A. The ecological community exists largely as modified occurrences that are likely to be capable of being substantially restored or rehabilitated. B. The ecological community may already be modified and would be vulnerable to threatening processes, is restricted in area and/or range and/or is only found at a few locations. C. The ecological community may be still widespread but is believed likely to move into a category of higher threat in the medium to long term future because of existing or impending threatening processes.
Priority ecological communities	
Priority One	<p><i>Poorly known ecological communities</i></p> <p>Ecological communities with apparently few, small occurrences, all or most not actively managed for conservation (e.g. within agricultural or pastoral lands, urban areas, active mineral leases) and for which current threats exist. Communities may be included if they are comparatively well-known from one or more localities but do not meet adequacy of survey requirements, and/or are not well defined, and appear to be under immediate threat from known threatening processes across their range.</p>
Priority Two	<p><i>Poorly known ecological communities</i></p> <p>Communities that are known from few small occurrences, all or most of which are actively managed for conservation (e.g. within national parks, conservation parks, nature reserves, state forest, unallocated Crown land, water reserves, etc.) and not under imminent threat of destruction or degradation. Communities may be included if they are comparatively well known from one or more localities, but do not meet adequacy of survey requirements, and / or are not well defined, and appear to be under threat from known threatening processes.</p>
Priority Three	<p><i>Poorly known ecological communities</i></p> <ul style="list-style-type: none"> i. Communities that are known from several to many occurrences, a significant number or area of which are not under threat of habitat destruction or degradation or; ii. Communities known from a few widespread occurrences, which are either large or within significant remaining areas of habitat in which other occurrences may occur, much of it not under imminent threat, or; iii. Communities made up of large, and/or widespread occurrences, that may or may not be represented in the reserve system, but are under threat of modification across much of their range from processes such as grazing by domestic and/or feral stock, and inappropriate fire regimes. <p>Communities may be included if they are comparatively well known from several localities, but do not meet adequacy of survey requirements and / or are not well defined, and known threatening processes exist that could affect them.</p>
Priority Four	<p>Ecological communities that are adequately known, rare but not threatened or meet criteria for Near Threatened, or that have been recently removed from the threatened list. These communities require regular monitoring.</p> <ul style="list-style-type: none"> i. Rare. Ecological communities known from few occurrences that are considered to have been adequately surveyed, or for which sufficient knowledge is available, and that are considered not currently threatened or in need of special protection, but could be if present circumstances change. These communities are usually represented on conservation lands. ii. Near Threatened. Ecological communities that are considered to have been adequately surveyed and that do not qualify for Conservation Dependent, but that are close to qualifying for Vulnerable. iii. Ecological communities that have been removed from the list of threatened communities during the past five years.
Priority Five	<p><i>Conservation Dependent Ecological Communities</i></p> <p>Ecological Communities that are not threatened but are subject to a specific conservation program, the cessation of which would result in the community becoming threatened within five years.</p>

ENVIRONMENTALLY SENSITIVE AREAS

There are a number of areas within Western Australia identified as being of environmental significance within which the exemptions to the Native Vegetation Clearing Regulations do not apply. These are referred to as Environmentally Sensitive Areas (ESAs), and are declared under section 51B of the EP Act and described in the *Environmental Protection (Environmentally Sensitive Areas) Notice*.

CONSERVATION ESTATE

The National Reserve System is a network of protected areas managed for conservation under international guidelines. The objective of placing areas of bushland into the Conservation Estate is to achieve and maintain a comprehensive, adequate and representative reserve system for Western Australia. The Conservation and Parks Commission is the vesting body for conservation lands, forest and marine reserves that are managed by DBCA (Government of Western Australia 2018b).

APPENDIX TWO

DESKTOP ASSESSMENT RESULTS AND LIKELIHOOD ASSESSMENTS

Table 14: Fauna database results and likelihood assessments

Blue shading indicates high likelihood; darker blue indicates species is known (recorded) from the survey area.

Species	Common name	Conservation status		Database			Likelihood of occurrence	
		EPBC Act	Western Australian	PMST**	DBCA	NatureMap	Desktop	Post-survey
Mammals								
<i>Sminthopsis longicaudata</i>	Long-tailed dunnart		P4		X	X	High	Medium
<i>Dasyercus blythi</i>	Brush-tailed mulgara		T		X		Low	Very low
<i>Lagostrophus fasciatus sp. fasciatus</i>	Banded hare-wallaby, Merrine	VU				X	Low	Very low
<i>Macrotis lagotis</i>	Greater bilby	VU	T	may			Low	Very low
<i>Rhinonicteris aurantia (Pilbara form)</i>	Pilbara leaf-nosed bat	VU		may			Low	Very low
Birds								
<i>Accipiter fasciatus</i>	Brown goshawk		IA			X	Medium	Medium
<i>Falco peregrinus</i>	Peregrine falcon		S			X	High	Low
<i>Leipoa ocellata</i>	Malleefowl	VU	T	likely		X	Low	Very low
<i>Falco hypoleucos</i>	Grey falcon	VU		likely			High	Low
<i>Pezoporus occidentalis</i>	Night parrot	E		likely			Low	Very Low
<i>Polytelis alexandrae</i>	Princess parrot, Alexandra's parrot	VU		may			Low	Very Low
<i>Motacilla flava</i>	Yellow wagtail	MA/MI		may			Low	Very low
<i>Motacilla cinerea</i>	Grey wagtail	MA/MI		may			Low	Very low

Table 15: Excluded species and reason for exclusion.

