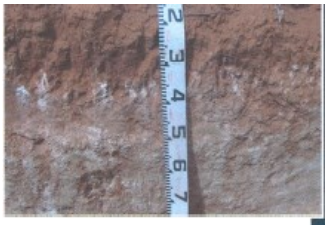

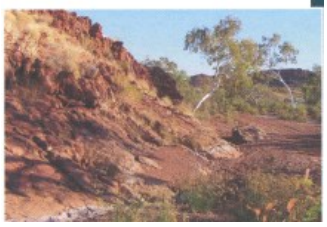

HILDITCH GOLD PROJECT

SUPPORTING DOCUMENT FOR CLEARING PERMIT APPLICATION

M15/1448, M15/1770 & M15/1771

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16 December 2024

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1.0 INTRODUCTION

1.1 BACKGROUND

Maximus Resources Ltd's (MXR) Spargoville Project encompasses 117 km^2 in tenements located 25km southwest of Kambalda, in the Goldfields region of Western Australia (Figure 1). MXR's initial focus is on development of the Hilditch, Larkinville, 8500N and Wattle Dam gold deposit areas (Figure 2) and exploration drilling has been ongoing.

MXR intends to initially commence mining development at the Hilditch gold deposit located on M15/1448 west of the Coolgardie-Esperance Highway (Figure 2). Hilditch is a greenfield site with site disturbance works to date limited to exploration. This is the first stage of mining proposed at Hilditch.

1.2 PURPOSE

This document is to complement the application relating to the clearing of up to 46 ha of native vegetation at the Hilditch gold project for mine infrastructure.

As required by the DEMIRS, the ten clearing principles and background information has been provided in this document relating to the site location, ownership, hydrology, vegetation, fauna and land degradation issues.

To assist in the DEMIRS's assessment of this clearing permit application, a summary of the relevant environmental information for the Project area has been included in this document in addition to the biological survey reports.

For the purpose of this document, reference to 'Clearing area' in this document refers specifically to the larger footprint within which clearing of 46 ha will occur, i.e. CPS application area.

1.3 LOCATION

The Project is located approximately 90 km southwest of Kalgoorlie and 15 km northwest of Widgiemooltha in the eastern Goldfields of Western Australia. Hilditch is located on the western side of the Coolgardie-Norseman Highway (Figure 2).

1.4 OWNERSHIP AND LAND TENURE

The clearing area is located on M15/1448, M15/1770 and M15/1771. Tenure is summarised in Table 1 and shown in Figure 2.

M15/1448 is held by MXR (90%) and Bullabulling Pty Ltd (10%) and a Letter of Authority from Bullabulling is attached as Appendix 1.

The Project is located on Unallocated Crown Land (UCL) within the Shire of Coolgardie.

The Coolgardie-Esperance Highway (and associated Road Reserve) and Water Corporation pipeline are located at the eastern end of the proposed haul/access roads (Figure 2).

Table 1: Summary of project tenure

TENEMENT	OWNER	DATE GRANTED	EXPIRY DATE	AREA
M15/1448	Maximus Resources Ltd (90%) Bullabulling Pty Ltd (10%)	30 June 2008	29 June 2029	417.3 ha
M15/1770	Maximus Resources Ltd	30 June 2008	29 June 2029	999.1 ha
M15/1771	Maximus Resources Ltd	30 June 2008	29 June 2029	777.85

Figure 1: Location of the Project

Figure 2: Hilditch Project tenure

2 PROPOSED CLEARING

MXR intend to apply for clearing of 46 ha of native vegetation within a CPS application area of 136.8 ha (Figure 3).

This clearing of native vegetation of 46 ha is to allow for development of the Hilditch deposit and construction/installation of associated mine infrastructure including (Figure 4):

- Open pit – mining is above the water table.
- Waste dump
- ROM
- Office/workshop/fuel storage
- Laydown/hardstand
- Haul/access roads – two access roads are proposed a northern and eastern road (Figure 4). Following discussion with Main Roads and a traffic consultant, MXR proposed to have one dedicated entry and exit roads.

Mining activities will be undertaken for 5-6 months with all ore transported to an offsite gold processing facility.

The northern access route follows an existing track which ranges in width up to 10m and will be widened to 15m (Figure 5). MXR anticipates a maximum of 4 ha of clearing is required to establish the northern road.

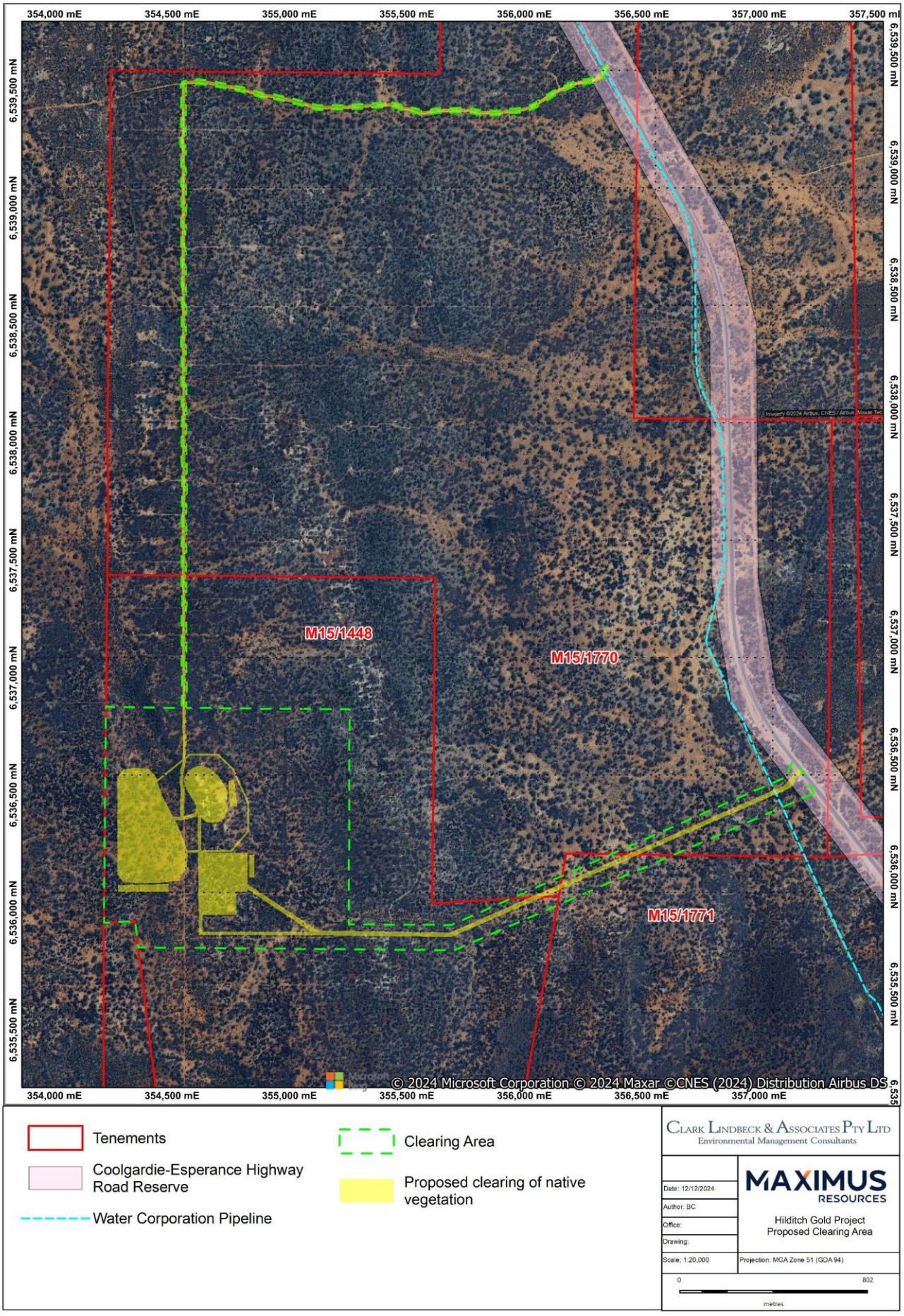

Figure 3: Area of proposed clearing within the Hilditch CPS application area

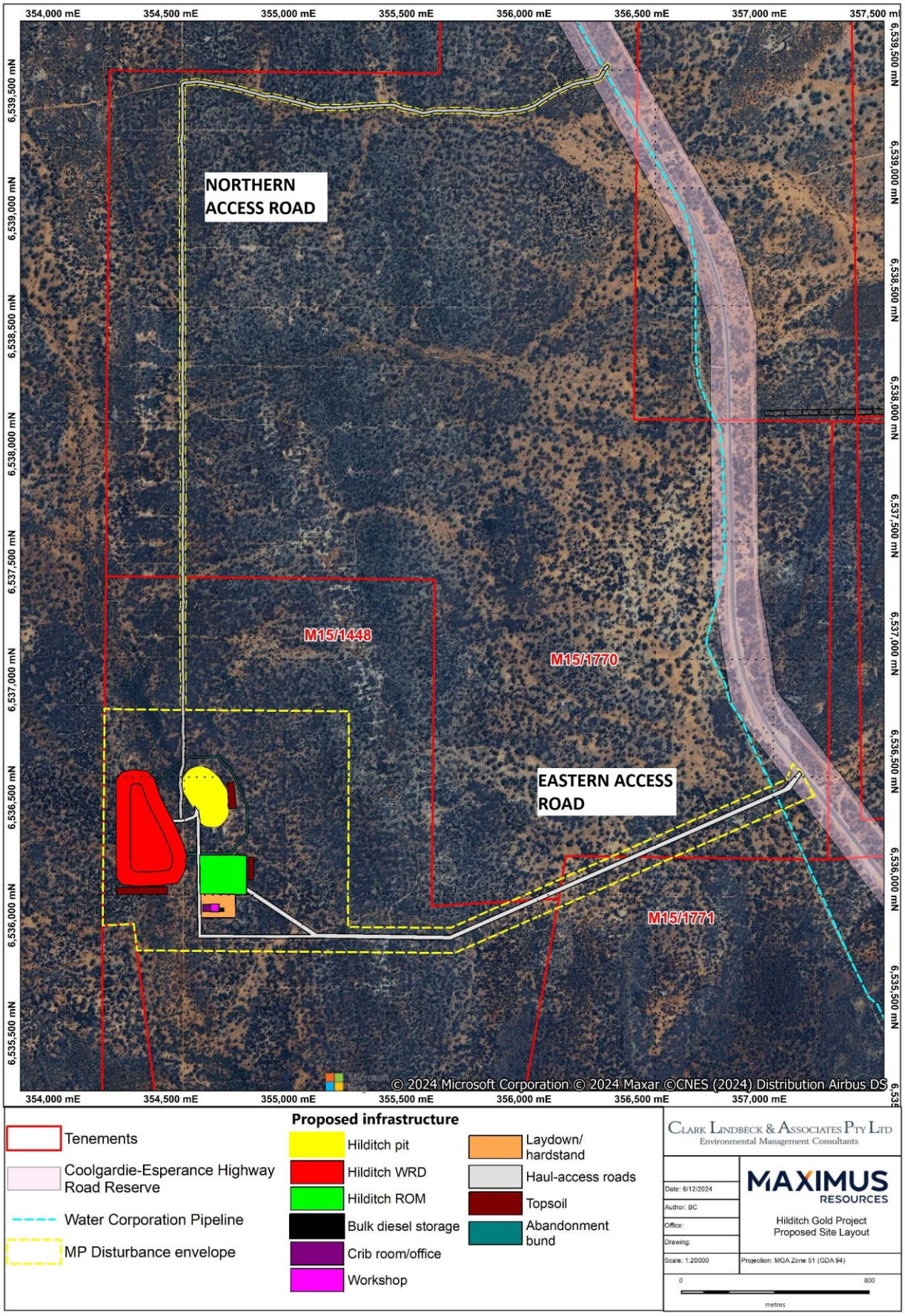

Figure 4: Hilditch site layout with proposed infrastructure

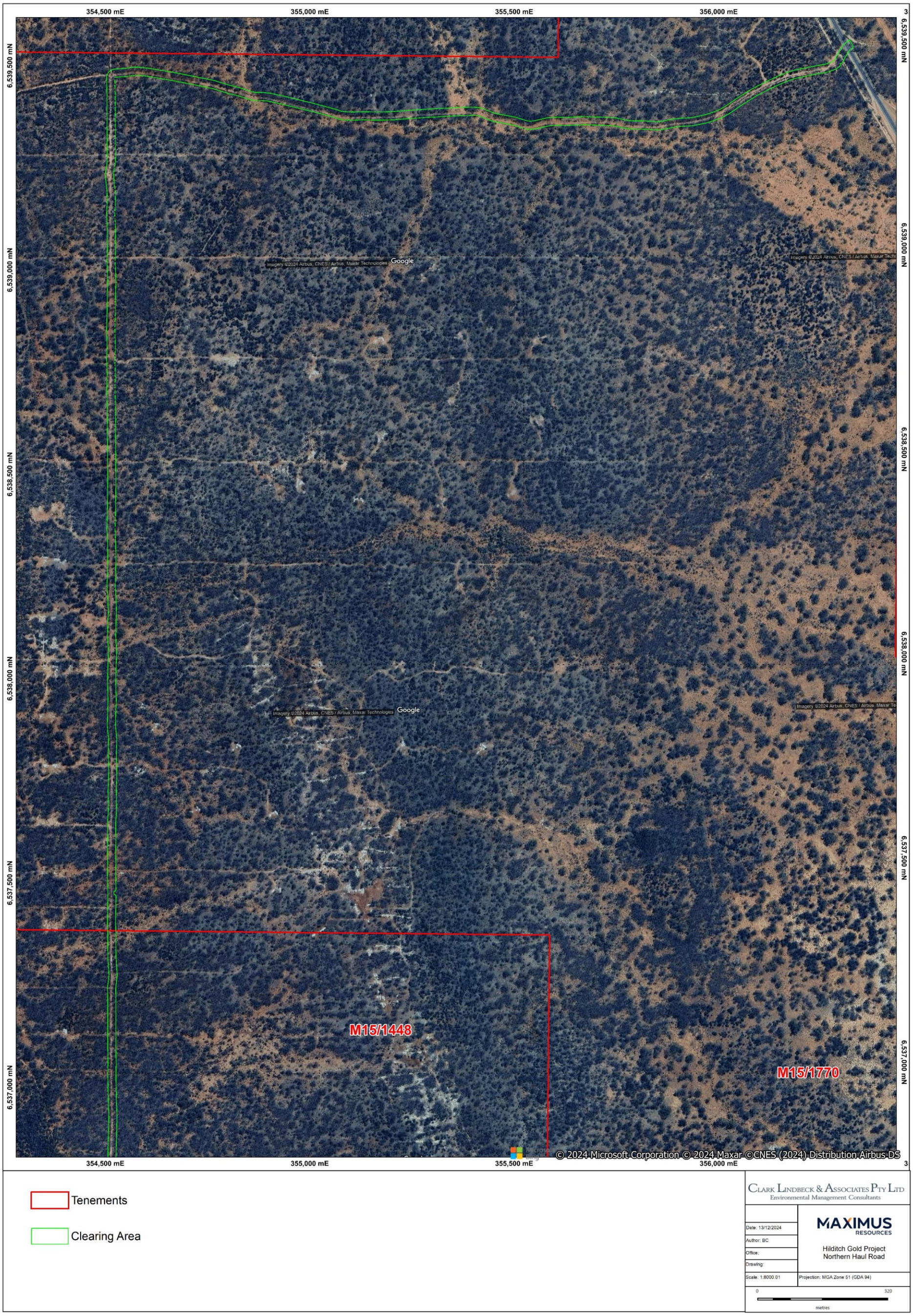

Figure 5: Northern access road showing existing track

3 BASELINE ENVIRONMENTAL DATA

3.1 CLIMATE

The Project area is located within the Kalgoorlie region which exhibits a semi-arid climate characterised by hot dry summers and mild dry winters (Cowan, 2001).

The nearest official meteorological station is located at Norseman Aero, approximately 40 km south of the Project area which has temperature and rainfall data from 1999 to present which is summarised in Table 2 and Figure 6 (BOM 2024a).

Mean annual maximum temperature is 25.2ºC and mean annual minimum 10.0ºC. Daily maxima above 30ºC are usual from December to February. Diurnal temperature variations are commonly high throughout the year.

The area is semi-arid and has an average annual rainfall of 279.5 mm. Rainfall is marginally higher in January to March but the amount varies greatly both seasonally and annually. The highest monthly rainfall was recorded 149.8 mm in February 2000. The region can receive high intensity rainfall from degenerating cyclonic low pressure systems and thunderstorms.

Annual wind roses for Norseman Aero for 0900 hrs and 1500 hrs are provided in Figure 7 and Figure 8 (BOM 2024a). The wind roses show the dominance of northerly winds at both 9:00 am and 3:00 pm.

Long-term annual average potential evaporation at Kalgoorlie is about 2,630 mm, with evaporation greatly exceeding rainfall during every month of the year.

Table 2: Meteorological data for Norseman Aero (Station Number 012009) (BOM 2024a)

Statistic Element	Jan	Feb	March	April	May	June	July	Aug	Sep	Oct	Nov	Dec	Annual
Mean maximum temperature (°C)	32.6	31 8	28.7	25.2	21.1	17.9	17.4	19.3	22.7	26.0	28.6	31.4	25.2
Mean minimum temperature (°C)	15.8	16.1	14.3	11.0	7.0	5.0	4.1	4.6	6.5	9.6	12.2	14.0	10.0
Mean rainfall (mm)	31.1	25.6	30.1	24.2	17.7	20.2	20.8	24.2	17.9	22.5	26.5	18.4	279.5
Highest rainfall (mm)	93.6	136.8	149.8	71.0	47.6	54.8	55.2	48.0	71.8	82.8	92.2	79.8	454.2

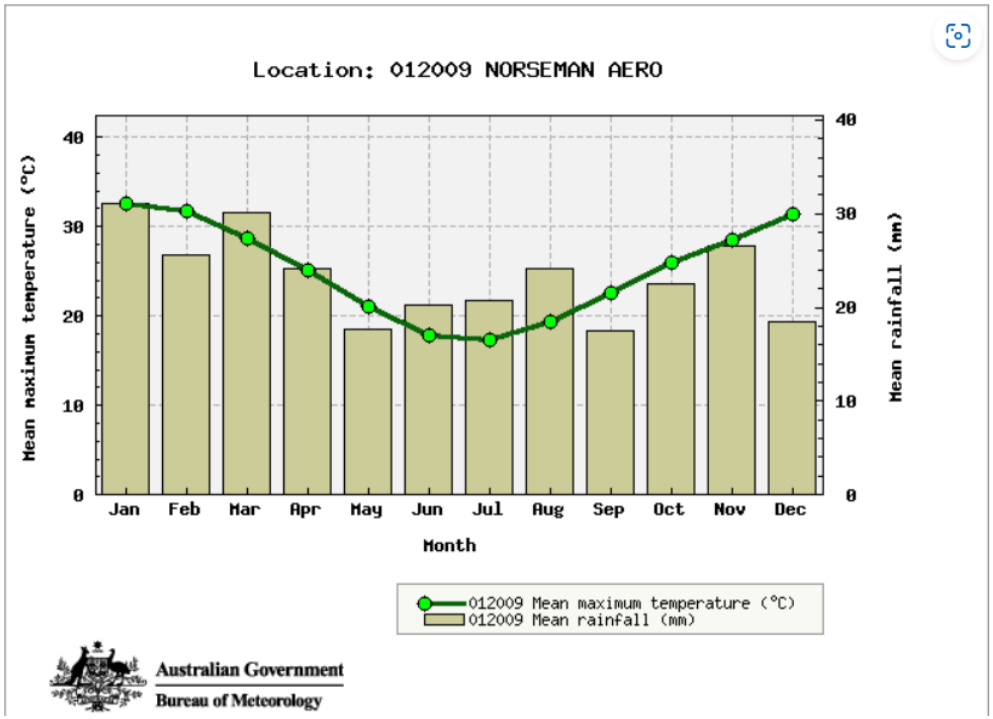

Figure 6: Norseman Aero mean maximum temperature and rainfall (BOM 2024a)

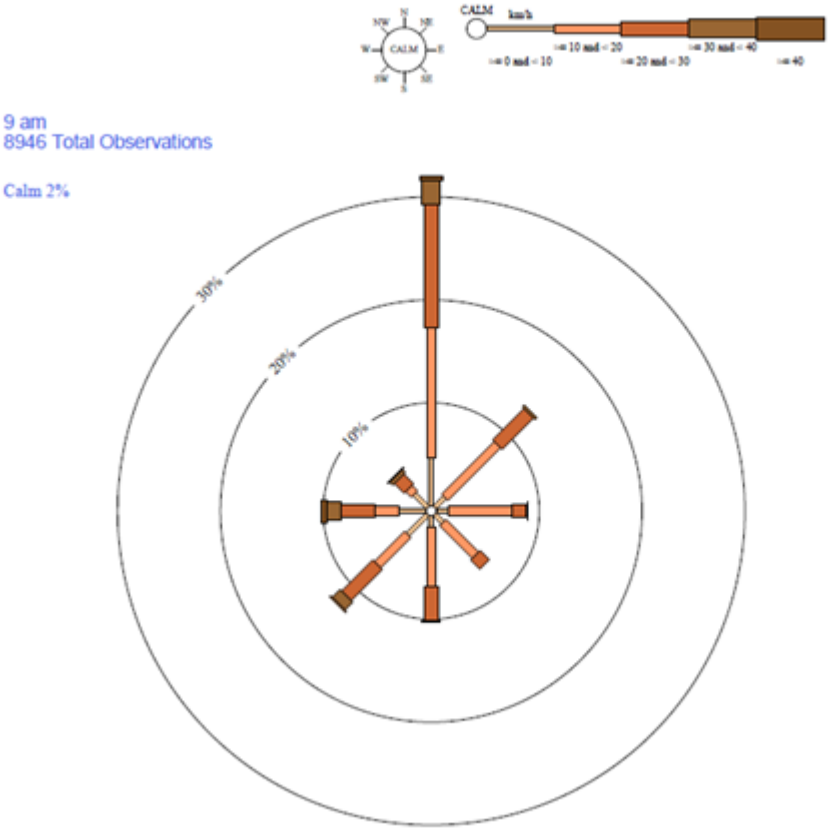

Figure 7: Norseman Aero Annual Wind Rose 0900 hrs (BOM 2024a)

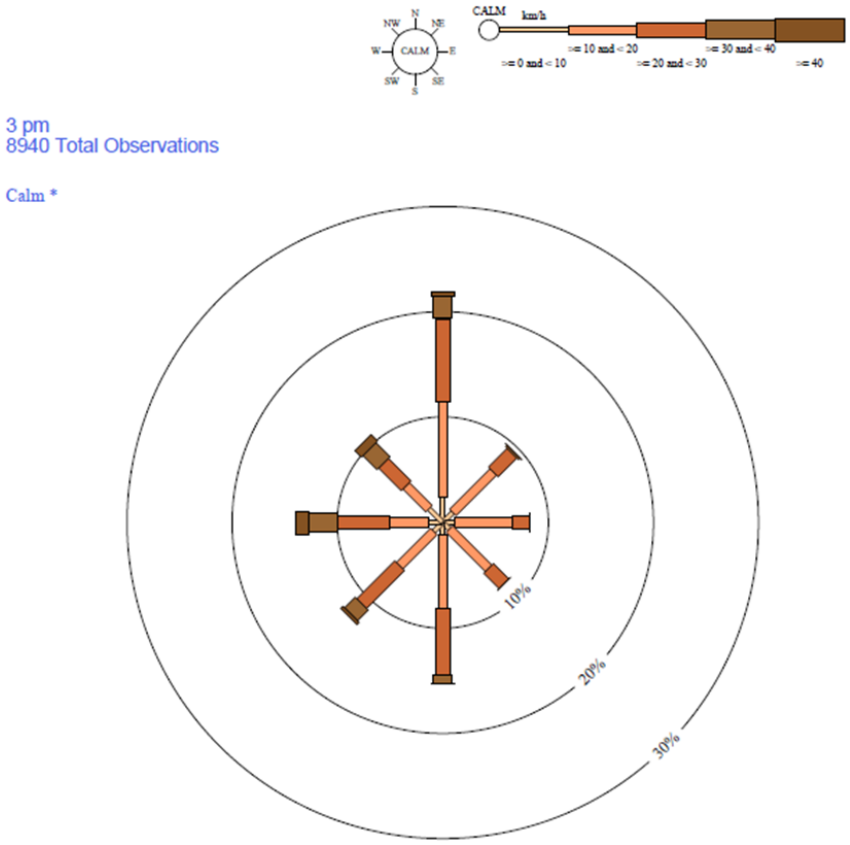

Figure 8: Norseman Aero Annual Wind Rose 1500 hrs (BOM 2024a)

3.2 LANDSCAPE

3.2.1 IBRA Region

The Interim Biogeographic Regionalisation for Australia (IBRA) divides the Australian continent into 89 bioregions and 419 subregions (DCCEEW 2024). The survey area lies in the Coolgardie (COO) bioregion, more specifically the Eastern Goldfields (COO03) subregion. The Eastern Goldfields subregion encompasses over 5 million hectares and comprises the Yilgarn craton's 'Eastern Goldfields' Terrains. The subregion is characterised by gentle undulating plains, the west containing Archaean greenstone ridges and low hills, while the east contains a horst of Proterozoic granulite. In the western half there are a series of large playa lakes which are remnants of an ancient major drainage line. The dominant soil type is Calcareous earth, which cover most of the plains and greenstone areas. The vegetation of the Eastern Goldfields botanical subregion consists of mallees, diverse *Eucalyptus* woodlands and *Dodonaea* shrublands and is rich in endemic Acacias. The salt lakes support dwarf shrublands of samphire. Acacia thickets and shrubheaths are found on sandplains (Cowan, 2001).

The Coolgardie Region and is characterised by granite strata of the Yilgarn Craton with Archaean Greenstone intrusions in parallel belts. Drainage is occluded. Mallees and scrubs on sandplains are associated with lateritised uplands, playas and granite outcrops. Diverse woodlands rich in endemic eucalypts, occur on low greenstone hills, valley alluvials and broad plains of calcareous earths. In the west, the scrubs are rich in endemic Proteaceae, in the east they are rich in endemic Acacias. The climate is arid to semi-arid warm Mediterranean (Thackway and Cresswell, 1995).

3.2.2 Land Systems

As part of the Rangeland resource surveys, the Department of Agriculture (now DPIRD) mapped the Land Systems of Western Australia (DPIRD, 2017). There are two land Systems occurring within the disturbance envelope as listed in Table 3 and presented in Figure 9.

The Hilditch deposit is located on fairly flat terrain. Surface elevations range up to 25 m adjacent to the proposed pit.

Table 3: Land Systems occurring within the Hilditch survey area (DPIRD 2017)

Land System	Description
Graves System	Basalt and greenstone rises and low hills supporting eucalypt woodlands with prominent saltbush and bluebush understoreys.
Moriarty System	Low greenstone rises and stony plains supporting chenopod shrublands with patchy eucalypt overstoreys.
Gumland System	Extensive pedeplains supporting eucalypt woodlands with halophytic and non-halophytic shrub understoreys.

3.2.3 Soil-Landscape Zone

The project is located within the Kambalda soil-landscape zone of the Kalgoorlie Province (labeled with number 265) (Tille 2006). This zone, which encompasses an area of 35,825 km^2, comprises flat to undulating plains (with hills, ranges and some salt lakes and stony plains) on greenstone and granitic rocks of the Yilgarn Craton. Calcareous loamy earths and Red loamy earths with Salt lakes soils and some Red-brown hardpan shallow loams and Red sandy duplexes. Red mallee, blackbutt-salmon, gum-gimlet woodlands with mulga and halophytic shrublands (and some spinifex grasslands).

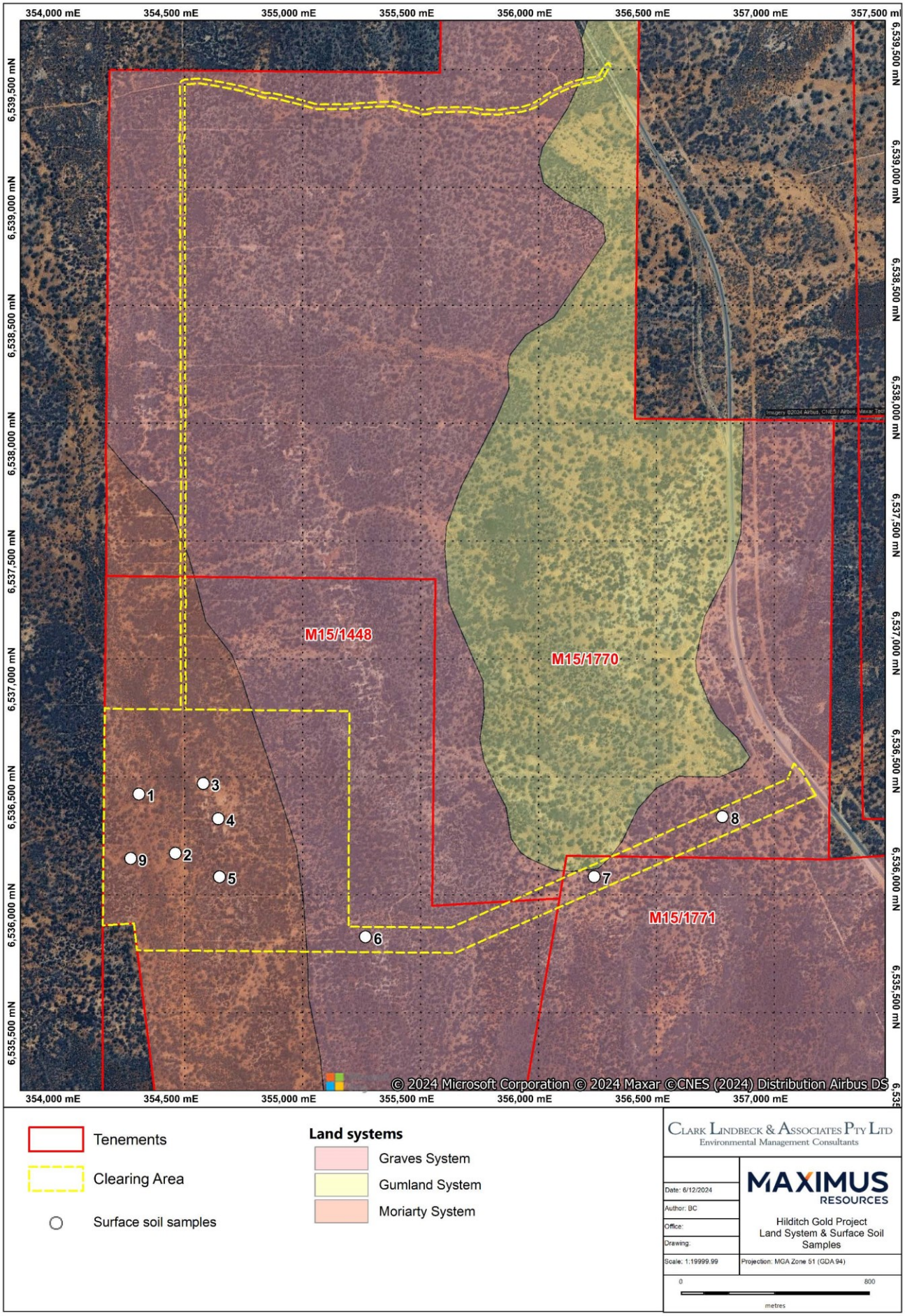

Figure 9: Land Systems and surface soil samples

3.3 SURFACE SOILS CHARACTERISATION

3.3.1 Local Soils

Northcote *et al* (1967) mapped the regional and local soils by the Atlas of Australian Soils system. The clearing area is located within two soil units BB5 and My154 which are described in Table 4 and presented in Figure 10. The main mine area is located within BB5, while the eastern ends of the access roads are located in the My154 unit (Figure 10).

Table 4: Soil unit of the Hilditch deposit and surrounds (Northcote *et al* (1967)

SOIL UNIT	DESCRIPTION
BB5	Rocky ranges and hills of greenstones (basic igneous rocks): chief soils seem to be shallow calcareous loamy soils (Um5.11) and similar soils with shallow brown and grey-brown calcareous earths (Gc1.12 and Gc1.22), below which weathered rock occurs at shallow depths. Associated soils are not described but may include alkaline red earths (Gn2.13).
My154	Undulating country on acid volcanic rocks and sedimentary materials: chief soils are probably neutral red earths (Gn2.12) with a variable content of ironstone gravel. Other soils, such as (Gn2.13) and (Gc) soils, may also occur

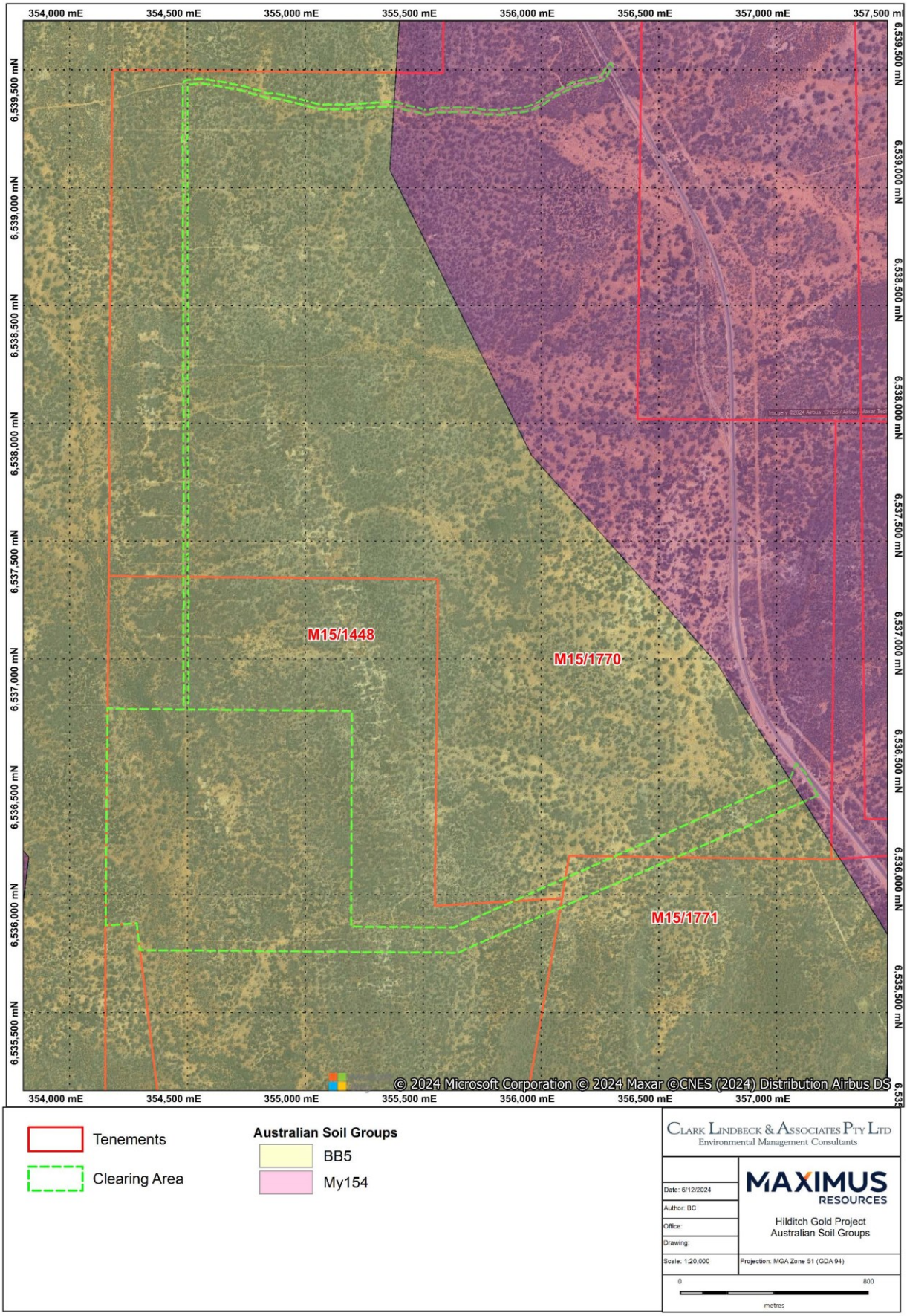

Figure 10: Local soils as mapped by Northcote *et al* (1967)

3.3.2 Project Soils

MXR collected nine surface soil materials from the Project area for analyses (Figure 9). Table 5 provides the results of the topsoil analyses and an assessment of the results was completed by CLA (2024a) and is attached as Appendix 2.

A summary of the soil results is provided below (CLA 2024a):

- The pH of the soils was quite variable from slightly acidic to alkaline (6.4 – 8.5). The moderately and strongly alkaline soils are typical of the soils that have high levels of carbonates which was evident in the more alkaline soil samples (Table 5).
- Soils in the proposed mining area are not saline (1-6, 9). Saline soils were recorded on the eastern haul road.
- All samples had reasonably high to very high levels of the major nutrients available to plants (SO_4, Ca, Mg, K and Total N).
- The soils generally can be classified as various clayey, silty or sandy loams as all samples have reasonable silt and clay class sizes, thus, they all can hold and retain moisture and soil nutrients.

Table 5: Results of surface soils analyses

HILDITCH MINE AND HAUL ROAD SOIL SAMPLES ANALYSES - SEPTEMBER 2024										
PARAMETER	Unit	SAMPLE NUMBER								
		1	2	3	4	5	6	7	8	9
pH (1:2)	pH unit	6.4	7.4	8.5	8.4	8.5	8.8	8.7	8.5	7.1
Electrical Conductivity (1:2) Extract	µS/cm	23	110	260	120	110	1600	340	1500	72
Total Soluble Salts (by calculation)	mg/kg	77	360	890	400	360	5200	1100	5100	240
SOLUBLE ELEMENTS IN SOIL										
Sulphate (SO_4^{2-})	mg/kg	<10	31	82	17	<10	610	16	880	<10
Chloride (Cl)	mg/kg	<10	21	220	19	<10	1700	330	1600	63
Calcium (Ca)	mg/kg	1300	2900	38000	4700	11000	74000	3600	1600	740
Magnesium (Mg)	mg/kg	1600	6300	39000	30000	6000	62000	5900	15000	2200
Sodium (Na)	mg/kg	100	190	430	230	130	3000	580	2700	290
Potassium (K)	mg/kg	960	3100	2100	1800	3100	1300	2900	6300	2200
Total Alkalinity as $CaCO_3$	mg/kg	25	55	180	210	240	180	290	190	39
Bicarbonate Alkalinity as $CaCO_3$	mg/kg	25	55	160	200	220	150	270	170	39
Total Nitrogen as N	mg/kg	550	560	870	1000	530	840	670	810	400
Total Phosphorus as P	mg/kg	98	99	120	74	69	86	84	140	100

3.4 VEGETATION AND FLORA

3.4.1 Vegetation

One vegetation association as defined by Beard (1990) is located within the disturbance envelope, Vegetation Association 9: Medium woodland; coral gum (*E.torquata*) and Goldfields blackbutt (*E. lesouefii*). This association has >97% of its pre-European extent remaining (Shepherd *et al*. 2002).

Native Vegetation Solutions (NVS) (2024) completed a Reconnaissance Flora and Vegetation Survey of the Hilditch Project area (and 8500N deposit area) in April 2024. The report is attached as Appendix 3 to the MP.

The NVS (2024) survey identified six vegetation groups in the disturbance envelope, with the exception of the northern access road (Figure 11):

- *Eucalyptus griffithsii over Acacia acuminata*
- *Eucalyptus* woodland over *Melaleuca sheathiana*
- Transitional *Eucalyptu*s woodland
- Mixed *Eucalyptus* woodland over sclerophyll shrubland on small rises.
- *Eucalyptus ravida* woodland.
- Open *Eucalyptus salmonophloia* woodland.

The northern access road was not part of this assessment but it is considered that the vegetation is consistent with that mapped by NVS (2024). The clearing required for the northern access road is approximately 4 ha.

NVS (2024) identified no unique or restricted vegetation communities, and considered all vegetation types/communities are common, widespread and well represented in the Eastern Goldfields subregion.

The survey did not record any Threatened Ecological Communities (TEC's) as defined by the Environmental Protection and Biodiversity Act (1999) or TEC or Priority Ecological Communities (PEC) as defined by the WA Minister for the Environment.

3.4.2 Vegetation Condition

Overall, the condition of the vegetation was determined to be "Completely Degraded" (areas which were affected by historic mineral exploration) to "Very Good" condition. (NVS 2024) (Figure 12).

3.4.3 Flora

NVS (2024) recorded a total of 24 Families, 46 Genera and 99 Species within the survey area (Appendix 3). There were 73 native species recorded at Hilditch.

No Threatened or Priority flora were identified during the NVS (2024) survey.

Like the area surveyed by NVS (2024), it is anticipated the clearing required for the northern access road route (2-8m either side of the existing track to establish a 15m wide track) does not comprise conservation significant fauna. A targeted Threatened flora survey will be completed prior to any clearing activities to confirm the absence of Priority flora.

3.4.4 Weeds

Two weed species were recorded at Hilditch: *Carrichtera annua* (Ward's Weed) and *Lysimachia arvensis* (Pimpernel) (Figure 11).

Neither of these species are considered Declared Pests under the *Biosecurity and Management Act 2017* (DPIRD, 2024).