Species	Common name	Database		Conservation status		Reason excluded from assessment
		PMST	DBCA/ NatureMap	EPBC Act	WA	
Birds						
<i>Calidris ruficollis</i>	Red-necked stint		X	MI	MI	No suitable habitat within survey area (wetlands, waterbodies...)
<i>Actitis hypoleucos</i>	Common sandpiper	known	X	MI	MI	No suitable habitat within survey area (wetlands, waterbodies...)
<i>Tringa nebularia</i>	Common greenshank		X	MI	MI	No suitable habitat within survey area (wetlands, waterbodies...)
<i>Calidris acuminata</i>	Sharp-tailed sandpiper	may	X	MI	MI	No suitable habitat within survey area (wetlands, waterbodies...)
<i>Calidris ferunginea</i>	Curlew sandpiper	may		CE		No suitable habitat within survey area (wetlands, waterbodies...)
<i>Calidris melanotos</i>	Pectoral sandpiper	may				No suitable habitat within survey area (wetlands, waterbodies...)
<i>Charadrius veredus</i>	Oriental plover	may				No suitable habitat within survey area (wetlands, waterbodies...)
<i>Ardea alba</i>	Great egret, White egret	known				No suitable habitat within survey area (wetlands, waterbodies...)
<i>Merops ornatus</i>	Rainbow Bee-eater	may				No suitable habitat within survey area (wetlands, waterbodies...)
<i>Chrysococcyx osculans</i>	Black eared-cuckoo	known				No suitable habitat within survey area (wetlands, waterbodies...)

APPENDIX THREE FIELD SURVEY RESULTS

Table 16: Recorded fauna species



Species	Common name	EPBC Act status	Western Australian status	Survey site
Mammals				
Bovidae				
<i>Bos taurus</i>	Cattle (Cow)		Introduced Fauna under WAM / Literature Source	SFG4, MC10
Canidae				
<i>Canis lupus</i>	Dog		Introduced Fauna under WAM / Literature Source	Opportunistic
Equidae				
<i>Equus caballus</i>	Horse		Introduced Fauna under WAM / Literature Source	Opportunistic
Felidae				
<i>Felis catus</i>	Cat		Introduced Fauna under WAM / Literature Source	Opportunistic
Emballonuridae				
<i>Saccolaimus flaviventris</i>	Yellow-bellied Sheath-tailed Bat			SM4 Bat 1240
Leporidae				
<i>Oryctolagus cuniculus</i>	Rabbit		Introduced Fauna under WAM / Literature Source	MC60
Macropodidae				
<i>Macropus robustus</i>	Euro			SFG3, Opportunistic
Molossidae				
<i>Chaerephon jobensis</i>	Greater Northern Free-tailed Bat			SM4 Bat 1240
<i>Ozimops lumsdenae</i>	Northern Free-tailed Bat			SM4 Bat 1240
Muridae				
<i>Mus musculus</i>	House Mouse		Introduced Fauna under WAM / Literature Source	SFG1, SFG2, SFG3, MC92,MC95,MC56
Dasyuridae				
<i>Sminthopsis macroura</i>	Stripe-faced Dunnart			SFG4
Vespertilionidae				
<i>Chalinolobus gouldii</i>	Gould's Wattled Bat			SM4 Bat 1240
<i>Scotorepens balstoni</i>	Inland Broad-nosed Bat			SM4 Bat 1240
<i>Scotorepens greyii</i>	Little Broad-nosed Bat			SM4 Bat 1240
<i>Vespadelus baverstocki</i>	Inland Forest Bat			SM4 Bat 1240
<i>Vespadelus finlaysoni</i>	Finlayson's Cave Bat			SM4 Bat 1240
Birds				