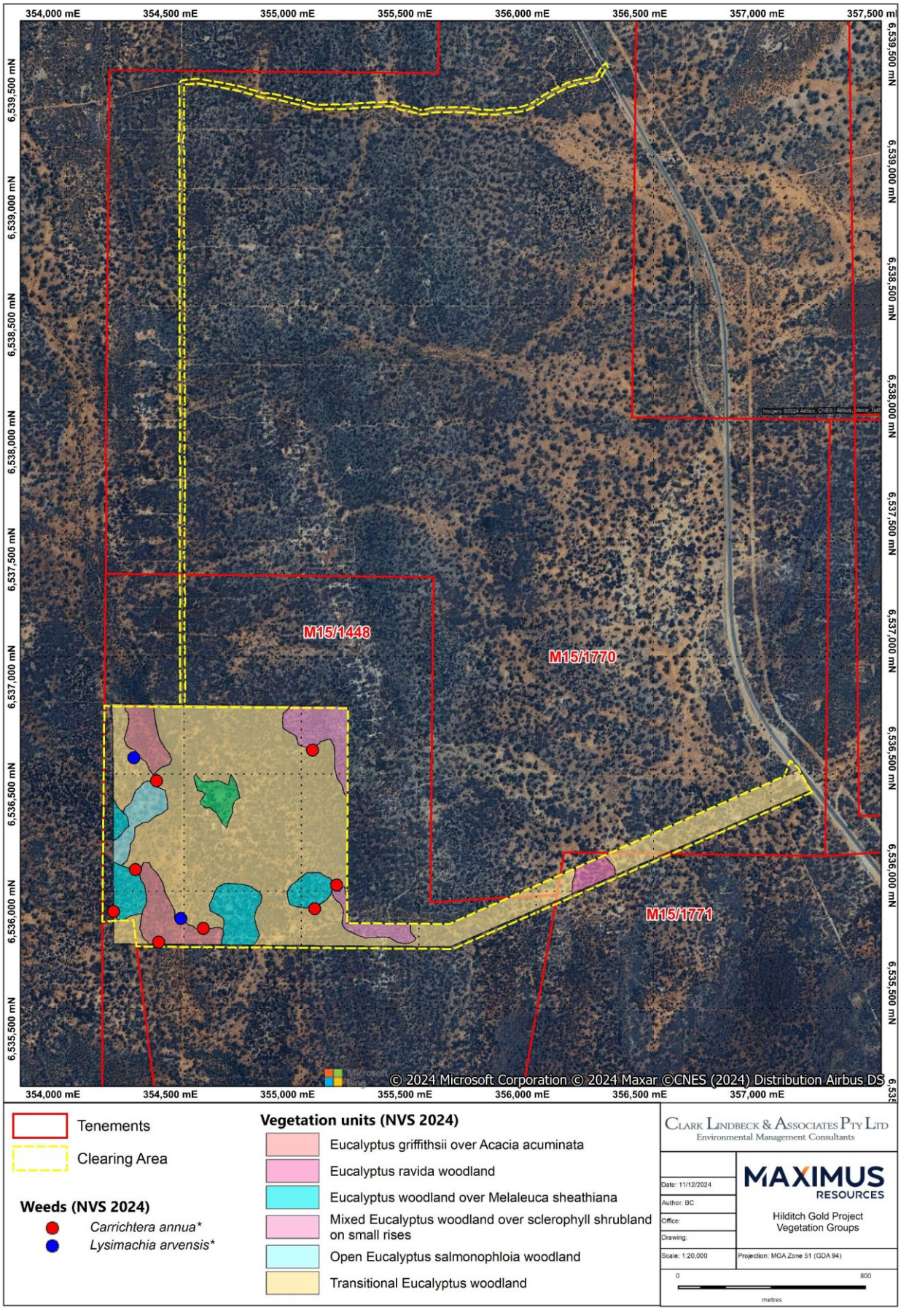

Figure 11: Vegetation associations in the project area (NVS 2024)

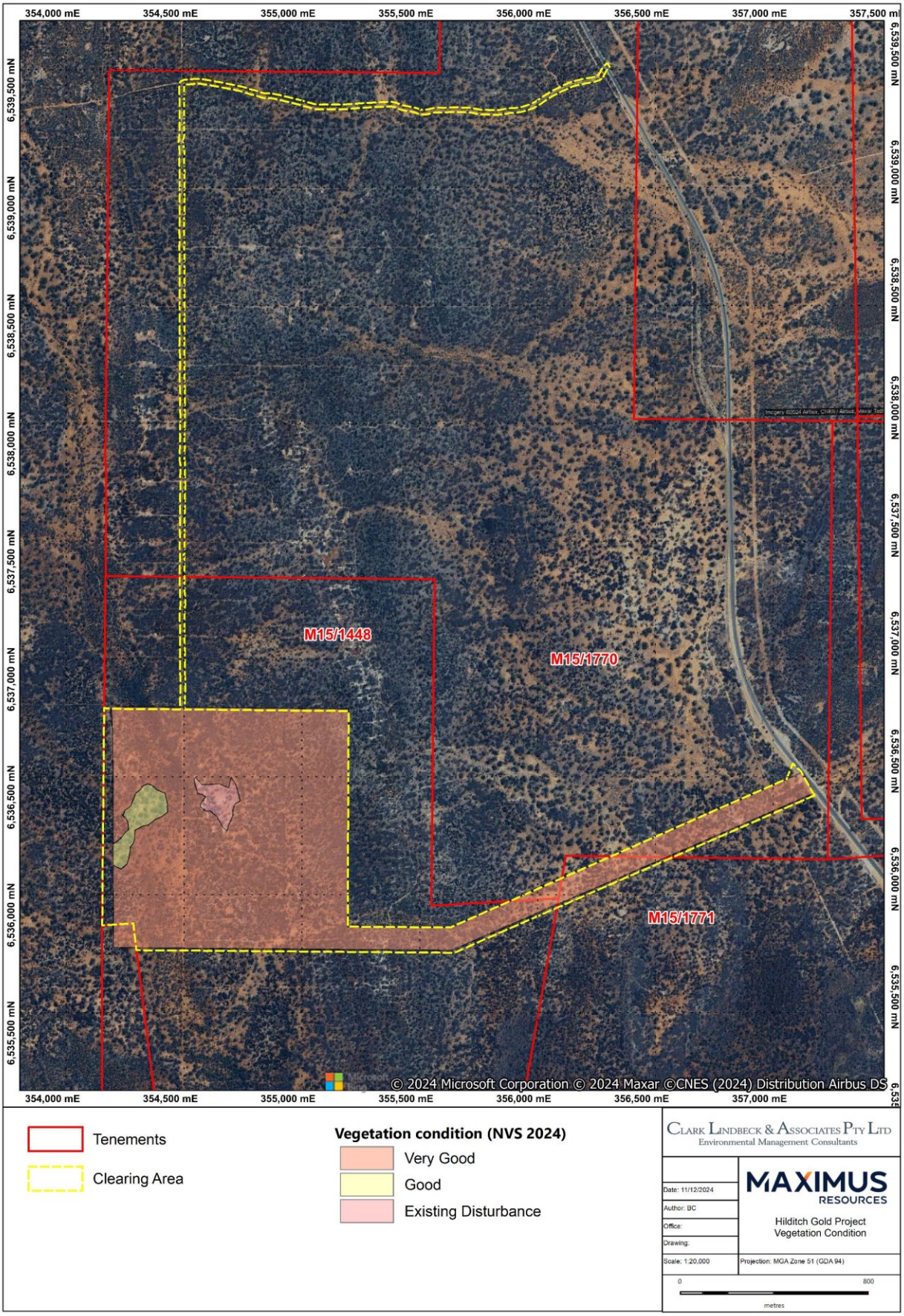

Figure 12: Vegetation Condition (NVS 2024)

3.5 FAUNA

3.5.1 Terrestrial Fauna

Terrestrial Ecosystems (2024a) undertook a Basic vertebrate fauna survey and risk assessment for the Hilditch Project area (and 8500N deposit area) in April 2024. The report is attached as Appendix 4 to the MP.

Terrestrial Ecosystems (2024) identified two fauna habitats in the disturbance envelope (Figure 13):

- Eucalypts with mixed shrubs
- Eucalypts with melaleuca.

An assessment of the potential occurrence of conservation significant fauna species in the Project area is included in Table 8 of Appendix 4 (p 25). Three fauna species of conservation significance were identified as having the potential to occur: Peregrine Falcon (listed as other specially protected fauna), the mallee form of the Western Rosella (Listed as Priority 4) and the Central Long-eared Bat (Listed as Priority 4).

These species "*may be seen infrequently in the project area, but vegetation clearing and mining activities are unlikely to significantly impact these species as they will readily move once vegetation clearing commences*" (Terrestrial Ecosystems 2024).

Terrestrial Ecosystems (2024a) determined that:

- Impacts on vertebrate fauna associated with clearing vegetation in the project area in a landscape or bioregional context are likely to be low as there are vast tracts of similar fauna habitat in adjacent areas.
- Based on the available information, no EPBC Act listed species are likely to be significantly impacted by the proposed vegetation clearing and development in the project area.

The northern access route was not part of this assessment but it is considered the fauna habitat is consistent with that mapped by Terrestrial Ecosystems (2024).

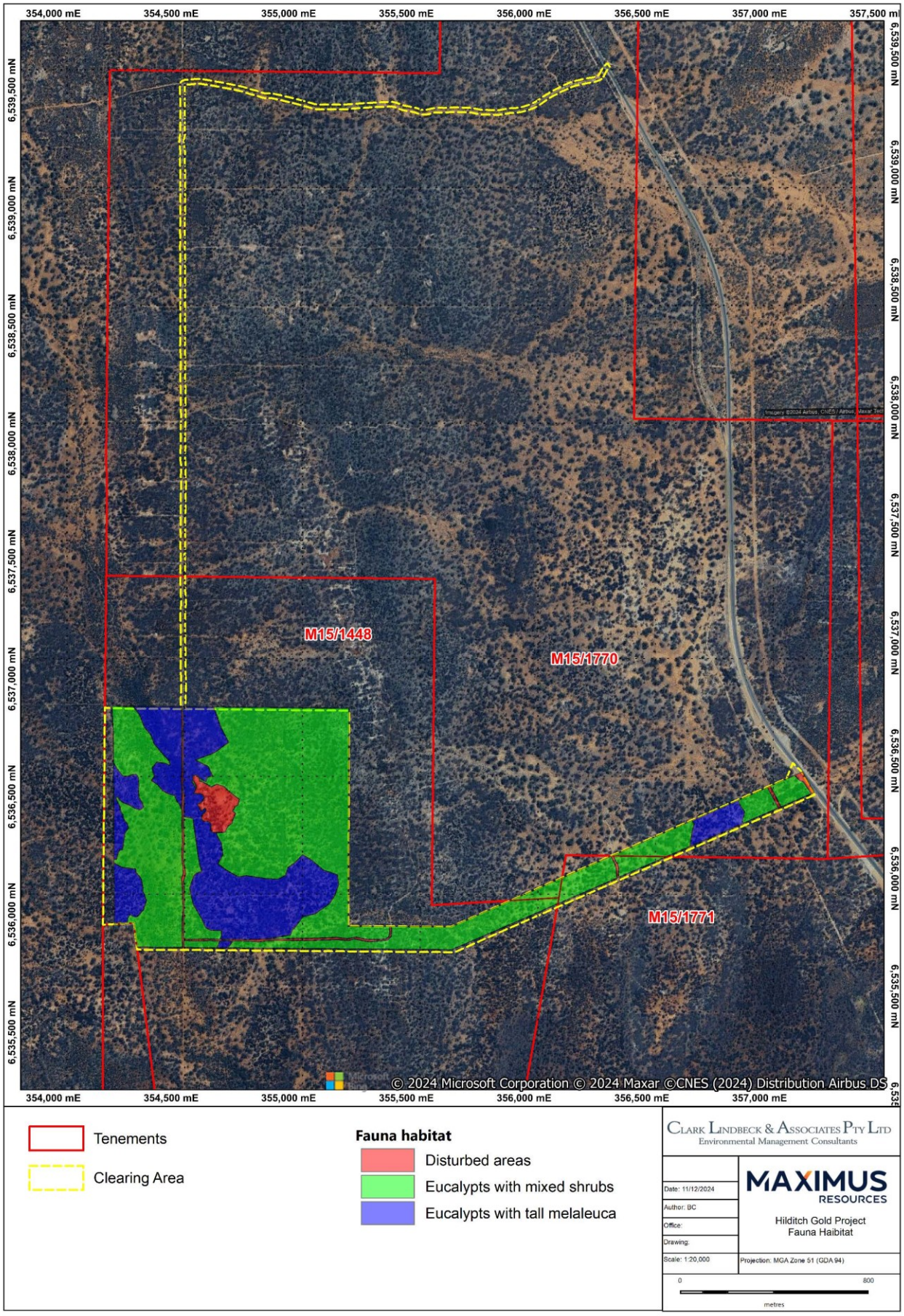

Figure 13: Fauna Habitat Types and Habitat Assessment Locations - Hilditch project

3.5.2 Arid Bronze Azure Butterfly

As part of the vertebrate fauna survey, Terrestrial Ecosystems (2024a) noted that the area contains vegetation which may be potential suitable habitat for the Arid Bronze Azure Butterfly (ABAB; *Oryris subterrestris petrina*) i.e. smooth barked eucalypts in tree and mallee form. The ABAB is listed as Critically Endangered under the EPBC Act 1999.

In September 2024 Terrestrial Ecosystems completed a targeted survey at Hilditch for the ABAB and its host ant (Camponotus terebrans) in accordance with the DBCA (2020) guidelines. The results of the survey are included as Appendix 5. There was no evidence of the ABAB (or host ant) recorded in the Project area (Terrestrial Ecosystems 2024b).

3.5.3 Short Range Endemic Invertebrates (SRE)

No specific assessment for SRE Invertebrates has been undertaken. However, from an SRE perspective, the habitats identified within the project area are typical of those occurring in the wider subregion and they are also contiguous with very similar habitat extending beyond the project area.

Using habitat as a surrogate to infer wider distributions, if SRE taxa were to occur, they would not be restricted solely to the project area, as there are no geomorphological or habitat attributes that would suggest a high risk of species level distributions being restricted to the scale of the project area.

3.6 SURFACE WATER HYDROLOGY

Hilditch falls within the broader Balladonia Water Catchment. There are no surface water bodies of significance, lakes or swamps in the Project area. Local drainage is towards Lake Lefroy, a salt lake located approximately 13 km west of the Project that forms the lowest topographic feature within the region.

Drainage lines in the Project area are poorly defined and ephemeral, and only flow following major rainfall events. Figure 14 shows the surface water drainage lines (250K topo) mapped in the local area with contours.

A surface water assessment was completed by Rockwater (2024a) for the Project area and eastern haul road to the Highway included analysis of flooding associated with a 1:100 year event and a Probable Maximum Flood (PMF) event. The following section is extracted from that report, which is currently being updated to include the current WRD design and northern access road.

Two minor drainage lines were identified which flow through the mining area and eastern access road (Figure 15). Catchment A, with a catchment area of 1,070 ha, flows north to south and passes between the open pit and the WRD (Rockwater 2024a). Catchment B drainage line has a much smaller catchment of 90 ha (also flowing north to south) and crosses the east-west haul/access road immediately west of the road junction with the Coolgardie-Norseman Highway (Figure 15).

The flood events as assessed by Rockwater, were slow moving (0.92-1.03 m/s) and shallow (640-760 mm depth) across the mining area and eastern access road.

For the northern access road, a drainage line crosses and then flows east immediately adjacent to the north-eastern section as broader sheet flow towards the highway (Figure 14).

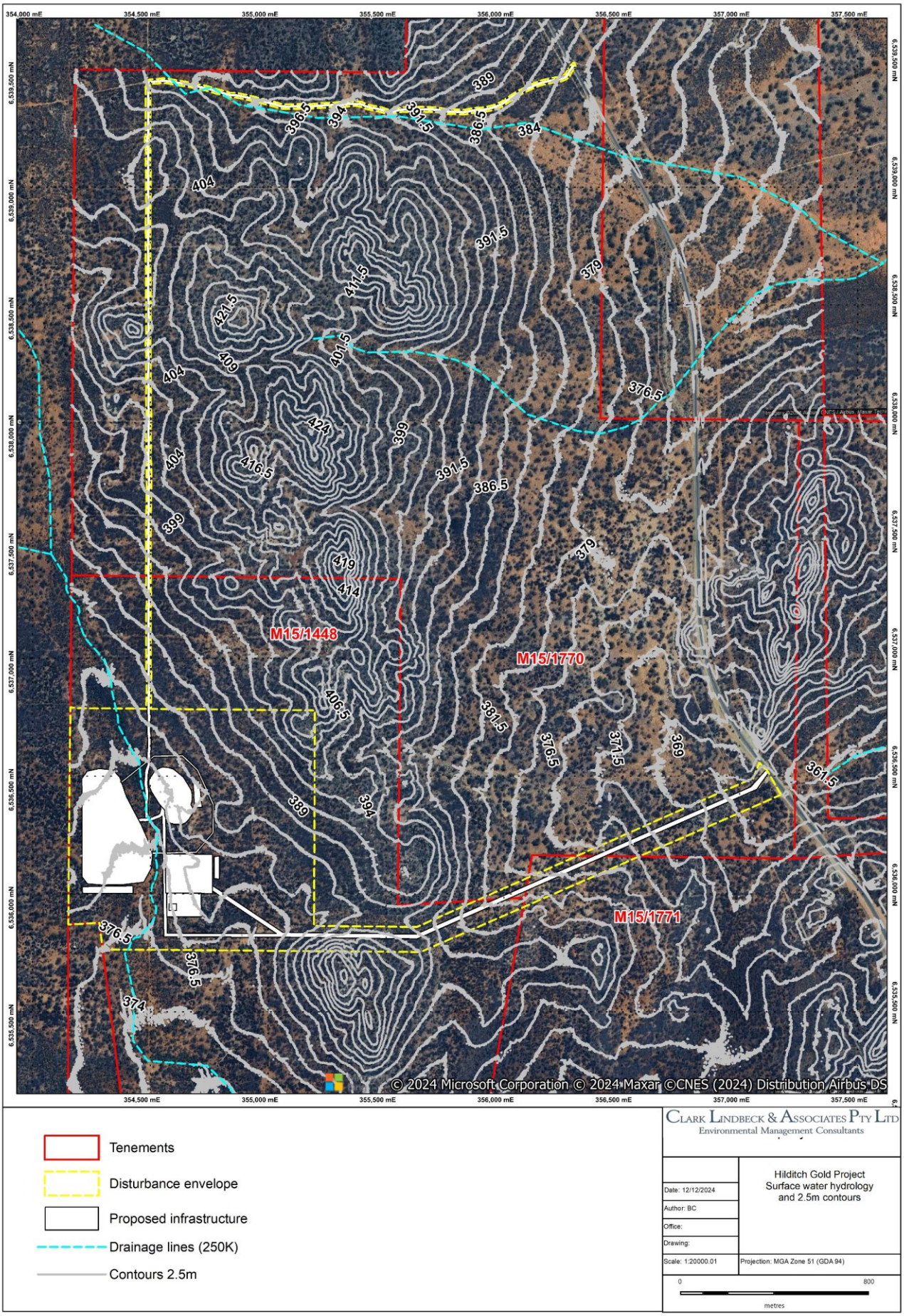

Figure 14: Surface water drainage lines (250K topo) and contours-2.5m

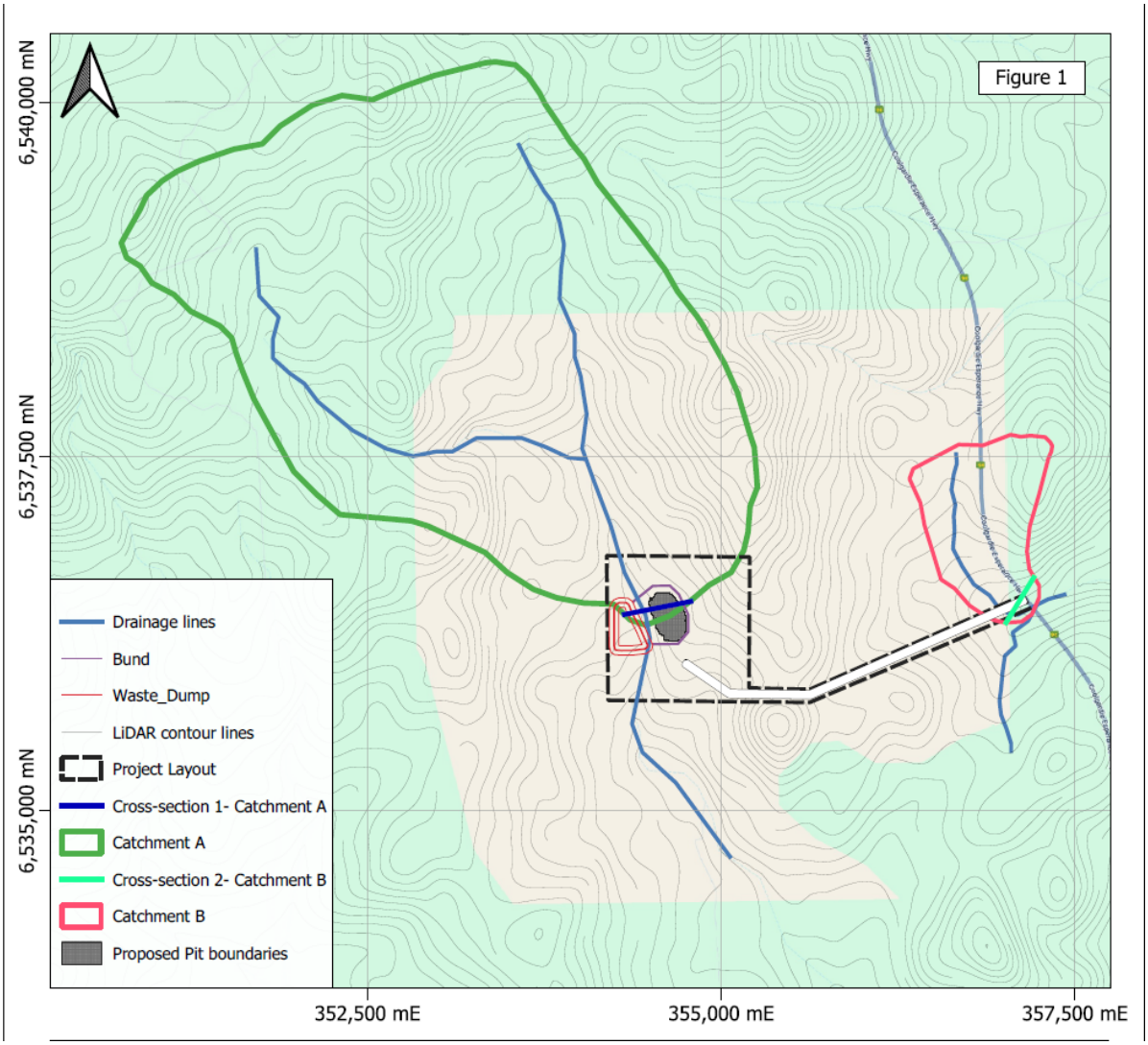

Figure 15: Surface water drainage and catchments at Hilditch (from Rockwater 2024a)

3.7 GROUNDWATER HYDROLOGY

The Hilditch deposit and MXR tenements in general lie on the Norseman Wiluna greenstone belt that contains ultramafic and basaltic units with intercalated sediments overlain by volcaniclastic and sedimentary rocks with the Hilditch deposit located on a shear zone between high-Mg basalt to the east, and felsic to intermediate volcanic rocks and volcaniclastics to the west.

The results of permeability testing, pumping tests and airlift water yields during drilling completed on MXR tenure indicate that rocks are generally of low permeability (hydraulic conductivity) (Rockwater 2024b).

Groundwater flows are to the southeast towards Lake Lefroy and the Lake Lefroy palaeodrainage.

No groundwater has been encountered during exploration drilling at Hilditch and based on a desktop hydrogeological assessment completed by Rockwater (2024b) over all of MXR's tenements, the standing water level (SWL) at Hilditch is estimated to be approximately 312 m RL (Figure 16).

As mining is above the water table, no mine dewatering is required. Groundwater for dust suppression will be sourced from Wattle Dam/Andrews Shaft (8km to the south). This groundwater hypersaline (around seawater level) and did not contain any other parameters, especially metals, that were of environmental concern.

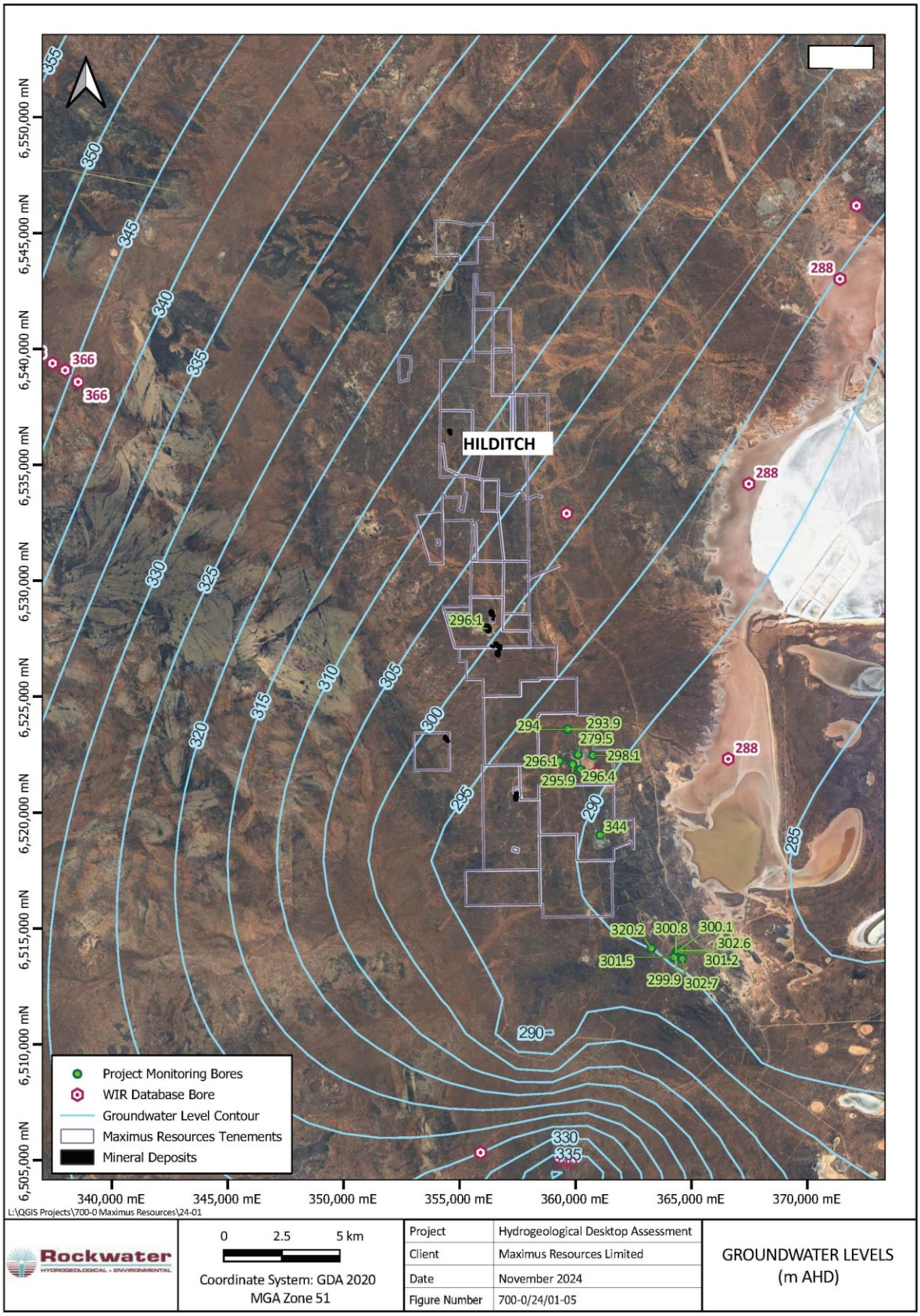

Figure 16: Groundwater levels contours over MXR tenements (from Rockwater 2024b)

The Project is located within the Goldfields Proclaimed Groundwater Management Area (Lefroy-Dundas Subarea).

The Project area does not fall within a Public Drinking Water Source Area (PDWSA) or PDWSA Protection Zone.

3.8 CONSERVATION RESERVES OR SIGNIFICANT ECOSYSTEMS IN ADJACENT AREAS

There are no conservation reserves or DBCA managed lands in the Project area. The nearest conservation reserves are the Kambalda Nature Reserve 35 km to the northeast, Scahill Timber Reserve 40 km to the northwest and Burra Rock Nature Reserve 35 km to the west.

A review of the BOM's Groundwater Dependent Ecosystem (GDE) Atlas (BOM 2024b) indicates that there are no significant GDE's reliant on groundwater or subterranean environments (i.e. a GDE with moderate or higher potential for interaction with groundwater, caves or aquifers) within 10 km of the Project.

The NVS (2024) survey did not record any TEC's or PEC's at the project.

None of the vegetation communities within the survey area were found to be a Matter of National Environmental Significance (MNES) as defined by the Commonwealth EPBC Act (NVS 2024).

3.9 LAND USE AND DEGRADATION

Exploration drilling has been completed around the Hilditch and Hilditch South gold deposits.

MXR intend to return the area as close as possible (with the exception of the pit) to its current land use as Unallocated Crown Land on completion of mining and rehabilitation activities.

4 CLEARING PRINCIPLES

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

The survey area lies in the Coolgardie (COO) bioregion, more specifically the Eastern Goldfields (COO03) subregion. The Eastern Goldfields subregion encompasses over 5 million hectares and comprises the Yilgarn craton's 'Eastern Goldfields' Terrains. The subregion is characterised by gentle undulating plains, the west containing Archaean greenstone ridges and low hills, while the east contains a horst of Proterozoic granulite. In the western half there are a series of large playa lakes which are remnants of an ancient major drainage line. The dominant soil type is Calcareous earth, which cover most of the plains and greenstone areas. The vegetation of the Eastern Goldfields botanical subregion consists of mallees, diverse *Eucalyptus* woodlands and *Dodonaea* shrublands and is rich in endemic Acacias (Cowan, 2001).

NVS (2024) completed a survey of the main mining area and eastern haul road and identified six vegetation communities with 73 species recorded. No unique or restricted vegetation communities were identified, and NVS (2024) considered all vegetation types/communities are common, widespread and well represented in the Eastern Goldfields subregion.

No Threatened or Priority Flora species, TEC's or PEC's were recorded by NVS (2024) in the proposed clearing area.

The vegetation to be cleared for the northern access road has been estimated at 4 ha (2-8 m either side of the existing track) and the vegetation is considered to be consistent with the vegetation groups. A targeted Threatened/Priority flora survey is proposed in this area to confirm the absence of Priority flora.

Two weed species have been recorded in the clearing area: *Carrichtera annua* (Ward's Weed) and *Lysimachia arvensis* (Pimpernel) (NVS, 2024). MXR will undertake weed control programs for these occurrences in the Project area and ensure all machinery involved in clearing operations will be cleaned prior to arrival at site to minimise the spread of weeds and soil pathogens.

There were two broad fauna habitat types recorded within the clearing area by Terrestrial Ecosystems (2024a) and they considered vertebrate fauna associated with clearing vegetation in the project area in a landscape or bioregional context are likely to be low as there are vast tracts of similar fauna habitat in adjacent areas.

The clearing will not reduce the extent of vegetation communities or reduce biodiversity within the region.

Given the above, the clearing will not be at variance to this principle.

(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.

No recent evidence of species of conservation significance have been recorded in the clearing area.

Terrestrial Ecosystems (2024a) identified three terrestrial fauna species of conservation significance as having the potential to occur:

- Peregrine Falcon (listed as other specially protected fauna)
- Mallee form of the Western Rosella (Listed as Priority 4)
- Central Long-eared Bat (Listed as Priority 4).

These species "*may be seen infrequently in the project area, but vegetation clearing and mining activities are unlikely to significantly impact these species as they will readily move once vegetation clearing commences*" (Terrestrial Ecosystems 2024a).

Terrestrial Ecosystems (2024a) assessed that, based on the available information, no EPBC Act listed species are likely to be significantly impacted by the proposed vegetation clearing and development in the project area.

As part of the vertebrate fauna survey, Terrestrial Ecosystems (2024a) noted that the area contains vegetation which may be potential suitable habitat for the Arid Bronze Azure Butterfly (ABAB; *Oryris subterrestris petrina*) i.e. smooth barked eucalypts in tree and mallee form. The ABAB is listed as Critically Endangered under the EPBC Act 1999.

A targeted survey at Hilditch for the ABAB and its host ant (*Camponotus terebrans*) was completed in September 2024. There was no evidence of the ABAB (or host ant) recorded in the Project area (Terrestrial Ecosystems 2024b).

The proposed clearing is not expected to have a significant impact on, or, significantly reduce the extent of fauna or fauna habitats at the Project or in the region.

Given the above, the clearing will not be at variance to this principle.

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

No DRF were located at the survey area. No plant taxa listed as Threatened pursuant to Schedule 1 of the *EPBC Act (1999)* have been recorded in the Hilditch or on MXR tenements to date. No Priority flora species were identified during the NVS (2024) survey.

Given the above, the clearing will not be at variance to this principle.

(d) Native vegetation should not be cleared if it comprises the whole or part of, or is necessary for the maintenance of a Threatened Ecological Community (TEC).

No TEC's are listed under the Commonwealth *Environmental Protection and Biodiversity Conservation Act 1999* or endorsed by the Western Australian Minister for the Environment within the clearing area.

Therefore, the proposed clearing is not at variance to this principle.

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

The clearing area is located in Vegetation Association 9 (Medium woodland; coral gum (*Eucalyptus torquata*) & Goldfields blackbutt (*E. le* souefii)) which has >97% of the original extent remaining and cannot be considered significant as a remnant of native vegetation in an area that has been extensively cleared.

Given the above, the clearing will not be at variance to 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 wetlands.

There are no surface water bodies of significance, lakes or swamps in the Project area. Local drainage is towards Lake Lefroy, a salt lake located approximately 13 km west of the Project that forms the lowest topographic feature within the region.

The clearing area contains broad and ill-defined ephemeral drainage lines which only flow following periods of heavy rainfall events. These are relatively common throughout the Kambalda-Widgiemooltha area and the region. There is no riparian vegetation associated with these drainage lines in the clearing area.

The flows assessed are shallow and given the relatively low velocities, Rockwater (2024a) consider the risk of scouring is minimal, and additional erosion protection is not considered to be necessary.

MXR has included provision for culverts, floodways and/or spoon drains as required to maintain surface water flow.

There is, therefore, no vegetation growing in association with a water course or wetland (i.e. riparian vegetation). The clearing is not at variance to this principle.

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

The recommended land management associated with the land systems in the Project area as summarised in Waddel and Galloway (2023) are included below.

Land System	Land management (Waddel and Galloway 2023)
Graves System	Stony mantles and moderately dense vegetation mean this land system is generally not prone to erosion, unless the protective mantle is disturbed.
Moriarty System	Slopes of low rises without protective stone mantles, alluvial plains and narrow drainage tracts are moderately susceptible to water erosion, particularly if perennial shrub cover is substantially reduced or the soil surface is disturbed.
Gumland System	Alluvial plains, drainage tracts and foci (units 3, 4 and 5) are susceptible to erosion if perennial shrub cover is substantially reduced, as are footslopes (unit 1) if protective mantles are disturbed. Poorly located infrastructure, such as track and fencelines, across sheetwash and alluvial plains can result in concentrated water flows and cause erosion incision. Impedance to natural drainage can also initiate loss of vigour in vegetation downslope because of water starvation.

The area remains well vegetated and all cleared areas (except for the open pit) will be rehabilitated at closure. MXR will ensure surface water flows are maintained through the Project area.

The clearing of vegetation is not likely to lead to land degradation issues such as salinity, water logging or acidic soils and therefore is not at variance to this principle. The disturbed area (except for the open pit) will be rehabilitated at completion of mining.

(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 are no conservation or nature reserves within the proposed clearing area. The closest nature reserves are more than 30 km from Hilditch.

The clearing, therefore, is not at variance to this principle.

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

Surface water in the project area is sourced from direct precipitation and surface runoff following rainfall events. The Hilditch area can receive considerable rainfall from rare degenerating cyclonic depressions from the northern parts of the State. However, overall, the mean annual rainfall is only 279 mm.

Surface water drainage lines in the Hilditch area are broad and ill-defined ephemeral watercourses and drainage lines which only flow following periods of heavy rainfall events. There is no surface water of significance, large drainage lines, lakes or swamps in the clearing area.

With an average rainfall of 279 mm and a mean annual evaporation rate of 2630 mm there is little surface flow during normal seasonal rains. The flood flows as assessed by Rockwater (2024) were shallow and of low velocity.

Given the low annual rainfall, high evaporation rate and size of the proposed clearing area there is expected to be little (if any) rainfall recharge that would impact the groundwater levels or the quality of groundwater in the local area or region.

The area proposed to be cleared does not fall within a Public Drinking Water Source Area (PDWSA) or PDWSA Protection Zone (www.dwer.wa.gov.au).

The clearing of native vegetation is not likely to cause deterioration in the quality of surface or groundwater and therefore, is not at variance to this principle.

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

The application area is located within the Balladonia catchment areas. Given the size of the area to be cleared (49 hectares) in relation to the size of the catchment area (2,488,250 hectares) the proposed clearing is not likely to increase the potential for flooding on a local or catchment scale.

The proposed clearing area is surrounded by native vegetation. Annual average rainfall is only 279 mm with little surface flow during normal seasonal rains. The flood flows as assessed by Rockwater (2024) were shallow and of low velocity.

Whilst large rainfall events may result in short-term flooding of the area, the proposed clearing is not likely to lead to an increase in incidence or intensity of flooding.

The proposed clearing is not at variance to this principle.

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APPENDICES

Appendix 1: Letter of Authority

Bullabulling Pty Ltd
375 Egan St Kalgoorlie WA 6430
astehn@iinet.net.au

Department of Energy, Mines, Industry Regulation and Safety
Mineral House
100 Plain Street
East Perth WA

16 October 2024

Dear Sir/Madam

RE: M15/1448 - CLEARING PERMITS, MINING PROPOSALS AND MINE CLOSURE PLANS

Bullabulling Pty Ltd (**Bullabulling**) is the registered holder of a 10/100 interest in Mining Lease M15/1448.

M15/1448 is subject to a Sale Agreement dated 3 October 2001, with Maximus Resources Ltd (**MXR**).

Please be advised that Bullabulling gives authority to MXR to access M15/1448 and under the terms of our Sale Agreement, MXR are responsible for the submission and management of any Clearing Permits, Mining Proposals and Mine Closure Plans submitted in relation to M15/1448.

Yours sincerely

Anthony Stehn
0410766204

Appendix 2: Surface Soils Report (CLA 2024)

CLARK LINDBECK & ASSOCIATES PTY LTD
Environmental Management Consultants

MEMORANDUM

TO: Gregor Bennett, Maximus Resources Ltd

FROM: Belinda Clark, Clark Lindbeck & Associates Pty Ltd

DATE: 10 October 2024

SUBJECT: **HILDITCH MINE SITE AND HAUL ROAD SURFACE SOILS ANALYSES**

1. INTRODUCTION

Maximus Resources Ltd (Maximus) propose to develop and mine the Hilditch gold deposit and construct a haul road from the mine site eastwards to the Coolgardie-Esperance Highway. The Project is located approximately 30 kilometres west of Kambalda and approximately 30 northwest of Widgiemooltha in the southern Goldfields of Western Australia.

The proposed mine and haul road corridor is located on two Land Systems listed below (DPIRD, 2017; Figure 1):

- Graves – Basalt and greenstone rises and low hills supporting eucalypt woodlands with prominent saltbush and bluebush understoreys.
- Moriarty – Low greenstone rises and stony plains supporting chenopod shrublands with patchy eucalypt overstoreys.

To obtain an understanding of the surface soils to be stripped and stockpiled following clearing activities, and later to be used for rehabilitation works at completion of mining and haulage operations, Maximus collected surface soil samples for laboratory analysis.

Northcote *et al* (1967) mapped the regional and local soils by the Atlas of Australian Soils system. The Hilditch site falls within the BB5 soil unit and this is described generally as loamy soils with weak pedological development – shallow calcareous loamy soils, and in more detail in Table 1.

The local soils described by Northcote *et al* (1967) are shown in Figure 2.

Table 1: Soil unit of the Hilditch deposit and haul road (Northcote *et al*, 1967)

SOIL UNIT	DESCRIPTION
BB5	Rocky ranges and hills of greenstones (basic igneous rocks): chief soils seem to be shallow calcareous loamy soils (Um5.11) and similar soils with shallow brown and grey-brown calcareous earths (Gc1.12 and Gc1.22), below which weathered rock occurs at shallow depths. Associated soils are not described but may include alkaline red earths (Gn2.13).

2. METHODOLOGY

2.1 SOIL SAMPLE LOCATIONS

A total of 18 surface soil samples were collected at each of the nine sampling sites to depths of 20-30 cm on 6 September 2024. Nine (9) samples were collected for chemical analyses and nine from each site for Particle Size Distribution (PSD) sieving. The nine sampling sites were within the principal areas of disturbance as shown on Figure 1 and from the representative land systems. Samples 1,2 and 9 were located within the footprint of the proposed waste rock dump (WRD), samples 3 and 4 within the open pit footprint, sample 5 within the proposed footprint of the Run-of-Mine (ROM) pad and samples 6, 7 and 8 were collected within the proposed haul road corridor.

These soils are considered representative of the surface soil material present at the project.

Sample site photographs and a table with a general description of each site are provided in Appendix 3.

2.2 LABORATORY ANALYSES

All samples were sent to Envirolab laboratory for analyses for the following parameters:

- $pH_{1:2\ extract}$
- Electrical Conductivity ($EC_{1:2\ extract}$)
- Total Soluble Salts (TSS) by calculation
- Total N
- Alkalinity
- Total Chloride
- Total Sulphate
- Total P
- Major Cations
- Major Anions.

The samples were also subjected to Particle Size Distribution (PSD) by sieving (coarser particles - gravel to sand and then bulk total particles finer than sand - <75µm).