Species	Common name	EPBC Act status	Western Australian status	Survey site
Acanthizidae				
<i>Acanthiza robustirostris</i>	Slaty-backed Thornbill			Opportunistic
Accipitridae				
<i>Accipiter fasciatus</i>	Brown Goshawk			SFG3
<i>Aquila audax</i>	Wedge-tailed Eagle			Opportunistic
<i>Aquila morphnoides subsp. morphnoides</i>	Little Eagle			SFG3, Opportunistic
Artamidae				
<i>Artamus cinereus</i>	Black-faced Woodswallow			SFG1, SFG3, SFG4
Campephagidae				
<i>Coracina novaehollandiae</i>	Black-faced Cuckoo-shrike			SFG3
Cinclosomatidae				
<i>Cinclosoma castaneothorax</i>	Chestnut-breasted Quail-thrush			SFG2, MC99
Columbidae				
<i>Geopelia cuneata</i>	Diamond Dove			SFG1, SFG3
<i>Geopelia striata subsp. placida</i>	Peaceful Dove			SFG3
<i>Phaps chalcoptera</i>	Common Bronzewing			SFG4, MC55
<i>Ocyphaps lophotes</i>	Crested Pigeon			SFG3, Opportunistic
Corvidae				
<i>Corvus bennetti</i>	Little Crow			SFG3
Cracticidae				
<i>Cracticus nigrogularis</i>	Pied Butcherbird			SFG3
Dicruridae				
<i>Rhipidura leucophrys</i>	Willie Wagtail			SFG1, SFG4, Opportunistic
Estrilidae				
<i>Taeniopygia guttata</i>	Zebra Finch			SFG1, SFG2, SFG3, SFG4, Opportunistic
Falconidae				
<i>Falco berigora</i>	Brown Falcon			SFG4
<i>Falco cenchroides</i>	Australian Kestrel			SFG4
Hirudinidae				
<i>Hirundo nigricans</i>	Tree Martin			SFG1, SFG3
Maluridae				
<i>Malurus lamberti</i>	Variegated Fairy-wren			SFG2
Meliphagidae				
<i>Anthochaera carunculata</i>	Red Wattlebird			SFG1, SFG3
<i>Gavicalis virescens</i>	Singing Honeyeater			SFG2, SFG3
<i>Manorina flavigula</i>	Yellow-throated Miner			SFG3



Species	Common name	EPBC Act status	Western Australian status	Survey site
<i>Ptilotula penicillata subsp. carteri</i>	Carter's White-plumed Honeyeater			SFG3
Meropidae				
<i>Merops ornatus</i>	Rainbow Bee-eater			SFG1, SFG2, SFG3, SFG4
Pachycephalidae				
<i>Colluricincla harmonica</i>	Grey Shrike-thrush			SFG3
<i>Pachycephala rufiventris</i>	Rufous Whistler			SFG2, SFG3
Pardalotidae				
<i>Pardalotus striatus subsp. murchisoni</i>	Striated Pardalote			Opportunistic
Petroicidae				
<i>Petroica goodenovii</i>	Red-capped Robin			SFG2
Pomatostomidae				
<i>Pomatostomus temporalis</i>	Grey-crowned Babbler			SFG3
Psittacidae				
<i>Cacatua roseicapilla</i>	Galah			SFG2, SFG3
<i>Platycercus varius</i>	Mulga Parrot			SFG3
<i>Platycercus zonarius</i>	Australian Ringneck			SFG3
Reptiles				
Agamidae				
<i>Amphibolurus longirostris</i>	Long-nosed Dragon			SFG4
<i>Ctenophorus caudicinctus</i>	Ring-tailed Dragon			Opportunistic
<i>Ctenophorus reticulatus</i>	Western Netted Dragon			Opportunistic
<i>Ctenophorus scutulatus</i>	Lozenge-marked Dragon			SFG4
Diplodactylidae				
<i>Diplodactylus conspicillatus</i>	Fat-tailed Gecko			SFG4
<i>Diplodactylus granariensis</i>	Western Stone gecko			SFG1, SFG2, SFG3, SFG4
<i>Diplodactylus laevis</i>	Desert Fat-tailed Gecko			SFG4
<i>Diplodactylus pulcher</i>	Fine-faced Gecko			SFG1, SFG2
Gekkonidae				
<i>Gehyra variegata</i>	Tree or Variegated Dtella			SFG1, SFG3
Pygopodidae				
<i>Delma tinctoria</i>	Excitable Delma			SFG3
Scincidae				
<i>Ctenotus leonhardii</i>	Spotted Ctenotus			SFG4
<i>Ctenotus schomburgkii</i>	Barred Wedgesnout Ctenotus			SFG1
<i>Ctenotus severus</i>	Stern Ctenotus			SFG4



Species	Common name	EPBC Act status	Western Australian status	Survey site
<i>Ctenotus uber</i>	Spotted Ctenotus			SFG2, SFG4
<i>Egernia depressa</i>	Southern Pigmy Spiny-tailed Skink			SFG1, SFG2
<i>Eremiascincus richardsonii</i>	Broad-banded Swimmer			SFG1, SFG2, SFG4
<i>Lerista macropisthopus</i>	Unpatterned Robust Slider			SFG3
<i>Menetia greyii</i>	Common Dwarf Skink			SFG1, SFG2, SFG3
Varanidae				
<i>Varanus gouldii</i>	Bungarra or Sand Monitor			SFG1, SFG2, Opportunistic
<i>Varanus panoptes</i>	Yellow-spotted Monitor			Opportunistic
Amphibians				
Hylidae				
<i>Cyclorana maini</i>	Sheep Frog			SFG4