3. RESULTS OF THE SAMPLES ANALYSES

The raw results of the analyses are contained in Table 2.

The Certified copy of the Analyses (COA) from Envirolab is provided in Appendix 1 attached to this report.

Particle Size Distribution curves are attached as Appendix 2.

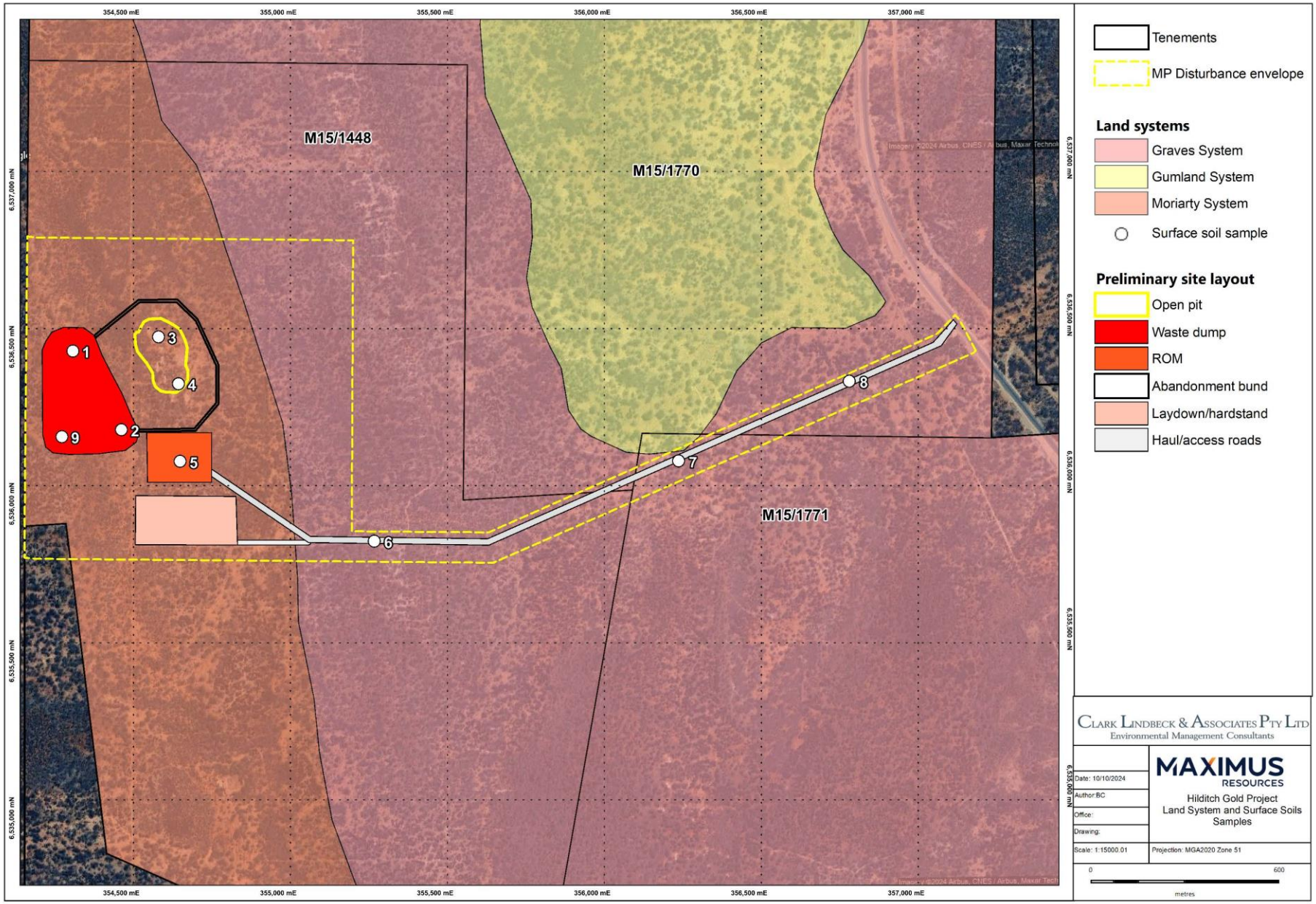

Figure 1: Land Systems and soil samples locations at Hilditch

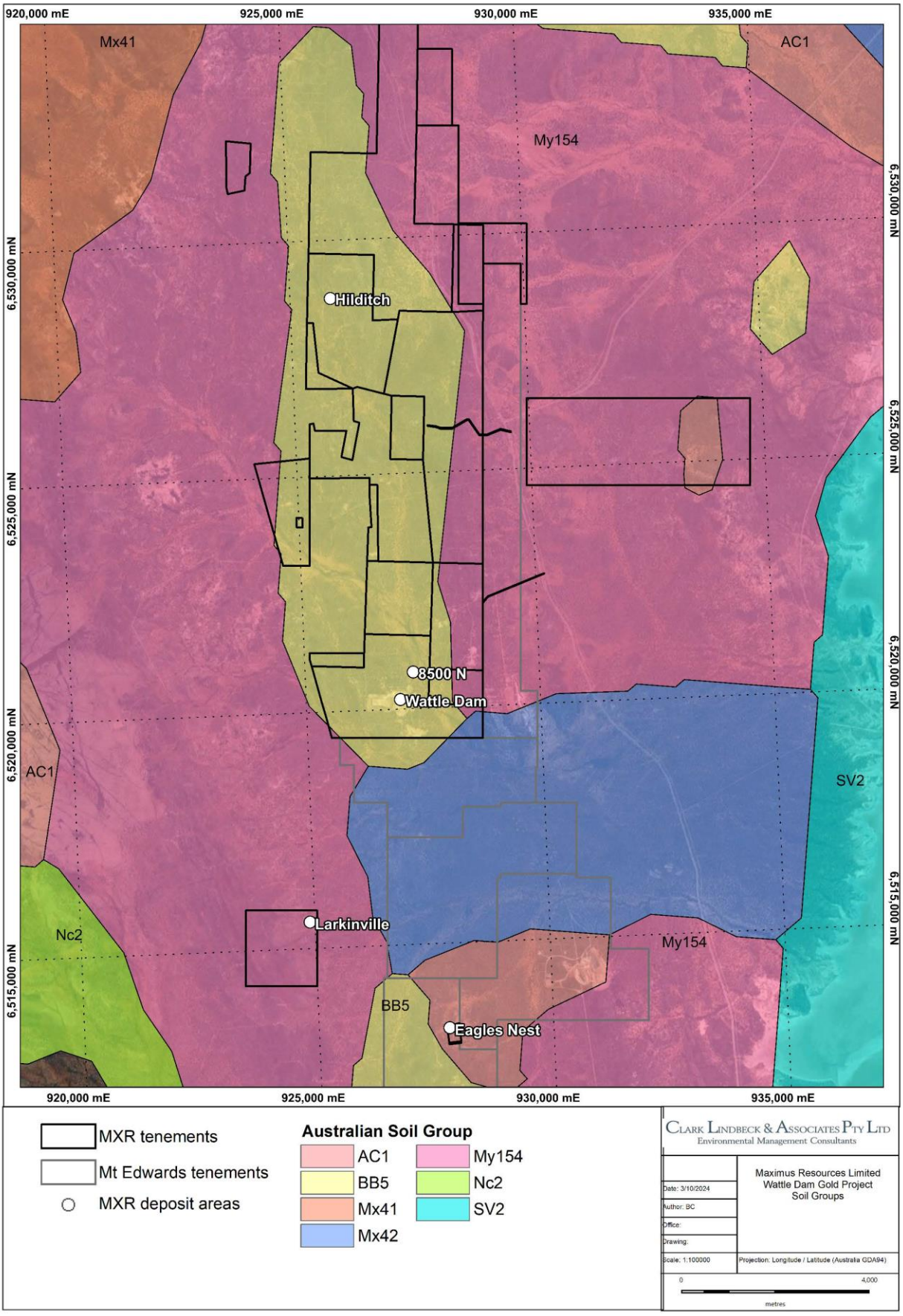

Figure 2: Project Soils mapped by Northcote *et al* (1967)

Table 2: Results of Surface Soil Samples Analyses

HILDITCH MINE AND HAUL ROAD SOIL SAMPLES ANALYSES - SEPTEMBER 2024										
PARAMETER	Unit	SAMPLE NUMBER								
		1	2	3	4	5	6	7	8	9
pH (1:2)	pH unit	6.4	7.4	8.5	8.4	8.5	8.8	8.7	8.5	7.1
Electrical Conductivity (1:2) Extract	µS/cm	23	110	260	120	110	1600	340	1500	72
Total Soluble Salts (by calculation)	mg/kg	77	360	890	400	360	5200	1100	5100	240
SOLUBLE ELEMENTS IN SOIL										
Sulphate (SO_4^{2-})	mg/kg	<10	31	82	17	<10	610	16	880	<10
Chloride (Cl)	mg/kg	<10	21	220	19	<10	1700	330	1600	63
Calcium (Ca)	mg/kg	1300	2900	38000	4700	11000	74000	3600	1600	740
Magnesium (Mg)	mg/kg	1600	6300	39000	30000	6000	62000	5900	15000	2200
Sodium (Na)	mg/kg	100	190	430	230	130	3000	580	2700	290
Potassium (K)	mg/kg	960	3100	2100	1800	3100	1300	2900	6300	2200
Total Alkalinity as $CaCO_3$	mg/kg	25	55	180	210	240	180	290	190	39
Bicarbonate Alkalinity as $CaCO_3$	mg/kg	25	55	160	200	220	150	270	170	39
Total Nitrogen as N	mg/kg	550	560	870	1000	530	840	670	810	400
Total Phosphorus as P	mg/kg	98	99	120	74	69	86	84	140	100

Table 3: Broadscale Particle Size Distribution Textures from PSD Curves (Appendix 2)

HILDITCH MINE AND HAUL ROAD LIMITED SOIL TEXTURE ANALYSES - SEPTEMBER 2024										
PARAMETER		SAMPLE NUMBER								
		1	2	3	4	5	6	7	8	9
Cobbles and Gravel	%	14	2	1	40	0	0	0	0	7
Sand	%	33	38	33	32	58	32	40	38	55
Finer than sand (silt and clay combined)	%	53	60	66	28	42	68	60	62	38

4. DISCUSSION

4.1 General Chemical Results

The pH of the samples was quite variable from slightly acidic (pH 6.4 – Site 1) to neutral (7.1 – Site 9 and 7.4 – Site 2) to slightly alkaline (pH 8.4 – Site 4 to 8.5-8.8 – Sites 3, 5, 6, 7 and 8). Sites 1 and 9 are typical levels for rangeland surface soils in Western Australia due to the preponderance of hydrogen ions in the soils. The alkaline soils are typical of the soils that have high levels of carbonates. Table 2 indicates that there are very high levels of calcium carbonate. The high levels of bicarbonate alkalinity also indicate an influence from sodium bicarbonate. Not only does this increase the pH of the soil but also increases recorded salinity level, but in these cases, relates to the presence of sodium bicarbonate, as well as sodium chloride, which is indicated in the results for Sites 6 and 8, with a lesser influence in Site 3. This strong carbonate presence is indicative of a wetting and drying environment where there has been a capillary rise in the carbonates from possibly ancient, perched water tables and a wetting/drying climatic cycle.

The high carbonate levels are supported by the mapping of Northcote *et al* (1967) as they describe the local soils as calcareous loams.

4.2 Major Elements

All samples had reasonably high to very high levels of the major nutrients available to plants (SO_4, Ca, Mg, K and Total N) which is not typical of the nutrient poor rangeland soils in which native vegetation thrives.

4.3 Particle Size Distribution (Soil Texture)

All nine samples were physically separated by sieving. The laboratory uses geotechnical sieve sizes (international standards) and the result are contained in the raw laboratory results in Appendix 1. PSD curves for all samples are provided in Appendix 2.

For Australian agricultural textural classes, the particles that are less than 2.0 mm are the only distributions used and these are then applied to a soil texture triangle. The results provided in Appendix 2 include the percentages for gravel and cobbles which are excluded from the textural triangle.

Lateritic nodules (pisolites) and cobbles were concentrated on the land surfaces at many of the sites through the impact of weathering and sheet flow (Appendix 3). Only two samples (Sites 2 and 4) had significant gravel or cobble contents while the remaining sites had variable sand and finer contents (Table 3).

On the information available, the soils generally can be classified as sandy loams. As all samples have reasonable silt and clay class sizes, they all have a reasonable ability to hold and retain moisture and soil nutrients.

5. CONCLUSION

The pH's of the samples were quite variable from slightly acidic (6.4) to slightly alkaline (8.5-8.8) and two samples had very high levels of soil salinity (<5200 mg/kg TSS).

The soils generally can be classified as various clayey, silty or sandy loams as all samples have reasonable silt and clay class sizes, thus, they all can hold and retain moisture and soil nutrients.

It is recommended that wherever possible, the topsoil stripped from each location, be returned to that general area, e.g. the topsoils along the haul road only be used to rehabilitate the haul road.

It is recommended that at rehabilitation of the constructed landform (WRD) that the stockpiled topsoils be blended on a 1:1 ratio with any lateritic hardpan materials that may become available (and stockpiled) from the mining of the Hilditch open pit.

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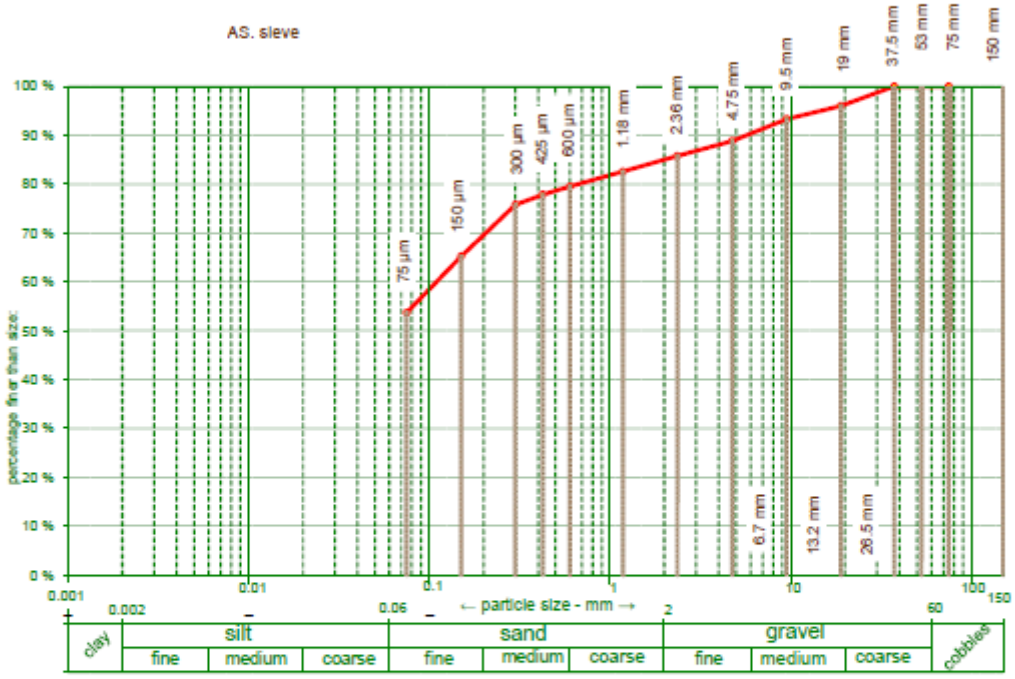
APPENDICES

APPENDIX 1: CERTIFIED COPY OF ANALYSES (COA) FROM ENVIROLAB

APPENDIX 2: CERTIFIED COPY OF PARTICLE SIZE DISTRIBUTION CURVES FROM ENVIROLAB

PARTICLE SIZE DISTRIBUTION

Client:	*Maximus Resouces Ltd*	Job No:	*PFI1211-10*
Principal:	*Tim Wither*	Laboratory:	*MPL*
Project:	*Hilditch*	Report Date	*20-Sep-24*
Location:		Test report No:	
Test procedure:	*INORG-107*	Depth:	*0.2*
Sample No:	*PFI1211-10*		
Sample Identification:	*Sample 1*		

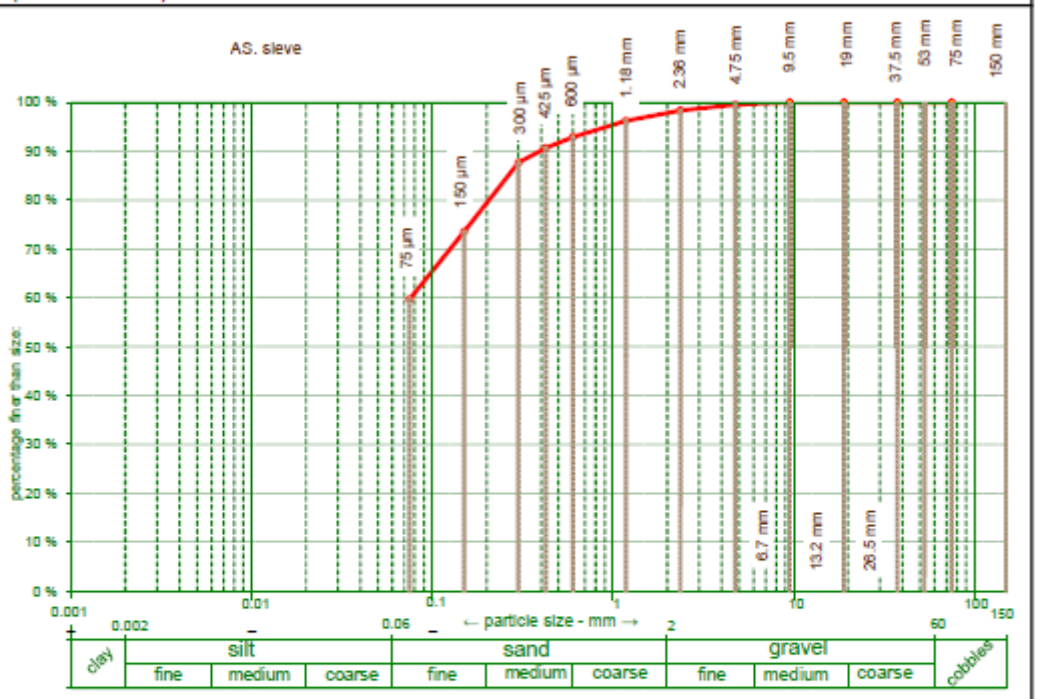


Sieve Analysis		Hydrometer Analysis	
Sieve Size mm	% Passing	Particle Size µm	% Passing
75	100		
37.5	100		
19	96		
9.5	93		
4.75	89		
2.36	86		
1.18	83		
600 µm	79		
425 µm	78		
300 µm	76		
150 µm	65		
75 µm	54		

Oven dried ☑ ☑

PARTICLE SIZE DISTRIBUTION

Client:	*Maximus Resouces Ltd*	Job No:	*PFI1211-10*
Principal:	*Tim Wither*	Laboratory:	*MPL*
Project:	*Hilditch*	Report Date	*20-Sep-24*
Location:		Test report No:	
Test procedure:	*INORG-107*	Depth:	*0.2*
Sample No:	*PFI1211-11*		
Sample Identification:	*Sample 2*		



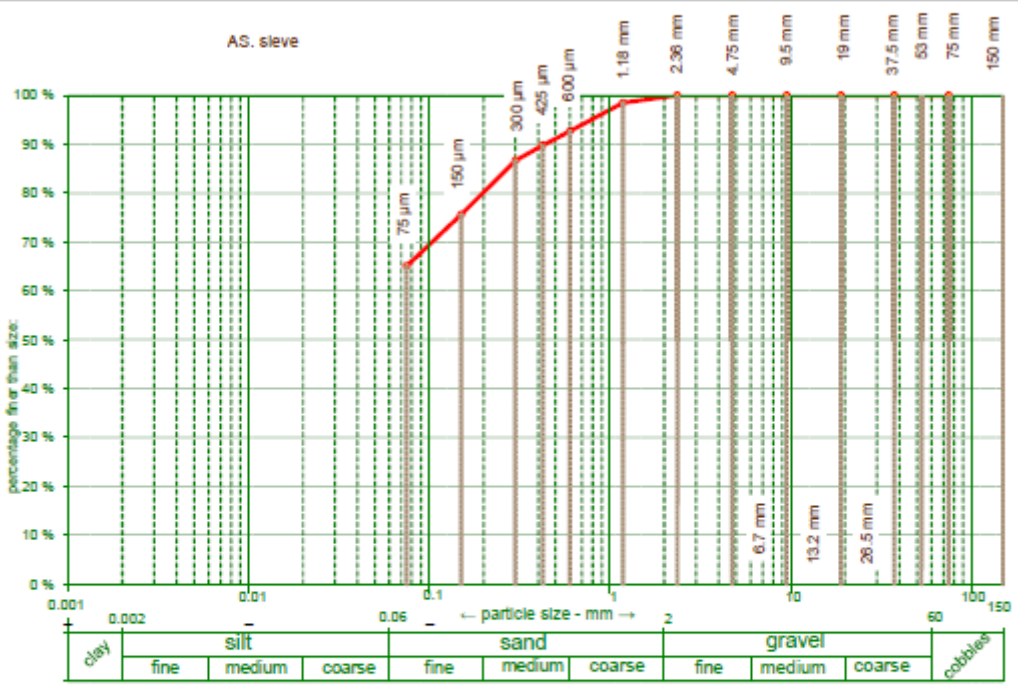
Sieve Analysis		Hydrometer Analysis	
Sieve Size mm	% Passing	Particle Size µm	% Passing
75	100		
37.5	100		
19	100		
9.5	100		
4.75	100		
2.36	98		
1.18	96		
600 µm	93		
425 µm	91		
300 µm	88		
150 µm	74		
75 µm	60		

Oven dried ☑

Hydrometer analysis not required, % passing 75um < 10% ☑

PARTICLE SIZE DISTRIBUTION

Client:	*Maximus Resouces Ltd*	Job No:	*PFI1211-10*
Principal:	*Tim Wither*	Laboratory:	*MPL*
Project:	*Hilditch*	Report Date	*20-Sep-24*
Location:		Test report No:	
Test procedure:	*INORG-107*	Depth:	*0.2*
Sample No:	*PFI1211-12*		
Sample Identification:	*Sample 3*		



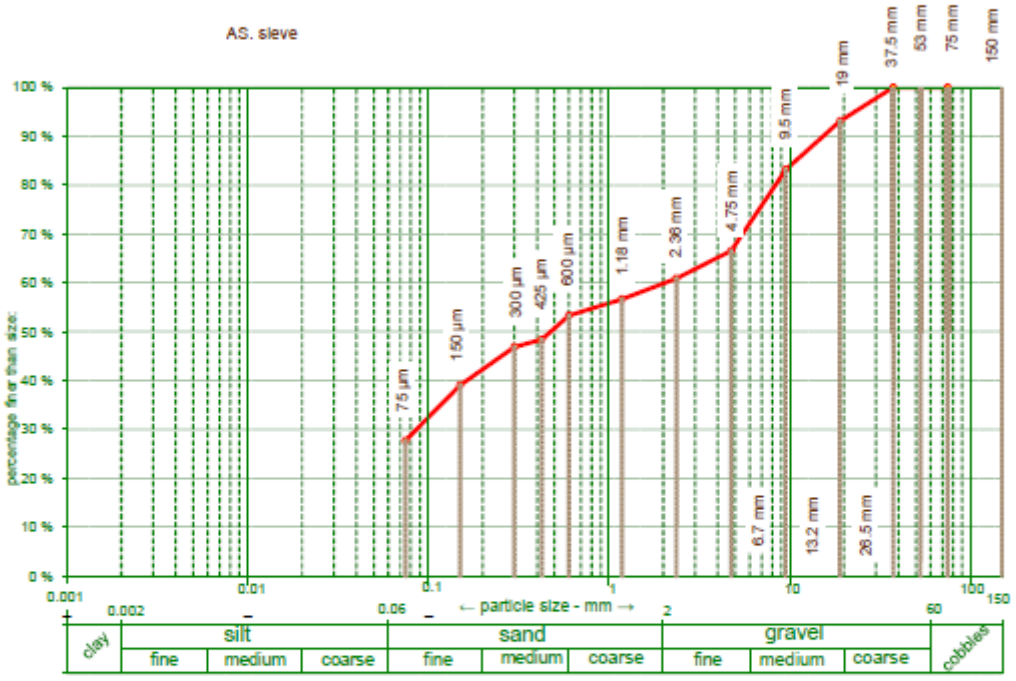
Sieve Analysis		Hydrometer Analysis	
Sieve Size mm	% Passing	Particle Size µm	% Passing
75	100		
37.5	100		
19	100		
9.5	100		
4.75	100		
2.36	100		
1.18	98		
600 µm	93		
425 µm	90		
300 µm	87		
150 µm	76		
75 µm	65		

Oven dried ☑

Hydrometer analysis not required, % passing 75um < 10% ☑

PARTICLE SIZE DISTRIBUTION

Client:	*Maximus Resouces Ltd*	Job No:	*PFI1211-10*
Principal:	*Tim Wither*	Laboratory:	*MPL*
Project:	*Hilditch*	Report Date	*20-Sep-24*
Location:		Test report No:	
Test procedure:	*INORG-107*	Depth:	*0.2*
Sample No:	*PFI1211-13*		
Sample Identification:	*Sample 4*		



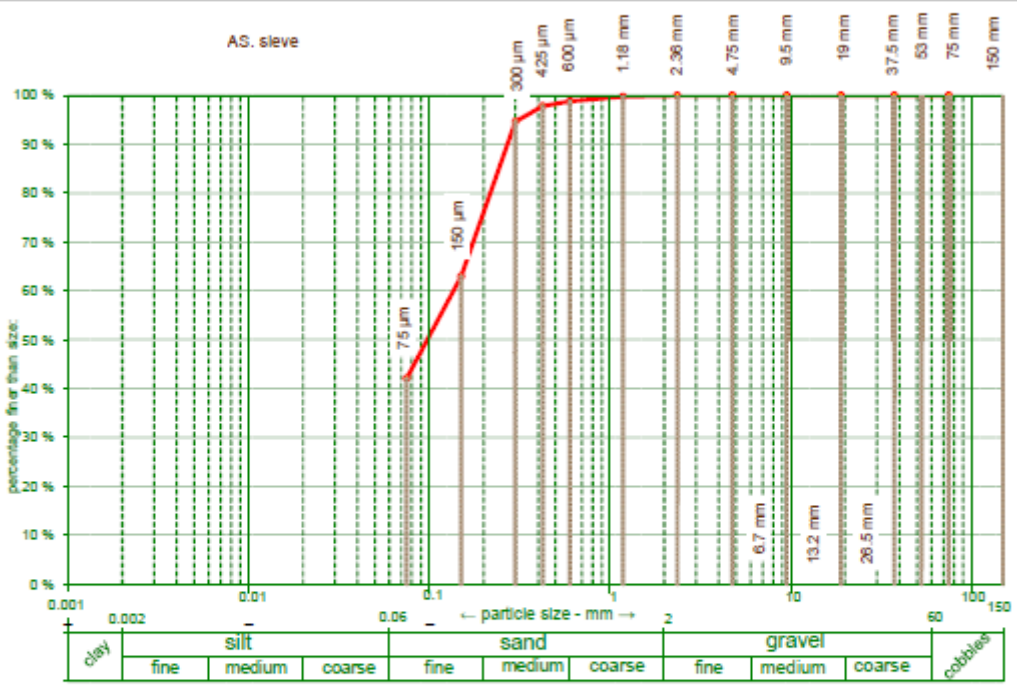
Sieve Analysis		Hydrometer Analysis	
Sieve Size mm	% Passing	Particle Size µm	% Passing
75	100		
37.5	100		
19	93		
9.5	83		
4.75	67		
2.36	61		
1.18	57		
600 µm	53		
425 µm	48		
300 µm	47		
150 µm	39		
75 µm	28		

Oven dried ☑ ☐

Hydrometer analysis not required, % passing 75um < 10% ☑

PARTICLE SIZE DISTRIBUTION

Client:	*Maximus Resouces Ltd*	Job No:	*PFI1211-10*
Principal:	*Tim Wither*	Laboratory:	*MPL*
Project:	*Hilditch*	Report Date	*20-Sep-24*
Location:		Test report No:	
Test procedure:	*INORG-107*	Depth:	*0.2*
Sample No:	*PFI1211-14*		
Sample Identification:	*Sample 5*		



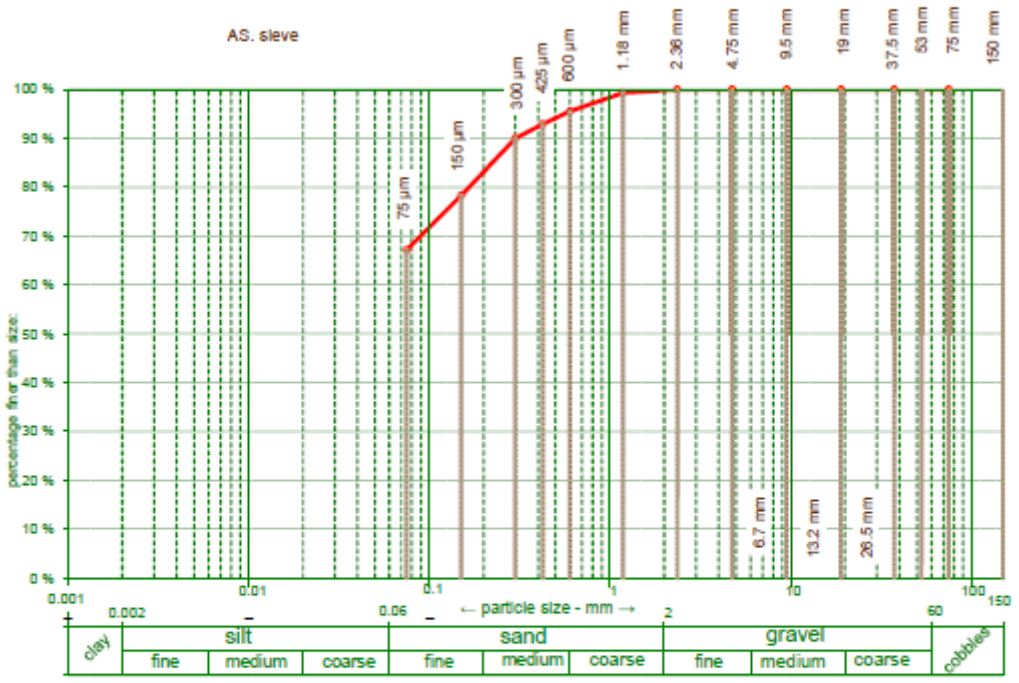
Sieve Analysis		Hydrometer Analysis	
Sieve Size mm	% Passing	Particle Size µm	% Passing
75	100		
37.5	100		
19	100		
9.5	100		
4.75	100		
2.36	100		
1.18	100		
600 µm	99		
425 µm	98		
300 µm	95		
150 µm	63		
75 µm	42		

Oven dried ☑

Hydrometer analysis not required, % passing 75um < 10% ☑

PARTICLE SIZE DISTRIBUTION

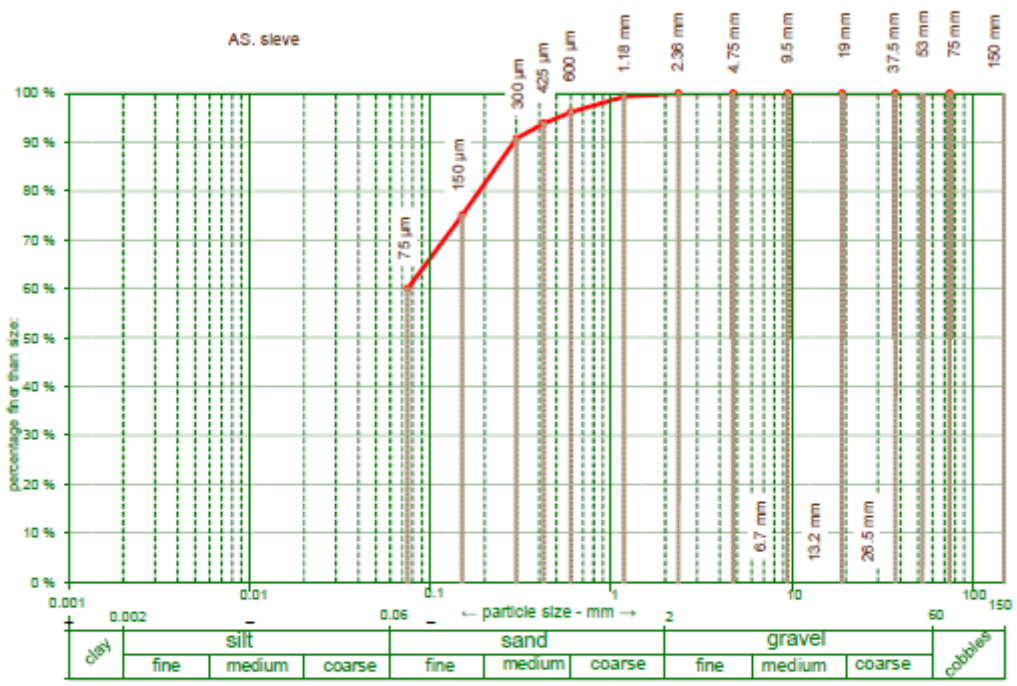
Client:	*Maximus Resouces Ltd*	Job No:	*PFI1211-10*
Principal:	*Tim Wither*	Laboratory:	*MPL*
Project:	*Hilditch*	Report Date	*20-Sep-24*
Location:		Test report No:	
Test procedure:	*INORG-107*	Depth:	*0.2*
Sample No:	*PFI1211-15*		
Sample Identification:	*Sample 6*		



Sieve Analysis		Hydrometer Analysis	
Sieve Size mm	% Passing	Particle Size µm	% Passing
75	100		
37.5	100		
19	100		
9.5	100		
4.75	100		
2.36	100		
1.18	99		
600 µm	95		
425 µm	93		
300 µm	90		
150 µm	78		
75 µm	67		

PARTICLE SIZE DISTRIBUTION

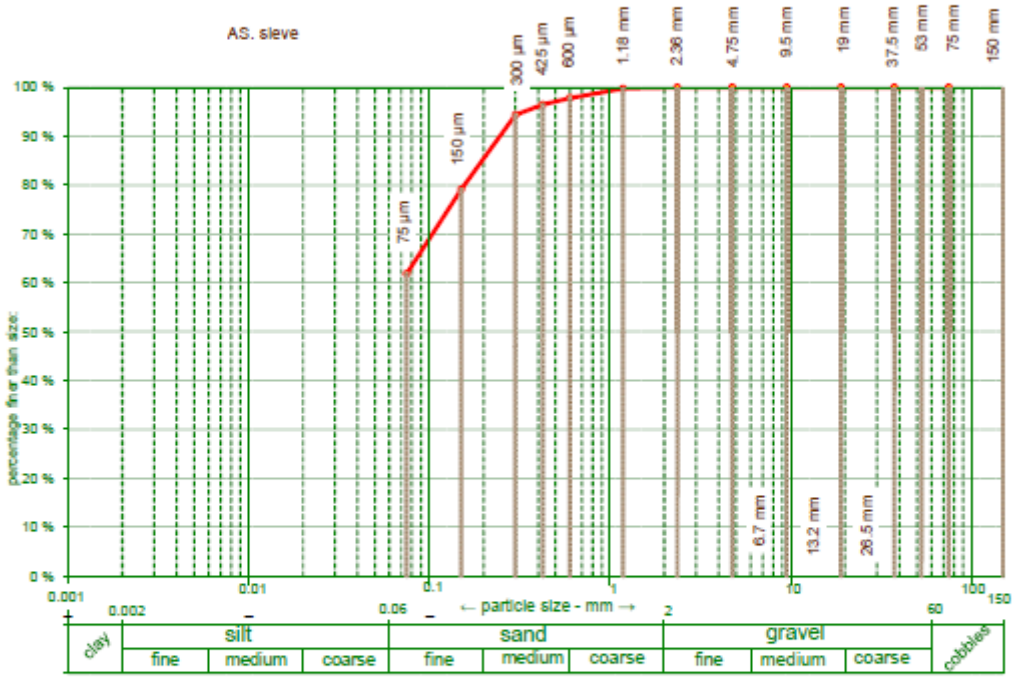
Client:	*Maximus Resouces Ltd*	Job No:	*PFI1211-10*
Principal:	*Tim Wither*	Laboratory:	*MPL*
Project:	*Hilditch*	Report Date	*20-Sep-24*
Location:		Test report No:	
Test procedure:	*INORG-107*	Depth:	*0.2*
Sample No:	*PFI1211-16*		
Sample Identification:	*Sample 7*		



Sieve Analysis		Hydrometer Analysis	
Sieve Size mm	% Passing	Particle Size µm	% Passing
75	100		
37.5	100		
19	100		
9.5	100		
4.75	100		
2.36	100		
1.18	99		
600 µm	96		
425 µm	94		
300 µm	91		
150 µm	75		
75 µm	60		

PARTICLE SIZE DISTRIBUTION

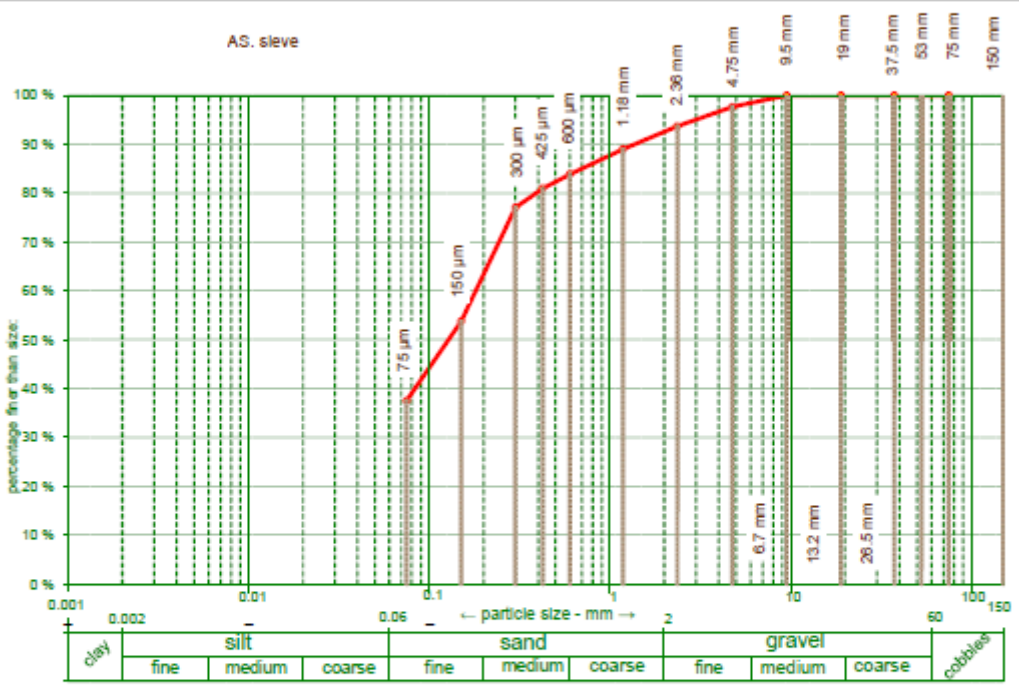
Client:	*Maximus Resouces Ltd*	Job No:	*PFI1211-10*
Principal:	*Tim Wither*	Laboratory:	*MPL*
Project:	*Hilditch*	Report Date	*20-Sep-24*
Location:		Test report No:	
Test procedure:	*INORG-107*	Depth:	*0.2*
Sample No:	*PFI1211-17*		
Sample Identification:	*Sample 8*		



Sieve Analysis		Hydrometer Analysis	
Sieve Size mm	% Passing	Particle Size µm	% Passing
75	100		
37.5	100		
19	100		
9.5	100		
4.75	100		
2.36	100		
1.18	100		
600 µm	98		
425 µm	96		
300 µm	94		
150 µm	79		
75 µm	62		

PARTICLE SIZE DISTRIBUTION

Client:	*Maximus Resouces Ltd*	Job No:	*PFI1211-10*
Principal:	*Tim Wither*	Laboratory:	*MPL*
Project:	*Hilditch*	Report Date	*20-Sep-24*
Location:		Test report No:	
Test procedure:	*INORG-107*	Depth:	*0.2*
Sample No:	*PFI1211-18*		
Sample Identification:	*Sample 9*		



Sieve Analysis		Hydrometer Analysis	
Sieve Size mm	% Passing	Particle Size µm	% Passing
75	*100*		
37.5	*100*		
19	*100*		
9.5	*100*		
4.75	*98*		
2.36	*94*		
1.18	*89*		
600 µm	*84*		
425 µm	*81*		
300 µm	*77*		
150 µm	*54*		
75 µm	*37*		