Table 17: Fauna sites (GDA94, Zone 50)

Site Name	Site Type	Site Description	Easting	Northing	Picture
SFG01	Plain (shrubland)	Shrubland on stony plain Mulga Grove	716404	7161259	
SFG02	Plain (shrubland)	Shrubland on stony plain Mulga Grove	714894	7160360	



Site Name	Site Type	Site Description	Easting	Northing	Picture
SFG03	Drainage Line/River/Creek (Minor)	Eucalyptus woodland	724015	7165500	
SFG04	Drainage Line/River/Creek (Minor)	Shrubland on creek	732394	7164966	
MC008	Plain (stony/gibber)	Shrubland on stony plain Mulga Grove	720681	7165671	
MC012	Plain (boulders)	Shrubland on stony plain mulga grove	734351	7166832	
MC011	Plain (shrubland)	Shrubland on stony plain Mulga Grove	716752	7162842	
MC006	Drainage Line/River/Creek (Minor)	Shrubland on creek	734329	7166796	



Site Name	Site Type	Site Description	Easting	Northing	Picture
MC010	Drainage Line/River/Creek (Minor / Major)	Shrubland	722222	7165473	
SFH1	Drainage Line/River/Creek (Minor / Major)	Shrubland	723155	7165475	
SFH2	Drainage Line/River/Creek (Minor / Major)	Shrubland	732433	7164975	
SFH3	Drainage Line/River/Creek (Minor / Major)	Shrubland	734337	7166766	



Site Name	Site Type	Site Description	Easting	Northing	Picture
SFH4	Plain (boulders)	Shrubland on stony plain mulga grove	734334	7166899	
SFH5	Drainage Line/River/Creek (Major)	Shrubland	734340	7168669	



Site Name	Site Type	Site Description	Easting	Northing	Picture
SFH6	Plain (shrubland)	Shrubland on stony plain mulga grove	734340	7168920	
SFH7	Plain (shrubland)	Shrubland on stony plain mulga grove	734363	7170074	



Site Name	Site Type	Site Description	Easting	Northing	Picture
SFH8	Plain (stony/gibber)	Shrubland on stony plain mulga grove	733016	7165474	
SFH9	Drainage Line/River/Creek (Minor)	Woodland	722217	7165481	



Site Name	Site Type	Site Description	Easting	Northing	Picture
SFH10	Plain (stony clay)	Sparse shrubland on stony clay plain	720106	7162047	
SFH11	Plain (shrubland)	Shrubland on stony plain mulga grove	717613	7161720	



Site Name	Site Type	Site Description	Easting	Northing	Picture
SFH12	Plain (stony/gibber)	Shrubland on stony plain mulga grove	719192	7163004	
SFH13	Plain (stony/gibber)	Shrubland on stony plain mulga grove	716416	7161244	


Site Name	Site Type	Site Description	Easting	Northing	Picture
SFH14	Plain (shrubland)	Shrubland on stony plain mulga grove	717190	7160982	
SFH15	Plain (stony/gibber)	Shrubland on stony plain mulga grove	734470	7170707	

Site Name	Site Type	Site Description	Easting	Northing	Picture
SFH16	Plain (boulders)	Shrubland on stony plain mulga grove	734616	7171314	
SFH17	Plain (stony/gibber)	Shrubland on stony plain mulga grove	715047	7160666	

Site Name	Site Type	Site Description	Easting	Northing	Picture
SFH18	Plain (shrubland)	Shrubland on stony plain mulga grove	715788	7160011	
SFH19	Plain (stony clay)	Sparse shrubland on stony clay plain	720027	7162377	

Site Name	Site Type	Site Description	Easting	Northing	Picture
SFH20	Plain (stony clay)	Sparse shrubland on stony clay plain	720340	7165683	
SFH21	Drainage Line/River/Creek (Minor)	Shrubland on stony plain mulga grove	724039	7165482	

Site Name	Site Type	Site Description	Easting	Northing	Picture
SFH22	Plain (stony/gibber)	Shrubland on stony plain Mulga Grove	723691	7165482	
SFH23	Plain (stony/gibber)	Shrubland on stony plain mulga grove	718881	7162680	

Site Name	Site Type	Site Description	Easting	Northing	Picture
SFH24	Plain (stony/gibber)	Shrubland on stony plain Mulga Grove	718901	7163006	
SFH25	Plain (shrubland)	Shrubland on stony plain Mulga Grove	716728	7162782	