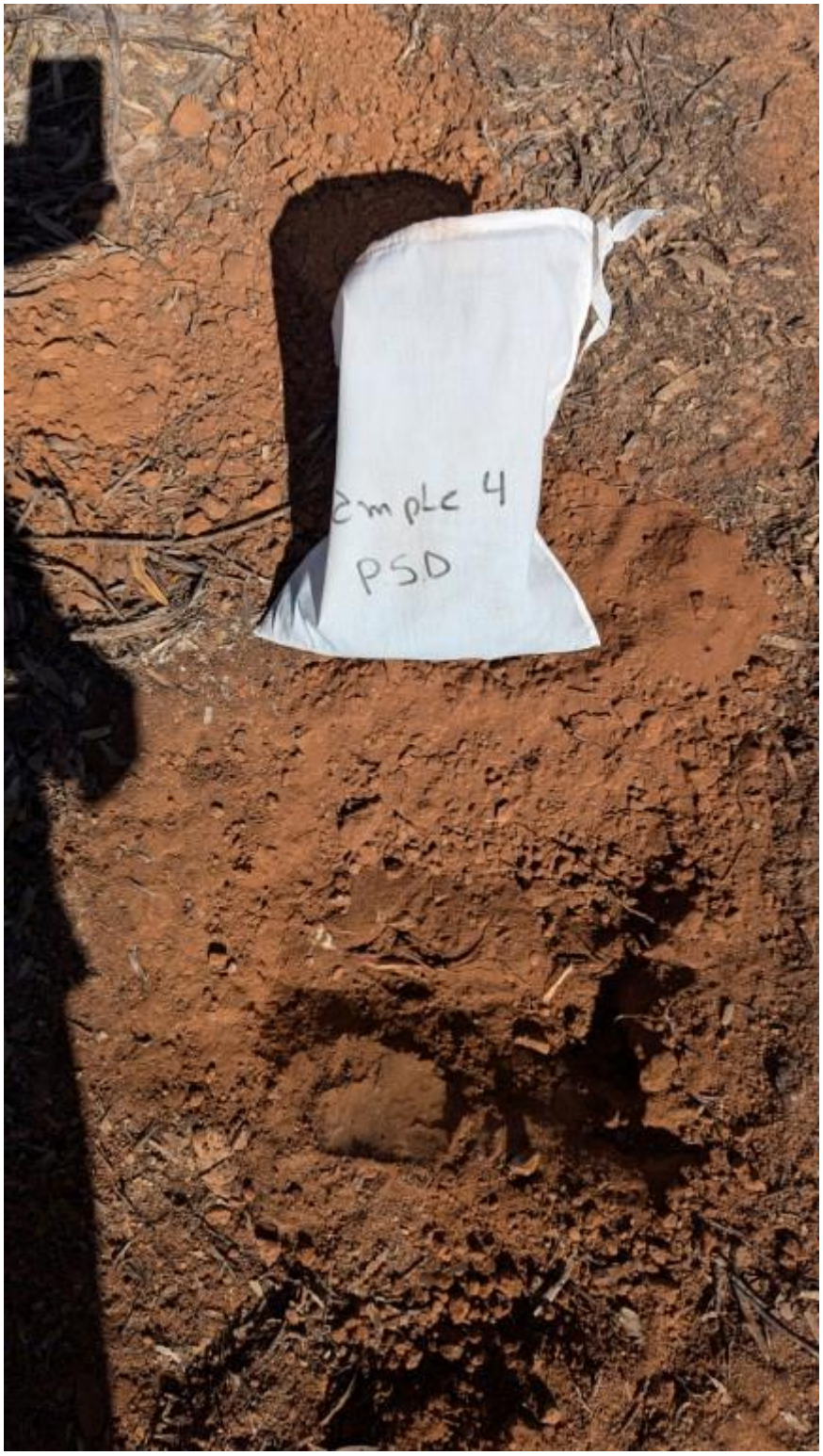
APPENDIX 3: GENERAL DESCRIPTIONS AND REPRESENTATIVE PHOTOGRAPHS OF SOIL SAMPLE SITES

SAMPLE SITE FIELD DESCRIPTIONS		
SAMPLE SITE #	DEPTH (cm)	GENERAL SITE DESCRIPTION
1	0-20	Predominantly sheetwash with minor felsic volcanic outcrop in proximity. Vegetation includes mulga and eucalypts.
2	0-20	Predominantly sheetwash with mulga and eucalypt vegetation present.
3	0-20	Dominated by sheetwash, with mulga and eucalypt vegetation in the area.
4	0-20	Collected from the top of a low ridge. Mafic subcrop identified, with a shale outcrop located 10 m to the west. Vegetation comprises mulga and eucalypts.
5	0-20	Collected from the west-facing slope. Shale float observed, with a shale outcrop located 10 m to the east. Vegetation consists of mulga and eucalypts.
6	0-20	North side of the hill. Weathered komatiite float and scree present, with some magnesite. Mulga and eucalypt vegetation observed.
7	0-20	Sheetwash-dominated area with abundant quartz float. Vegetation includes mulga and eucalypts.
8	0-20	Predominantly sheetwash with minor quartz float. Mulga and eucalypt vegetation observed.
9	0-20	Sheetwash-dominated area with mulga and eucalypt vegetation present.

Site 1 – Hilditch WRD (north)

Site 2 – Hilditch WRD (southeast)

Site 3 – Hilditch Open Pit (north)



Site 4 – Hilditch Open Pit (south)

Site 5 – Hilditch ROM

Site 6 – Haul Road

Site 7 – Haul Road

Site 8 – Haul Road

Site 9 – Hilditch WRD (southwest)

Appendix 3: Vegetation Report (NVS 2024)

Reconnaissance Flora and Vegetation Survey of the 8500N and Hilditch South Project Areas- April 2024

Prepared for

Maximus Resources Ltd

FINAL V2.0
June 2024

Prepared by:
Native Vegetation Solutions
PO Box 41
KALGOORLIE
Ph: (08) 9021 5818
Mob: 0407 998 953
Email: eren@nativevegsolutions.com.au

Appendices

Figures

Tables

1 INTRODUCTION

Maximus Resources Ltd (ASX:MXR) are conducting exploration and mining activities at their 5800N and Hilditch South project areas located in Western Australia's Coolgardie Region (DCCEEW, 2024).

MXR require a reconnaissance flora and vegetation survey to determine any impact to flora and vegetation within the 5800N and Hilditch South project areas.

Native Vegetation Solutions (NVS) was supplied with two survey areas located approximately 39.5 km northwest of Leinster, in the Coolgardie Region (COO) of Western Australia (Figure 1).

The total survey area received from MXR covered approximately 340.6 ha. The 8500N survey area is approximately 218.4 ha and lies within Mining Tenements M 15/1101, M 15/6390, M 15/395 and one Prospecting Tenement P 15/6390. The Hilditch South survey area is approximately 122.2 ha and lies within Mining Tenements M 15/1773, M 15/1448, M 15/1770 and M 15/1771. Actual disturbance footprints are not yet defined; however, clearing required within the boundary of the survey area is anticipated to be less than the total survey area.

This report will encompass results of the reconnaissance flora and vegetation survey within the 8500N and Hilditch South project areas.

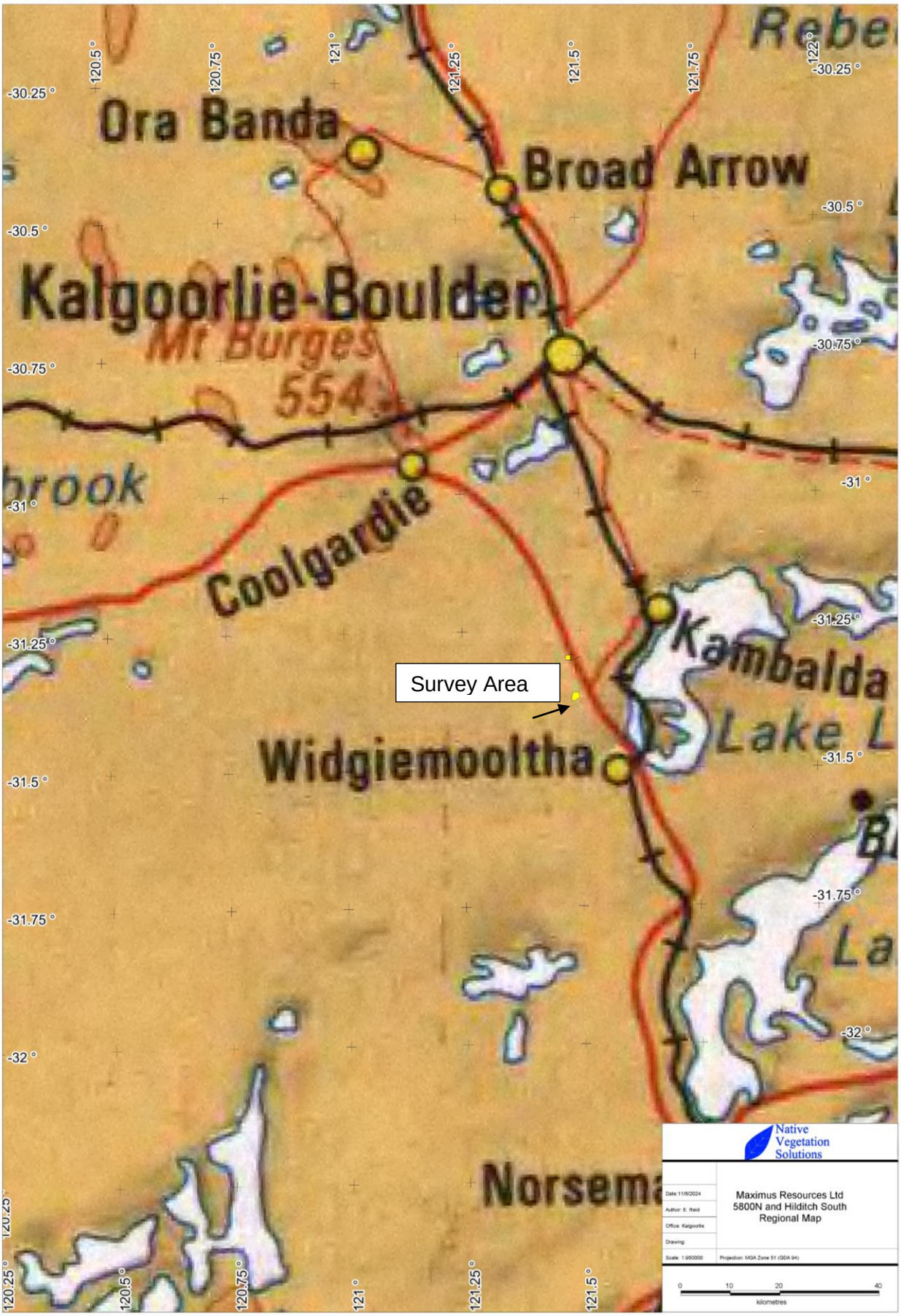


Figure 1: Regional map of survey location

1.1 Purpose and Scope

The objective of this report is to document the results of the flora and vegetation component of a reconnaissance assessment conducted in accordance with:

- Statement of environmental principles, factors, objectives and aims of EIA (EPA, 2023);
- Environmental Factor Guideline- Flora and Vegetation (EPA, 2016); and
- Technical Guidance Flora and Vegetation Surveys for Environmental Impact Assessment (EPA, 2016a).

A reconnaissance assessment has two components:

1). Desktop study which includes a literature review and a search of the relevant databases;
2). Reconnaissance survey of the survey area to verify the desktop survey, to define vegetation units present in the area, search for species of conservation significance and to determine potential sensitivity to impact.

As part of the reporting for the reconnaissance assessment, NVS has conducted a flora and vegetation survey which includes broad-scale vegetation mapping and vegetation condition mapping of the survey area.

The scope of work for the reconnaissance flora and vegetation survey was to:

- conduct a desktop study that includes a literature review and search of the relevant databases;
- describe the vegetation associations in the survey area;
- prepare an inventory of species occurring in the survey area;
- identify any vegetation communities or flora species of conservation significance;
- map broad-scale vegetation groups found within the survey area, including vegetation condition; and
- provide recommendations, including the management of perceived impacts to flora and vegetation within the survey area.

1.2 Statutory Framework and Guidance

This assessment took into account relevant sections of Commonwealth and State legislation and guidelines:

- *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act)
- *Environmental Protection Act 1986* (EP Act)
- *Biodiversity Conservation Act 2016* (BC Act)
- *Biosecurity and Agriculture Management Act 2007* (BAM Act)

The Minister for the Environment publishes lists of flora species in need of special protection because they are considered rare, likely to become extinct, or are presumed extinct. The current listings were published in the Government Gazette on 5 December 2018 (Smith and Jones, 2018) and were taken into account.

As well as those listed above, the assessment took into account relevant sections of:

- EPA (2016) *Environmental Factor Guideline- Flora and Vegetation*;
- EPA (2016a) *Technical Guidance - Flora and Vegetation Surveys for Environmental Impact Assessment*, known as *Flora and Vegetation Technical Guidance; and*
- EPA (2023) *Statement of environmental principles, factors, objectives and aims of EIA*

1.2.1 Western Australian *Biodiversity Conservation Act 2016*

The Western Australian *Biodiversity Conservation Act 2016* (BC Act) provides for the conservation, protection and ecologically sustainable use of biodiversity and biodiversity components in Western Australia. The BC Act replaced the *Wildlife Conservation Act 1950*.

Threatened species (both flora and fauna) that meet the categories listed within the Act are highly protected and require authorisation by the Ministerial to take or disturb. These are known as Threatened Flora and Threatened Fauna. The conservation categories of Critically Endangered, Endangered and Vulnerable have been aligned with those detailed in the EPBC Act, as below.

Flora and fauna species may be listed as being of special conservation interest if they have a naturally low population, 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 BC Act. These are known as specially protected species in the BC Act.

Threatened Ecological Communities (TECs) are also protected under BC Act and are categorised using the same criteria as threatened species.

1.2.2 Environmental Protection Act 1986

The *EP Act 1986* 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 included in environmental assessments and provided by the proponent), initiates measures to protect the environment and provides advice to the Minister responsible for environmental matters.

1.2.3 Environment Protection and Biodiversity Conservation Act 1999

At a Commonwealth level, Threatened taxa are protected under the EPBC Act, which lists species and ecological communities that are considered Critically Endangered, Endangered, Vulnerable, Conservation Dependent, Extinct, or Extinct in the Wild (Section 6 below).

1.2.4 Flora

1.2.4.1 Threatened and Priority Flora

Conservation significant flora species are those that are listed as TF (Threatened Flora) and (within Western Australia) as PF (Priority Flora). TF species are listed as threatened by the Western Australian Department of Biodiversity Conservation and Attractions (DBCA) and protected under the provisions of the BC Act. Some State-listed TF are provided with additional protection as they are also listed under the Commonwealth EPBC Act. Species can also be listed under the EPBC Act without being listed under the BC Act.

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 these may require a greater level of protection than unlisted species. Generally though, PF have no statutory protection. They are generally considered in environmental impact assessments under the state approval processes by Department of Energy, Mines, Industry Regulation and Safety (DEMIRS) under the *Mining Act 1978* and DBCA under the EP Act. Under this approval process measures are usually taken to protect and avoid PF.

There are seven categories covering State-listed TF and PF species (DBCA, 2019a) which are defined in Section 7 below. PF for Western Australia are regularly reviewed by DBCA whenever new information becomes available, with species status altered or removed from the list (Smith and Jones, 2018) when data indicates that they no longer meet the requirements outlined in Section 7 below.

1.2.4.2 Other Significant Flora

According to the Flora and Vegetation Technical Guidance (EPA 2016a) 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., surface water or groundwater dependent ecosystems)
- 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 and
- relictual status, being representative of taxonomic groups that no longer occur widely in the broader landscape.

1.2.5 Ecological Communities and Vegetation

1.2.5.1 Threatened and Priority Ecological Communities

Nationally Listed Threatened Ecological Communities

An ecological community is a naturally occurring group of plants, animals and other organisms interacting in a unique habitat. The complex range of interactions between the component species provides an important level of biological diversity in addition to genetics and species. At Commonwealth level, Threatened Flora and TECs are protected under the Commonwealth EPBC Act. An ecological community may be categorised into one of the three subcategories:

- Critically Endangered, if it is facing an extremely high risk of extinction in the wild in the immediate future
- Endangered, if it is not critically endangered and is facing a very high risk of extinction in the wild in the near future and
- Vulnerable, if it is not critically endangered or endangered, and is facing a high risk of extinction in the wild in the medium-term future.

State Listed Threatened Ecological Communities

The Western Australian DBCA also maintains a list of TECs, protected under the BC Act, which are further categorised into three subcategories much like those of the EPBC Act.

State Listed Priority Ecological Communities

DBCA maintains a list of Priority Ecological Communities (PECs). PECs include potential TECs that do not meet survey criteria, or that are not adequately defined.

1.2.5.2 Other Significant Vegetation

According to the Flora and Vegetation Technical Guidance (EPA 2016a), 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; and/or
- provides an important function required to maintain ecological integrity of a significant ecosystem.

1.2.5.3 Declared Pest Plants

The Western Australian Organism List (WAOL) details organisms listed as Declared Pests under the 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; or
- Exempt (no category).

2. EXISTING ENVIRONMENT

2.1 Geology and Vegetation

The survey area lies in the Coolgardie (COO) bioregion, more specifically the Eastern Goldfields (COO03) subregion. The Eastern Goldfields subregion over 5 million hectares and comprises the Yilgarn craton's 'Eastern Goldfields' Terrains. The subregion is characterised by gentle undulating plains, the west containing Archaean greenstone ridges and low hills, while the east contains a horst of proterozoic granulite. In the western half there are a series of large playa lakes which are remnants of an ancient major drainage line. The dominant soil type is Calcareous earth, which cover most of the plains and greenstone areas. The vegetation of the Eastern Goldfields botanical subregion consists of mallees, diverse *Eucalyptus* woodlands and *Dodonaea* shrublands and is rich in endemic Acacias. The salt lakes support dwarf shrublands of samphire. Acacia thickets and shrubheaths are found on sandplains (CALM, 2002).

2.2 Climate

The climate of the Coolgardie Region is classified as Arid to Semi-arid with 200-300 mm of rainfall, sometimes in summer but usually in winter (CALM, 2002). The nearest official meteorological weather station with the most complete and up to date temperature information is Kalgoorlie-Boulder Airport (station number 012038), which is located approximately 66.5 km north of the survey area.

2.2.1 Temperature

Mean annual minimum temperature at Kalgoorlie-Boulder Airport is 11.8°C and mean annual maximum temperature is 25.4°C (BOM, 2024). The coldest temperatures are attained in July (mean minimum temperature 5.1°C), the hottest is January (mean maximum temperature 33.7°C) and diurnal temperature variations are relatively consistent throughout the year (Figure 2).

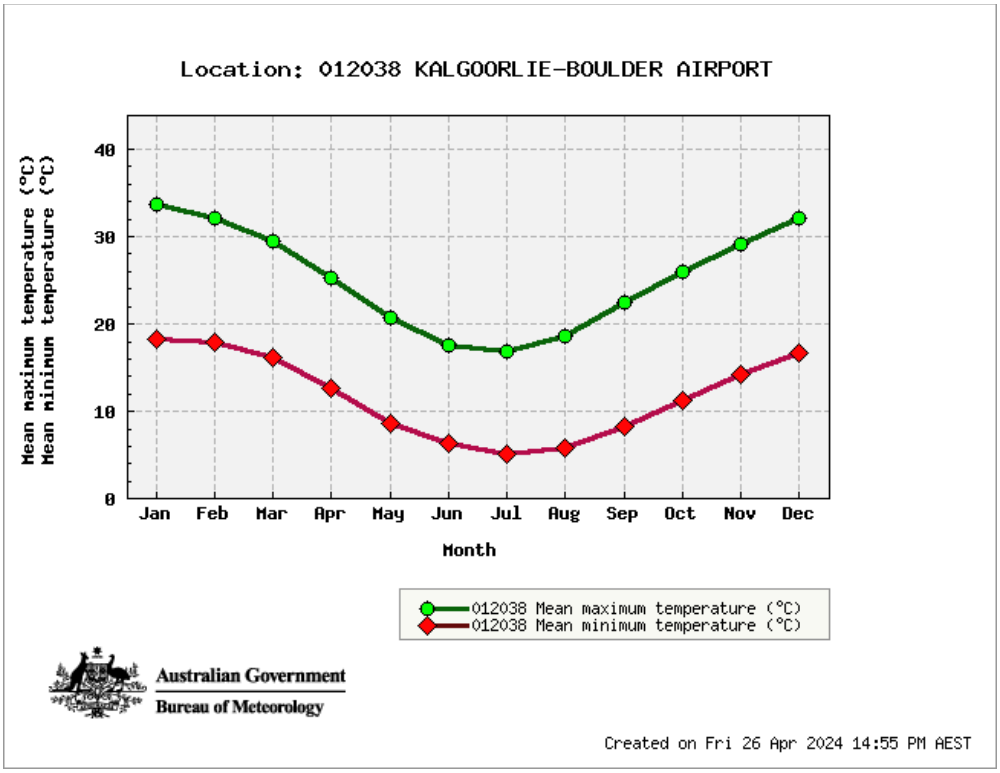


Figure 2: Mean temperature ranges for Kalgoorlie-Boulder Airport weather station

2.2.2 Rainfall

The annual average rainfall at Kalgoorlie-Boulder Airport is 264.6 mm, which falls (>1 mm) on an average of 39.3 rain-days (BOM, 2024). Larger rainfall events occur from January to March and May to August (Figure 3). Prior to the survey in 2024, rainfall in March exceeded monthly averages while rainfall for all other months remained below monthly averages (BOM, 2024).

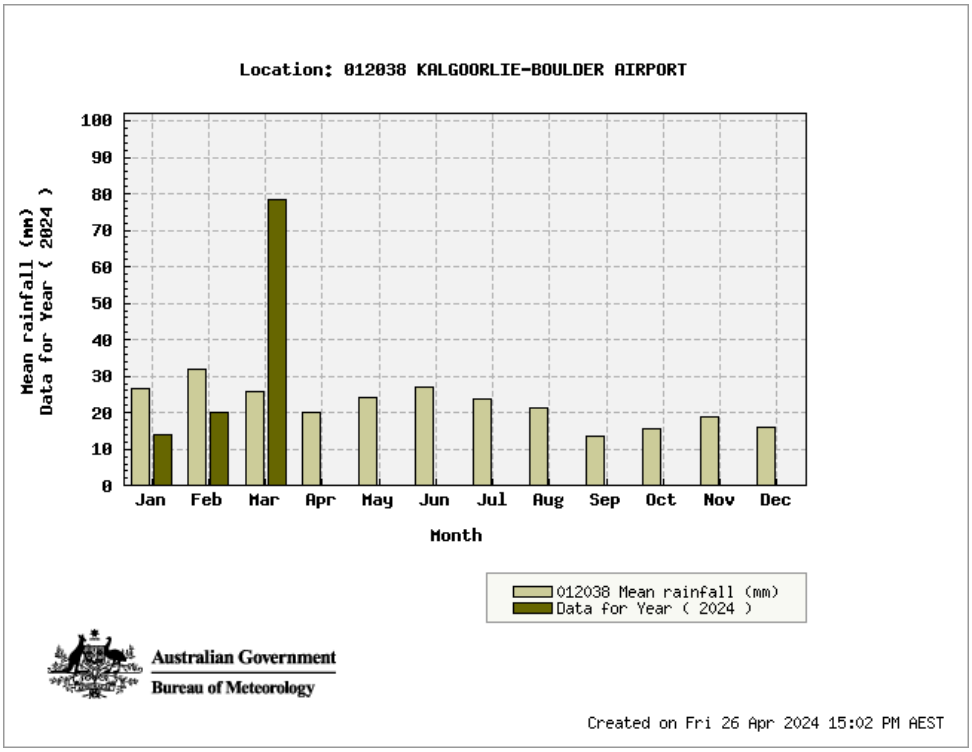


Figure 3: Monthly and mean rainfall for Kalgoorlie-Boulder Airport weather station

3. ASSESSMENT METHODOLOGY

3.1 Personnel and Reporting

The following personnel were involved in the Reconnaissance flora and vegetation survey:

- Mr Eren Reid (*BSc- Biological Science),* Principal Botanist, Native Vegetation Solutions, undertook the survey, vegetation mapping, data collation, field identification of flora, preparation and review of the report. Mr Eren Reid has over 18 years' experience in botanical surveys throughout the Murchison Region and over a variety of environments across Western Australia.
- Ms Adele Thomasz (*BSc*- Conservation and Wildlife Biology), Native Vegetation Solutions, data collation and preparation of the report. Adele Thomasz has over 5 years' experience working in the conservation sector and three years specifically working on botanical survey reporting; and

3.2 Preliminary Desktop Study

A preliminary assessment of the survey area and its potential constraints was undertaken by reviewing relevant government agency managed databases (Sections 3.2.1 to 3.2.6, and Appendices 1 & 2) and consulting with government agencies where necessary. The following sections provide a summary of desktop searches undertaken for the project.

3.2.1 Known Previous Flora and Vegetation Surveys

Two known previous surveys have been conducted within the vicinity of the current survey areas. One Detailed Flora and Vegetation and Basic / Detailed Fauna Survey for the Larkinville and Eagles Nest Projects, prepared for Maximus Resources Ltd in November 2021 (PES, 2021), and one Flora survey of the Proposed Wattle Dam Project Area prepared for Ramelius Resources Ltd in January 2005 (OES, 2005).

The 2021 Detailed Flora and Vegetation and Basic / Detailed Fauna Survey for the Larkinville and Eagles Nest Projects recorded a total of 141 flora taxa representing 32 families and 67 genera, of these seven non-native species were recorded (PES, 2021). A single plant of *Eremophila praecox* (P2) was recorded, and no Threatened Flora were recorded.

The 2005 Flora survey of the Proposed Wattle Dam Project Area recorded a total of 67 flora taxa representing 21 families and 30 genera, and no Priority or Threatened Flora were recorded (OES, 2005).

3.2.2 *Environment Protection and Biodiversity Conservation Act* Protected Matters

The *EPBC Act* Protected Matters Search tool was utilised to provide results for matters of National Environmental Significance within the survey area using the survey area as the search criteria with a 10 km buffer (DCCEEW, 2024a).

3.2.3 Threatened Flora and Communities

The Threatened and Priority Flora Database managed by the Department of Biodiversity, Conservation and Attractions (DBCA) was searched for threatened and priority flora within a 20 km radial area of the survey area (DBCA, 2020a).

The TEC and PEC database was searched to determine the presence of PECs or TECs (DBCA, 2020), with Geographic Information System (GIS) data supplied for assessment, within a 20 km radial area of the survey area.

3.2.4 Environmentally Sensitive Areas (ESAs) and Conservation Reserves

The Department of Water and Environmental Regulation (DWER, 2024) Clearing Permit System Map Viewer was used to determine the location of any ESAs and Conservation Reserves.

3.2.5 Vegetation Type, Extent and Status

Vegetation extent and status data was sourced from the Department of Agriculture and Food (DAFWA) report and its associated GIS file (Shepherd *et al*, 2002). This data comprises Beard's Pre-European vegetation groups.

DBCA's Statewide Vegetation Statistics (DBCA, 2019) was also referenced for the current extent of Beard's Vegetation Groups. The purpose of examining this information is to determine if the survey area lies within any vegetation groups defined by Beard that may have been subjected to widescale clearing for European settlement. The national objectives and targets for biodiversity conservation recognise that the retention of 30% or more of the pre-clearing extent of a Beard vegetation association is necessary if Australia's biological diversity is to be protected.

3.2.6 Wetlands

The potential of wetlands within the project area was determined by examining DWER's Clearing Permit System Map Viewer (DWER, 2024).

3.2.7 Dieback

Under normal circumstances Dieback is only considered a potential issue for any project if the project area lies within the Southwest Land Division and the mean annual rainfall of the area is greater than 400 mm. There is no record of *Phytophthora cinnamomi* (Dieback*)* establishing in natural ecosystems in regions receiving <400mm rainfall per annum (CALM, 2003).

However, as indicated within the more recent Dieback guidelines (DBCA, 2020), other species of *Phytophthora* may persist east of the 400mm isohyet in unusually wet conditions. It is therefore recommended to conduct a risk assessment as per these guidelines.

3.3 Site Investigation

A site visit of the survey area was carried out by Botanist Eren Reid from Native Vegetation Solutions on the 3rd of April 2024 to examine the flora and vegetation groups contained within the survey area. A total of 12 hours was spent on site traversing the survey area, by Yamaha Viking All Terrain Vehicle (ATV) and on foot.

The survey was conducted in accordance with relevant Environmental Protection Authority's (EPA's) Statements and Technical Guidance (Section 1.1).

The EPA uses the Interim Biogeographic Regionalisation of Australia (IBRA) as the largest unit for Environmental Impact Assessment (EIA) decision making in relation to the conservation of biodiversity. Given the scale and nature of the proposed disturbance as well as the existing disturbance, and that the survey area is located within the Coolgardie (COO) IBRA region, a reconnaissance flora and vegetation survey was deemed adequate.

3.3.1 Licenses

A Scientific License was not required for the field work as no samples were collected for identification. All taxa were able to be identified in the field.

3.3.2 Field Methods

Prior to the field work, the aerial photography was examined and representative sample sites for relevés were chosen to provide coverage over all potential vegetation types.

In the field, 20m x 20m relevé sites were established at these sites, taking into account representation of surrounding vegetation and vegetation boundaries. Relevé sites are represented in Appendix 4.

Each relevé site was captured on a TwoNav Aventura GPS at ±4m accuracy, using Universal Transverse Mercator location on GDA94 datum. Digital photographs were taken of each representative vegetation group present in the survey area.

Data collected at each relevé included:

- Photograph of representative vegetation group:
- GPS Location;
- Species Present;
- Population Count/Estimate of Conservation Significant Flora (if present);
- Disturbance Level; and
- Vegetation Condition

The vegetation structure was assessed using the method developed by Muir (1977). Definitions of the vegetation structure are presented in Appendix 3.

The condition of each relevé was assessed using the method developed by Keighery (1994). Definitions of the condition scale are presented in Appendix 3.

Vegetation groups were mapped using the methods listed in Section 3.3.4 below.

Opportunistic recording of plant taxa and vegetation group mapping was also utilised in the survey area between relevé sampling points, via wandering traverses. Smaller singular relevé sites were also utilised as opportunistic sample sites to record taxa and assist in mapping vegetation groups.

All relevé sample sites and GPS tracks are included in Appendix 4.

3.3.3 Post-Field Methods

Taxa were identified with the use of information published on Florabase (WAHERB, 2024). Potential threatened flora range extensions and new locations were submitted to the Western Australian Herbarium (WAHERB) as per the EPA Technical Guidelines (EPA 2016a).

Species information was transferred into Microsoft Excel® worksheets representing presence/absence of species per vegetation group.

3.3.4 Mapping

Vegetation mapping was produced via GPS recorded information in the field, cross-referenced with vegetation descriptions made in the field, overlaid on aerial imagery of the survey area. The GPS utilised (TwoNav Aventura GPS) displayed aerial imagery, hence real-time mapping of vegetation groups was available during field work.

Vegetation Health Condition was assessed in the field with reference to Keighery (1994).

GPS tracks and waypoints recorded during field work are presented in Appendix 4.

3.3.5 IBSA Data Package

The Environmental Protection Authority (EPA), Department of Water and Environmental Regulation (DWER) and Department of Energy, Mines, Industry Regulation and Safety (DEMIRS) require Index of Biodiversity Surveys for Assessments (IBSA) Data Packages to be submitted to support assessment and compliance under the *Environmental Protection Act 1986.*

An IBSA data package is a single file in .zip format, containing:

- one survey report in .pdf format;
- one plain-text survey report in .txt format; and
- a set of electronic data files, comprising:
    - one survey details spatial dataset in shapefile (.shp, etc.) or MapInfo (.tab, etc.) format; and
    - one or more survey data spatial datasets, as required, in shapefile (.shp, etc.) or MapInfo (.tab, etc.) format.

The IBSA Data package for this survey will be submitted via the DWER IBSA Submission Portal.

3.4 Nomenclature And Taxonomy

Nomenclature follows that used by the WAHERB.

The WAHERB has updated its sequence and arrangement of collections to conform to the systematic sequence of the Angiosperm Phylogeny Group (APGIII), with the result that many Families and Genera have been moved or renamed. This report attempts to follow those changes in relation to species recorded during this survey.

3.5 Limitations

Table 1 lists potential limitations that may have affected the survey.

Table 1: List of potential survey limitations

Potential Limitations	Constraint (Y/N)	Comment
Competency and experience of the consultants undertaking the survey	N	Experienced and competent personnel conducted the survey. Eren Reid (*BSc*) has over 20 years' experience in botanical surveys throughout the Murchison Region and over a variety of environments across Western Australia.
Scope	N	The Scope of work was adequately defined. Vascular flora species were the focus of the survey and were thoroughly sampled.
Proportion of flora identified during survey	N	As the survey was planned to target species of conservation significance and flora within a defined survey area, a complete census of the species present was attempted (Approx. 95%). Sufficient identifications were made to allow vegetation descriptions to be made.
Sources of information	N	Threatened and Priority Flora GIS information was available from DBCA.
Proportion of the task achieved	N	All tasks completed.
Timing/Season	N	The reconnaissance flora and vegetation survey was conducted in April 2024. Flowering annual species were present within the survey area, suggesting recent above average rainfall in March 2024 was sufficient for the period of survey. The most recent rainfall received in the area was on 19th March 2024.
Disturbance in survey area	N	Minor disturbance (historical mining access tracks and exploration) was observed within the survey area, however, did not compromise the results of the survey as these areas were avoided whilst collecting data.
Intensity of survey effort	N	The survey intensity is considered to have been sufficient for a reconnaissance survey according to EPA (2016) guidelines. Areas most likely to contain threatened and priority species were targeted. Vegetation mapping sites were selected to provide adequate coverage of the survey area.
Resources	N	Resources, in terms of time, equipment, support and personnel were adequate to undertake and complete the reconnaissance survey.
Access problems	N	All the areas in need of survey were easily accessible from existing tracks, or by foot.
Availability of contextual information on the region	N	Contextual information regarding vegetation and flora of the Coolgardie bioregion is readily available. Adequate information was able to be accessed from available databases.

4. RESULTS

4.1 Preliminary Desktop Assessment

4.1.1 EPBC Act Protected Matters

The EPBC Protected Matters report indicated no TF, TECs or Commonwealth, State or Territory Reserves are located within the survey area (DCCEEW, 2024a).

The search results indicated that one Priority Flora, *Tecticornia flabelliformis* (P2) is likely to occur or habitat for this species is likely to occur within 10 km of the survey area, and the Ngadju Indigenous Protected Area (State Reserve) is located approximately 9.5 east of the survey area (DCCEEW, 2024a).

Results of the EPBC Protected Matters search tool are included in Appendix 1.

4.1.2 Threatened Flora and Communities

The DBCA database searches revealed a potential for one Threatened and 27 Priority Flora species to occur within a 20 km radius of the survey area (DBCA, 2020a). No known locations of Threatened or Priority Flora occur within the survey area, with the closest Priority Flora located approximately 4.1 km northwest of the Hilditch South survey area.

Results of the threatened flora database search are included in Appendix 2 which includes the likelihood of each species to occur within the survey area.

The PEC/TEC search (DBCA, 2020) revealed that no PECs or TECs fall within the survey area, or within 20km of the survey area.

Priority Flora species within a 20 km radius of the survey area are displayed in Map 3 of Appendix 4.

4.1.3 Environmentally Sensitive Areas and Conservation Reserves

The Clearing Permit System Map Viewer indicated no ESA's or conservation reserves are located within the survey area (DWER, 2024).

4.1.4 Land Systems

As part of the Rangeland resource surveys, the Department of Agriculture mapped the Land Systems of Western Australia (DPIRD, 2017). The Land Systems occurring within the survey area are listed in Table 2 below and displayed in Appendix 4.

Table 2: Land Systems occurring within the survey area (DPIRD, 2017)

Land System	Description	Extent of Hilditch survey area (ha)	Extent of 8500N area (ha)	Total area (ha)	Percentage of survey area (%)
Graves System	Basalt and greenstone rises and low hills supporting eucalypt woodlands with prominent saltbush and bluebush understoreys.	0.15	187.04	187.19	54.96
Moriarty System	Low greenstone rises and stony plains supporting chenopod shrublands with patchy eucalypt overstoreys.	47.29	0.00	47.29	13.89
Gumland System	Extensive pedeplains supporting eucalypt woodlands with halophytic and non-halophytic shrub understoreys.	74.75	31.36	106.11	31.15
	Total	**122.20**	**218.40**	**340.60**	**100.00**

4.1.5 Vegetation Type, Extent and Status

Two vegetation units defined by Beard (1990) were identified as part of the desktop assessment. The vegetation units identify the Pre-European extent of vegetation, as mapped by Beard (1990). The national objectives and targets for biodiversity conservation recognise that the retention of 30% or more of the pre-clearing extent of Beard's vegetation associations is necessary if Australia's biological diversity is to be protected.

Information relating to known Beard (1990) vegetation units within the survey area has been summarised in Table 3,
Table 4 and Table 5 below. This information has been compiled through both desktop assessments and the site visit.

The extent of the Beard vegetation units within the survey area at all scales is less than 1% of the total area at each scale (Table 3). Both Beard vegetation units are above the 30% threshold at a State, bioregional and subregional scale.

Table 3: Extent of Beard Associations within the survey area

Beard Vegetation Association	Extent of Hilditch survey area (ha)	Extent of 8500N area (ha)	Total survey area (ha)	% of survey area (%)	By Association WA	By IBRA Region *(COO)*	By IBRA Sub-region *(COO03)*	By Shire *(Shire of Coolgardie)*
9	122.20	173.15	295.35	86.71	<1%	<1%	<1%	<1%
936	0.00	45.25	45.25	13.29	<1%	<1%	<1%	<1%

Table 4: Summary of information regarding Pre-European and current vegetation extent of Vegetation Association 9 within the survey area

Factor	Value				
Beard Vegetation Association*	9				
Vegetation Association Description*	Medium woodland; coral gum (E. torquata) & Goldfields blackbutt (E. le souefii) (also some e10,11)				
Pre-European Extent (ha)	Scale				
	By Association (WA)	By Association (WA)	By IBRA Region (COO)	By IBRA Sub-region (COO03)	By Shire (Shire Coolgardie)
	244,735*	240,509.33**	240,441.99**	235,047**	166,572.37**
% Pre-European Extent Remaining	100.00%*	97.78%**	97.78%**	97.75%**	98.29%**
Surrounding Land Use***	Mining, Exploration, Pastoral Lease				
Weed prevalence***	Low				

* Source: Shepherd *et al.* (2002) Appendix 2
**Source: DBCA, (2019)
***Source: Field Assessment

Table 5: Summary of information regarding Pre-European and current vegetation extent of Vegetation Association 936 within the survey area

Factor	Value				
Beard Vegetation Association*	936				
Vegetation Association Description*	Medium woodland; salmon gum				
Pre-European Extent (ha)	Scale				
	By Association (WA)	By Association (WA)	By IBRA Region (COO)	By IBRA Sub-region (COO03)	By Shire (Shire Coolgardie)
	924,675*	698,752**	586,792.23**	310,897.74**	359,112.73**
% Pre-European Extent Remaining	96.46%*	96.84%**	99.58%**	99.22%**	99.32%**
Surrounding Land Use***	Mining, Exploration, Pastoral Lease				
Weed prevalence***	Low				

* Source: Shepherd *et al.* (2002) Appendix 2
**Source: DBCA, (2019)
***Source: Field Assessment

4.1.6 Wetlands

The DWER Clearing Permit System Map Viewer revealed no waterbodies within the survey area (DWER, 2024).

4.1.7 Dieback

The survey area lies south of the 26th parallel, however receives average annual rainfall of 264.6 mm. There is no record of *Phytophthora cinnamomi* establishing in natural ecosystems in regions receiving less than 400mm rainfall per annum (CALM, 2003).

However, as indicated within the more recent Dieback guidelines (DBCA, 2020), other species of *Phytophthora* may persist east of the 400mm isohyet in unusually wet conditions. It is therefore recommended to conduct a risk assessment as per these guidelines.

Additionally, all measures should be taken to prevent any possible soil contamination (including seeds of non-native species *etc*.) which poses a risk in the survey area during seasonally favourable conditions.

4.2 Field Assessment

4.2.1 Threatened Flora

No Priority Flora or Threatened Flora were recorded in the survey area.

4.2.2 Vegetation Type, Extent and Status

A total of 24 Families, 46 Genera and 99 Species were recorded within the survey area. Twelve major vegetation groups were recorded in the survey area and range from Completely Degraded to Very Good condition (using the scale of Keighery 1994, see Appendix 3). Existing disturbance within the survey area is comprised of mining, historic exploration activities and access roads.

No unique or restricted vegetation communities were identified, and all vegetation types/communities are common, widespread and well represented in the Eastern Goldfields subregion.

The summary of vegetation groups contained within the survey area is summarised in Table 6 below. Maps of the survey area can be seen in Appendix 4.

Table 6: Vegetation Group Summary

Vegetation Group	Veg Group Code	Families	Genera	Species	Area (ha)	Percentage of survey area (%)
Eucalyptus griffithsii woodland	A	7	11	21	9.2	2.7
Low Chenopod shrubland	B	14	22	26	3.9	1.2
Transitional Eucalyptus woodland	C	16	27	52	199.3	58.5
Eucalyptus salmonophloia creekline	D	11	18	31	5.4	1.6
Eucalyptus ravida woodland	E	8	11	15	2.8	0.8
Eucalyptus yilgarnensis over *Eremophila dempsteri*	F	8	11	18	3.7	1.1
Eucalyptus griffithsii over *Acacia acuminata* creekline	G	14	18	29	7.5	2.2
Eucalyptus lesouefii thicket	H	7	9	13	6.2	1.8
Mixed Eucalyptus woodland over sclerophyll shrubland on small rises	I	14	18	34	17.0	5.0
Eucalyptus griffithsii over *Acacia acuminata*	J	15	19	31	8.8	2.6
Eucalyptus woodland over *Melaleuca sheathiana*	K	10	15	20	31.5	9.3
Open *Eucalyptus salmonophloia* woodland	L	8	10	14	5.0	1.5
Existing Disturbance	N/A	N/A	N/A	N/A	40.2	11.8
	Total	24*	46*	99*	340.6#	100.00#

Note: * Within total survey area (not sum of column)
Sum of column

The vegetation groups within the survey area are described in more detail below.

4.2.2.1 Eucalyptus griffithsii woodland (A)

This Tree Mallee (Muir, 1977) consisted of 7 Families, 11 Genera and 21 Species. The vegetation group was approximately 9.2 ha which makes up 2.7% of the survey area.

Figure 4: Vegetation Group A within the survey area

4.2.2.2 Low Chenopod shrubland (B)

This Low Scrub B (Muir, 1977) consisted of 14 Families, 22 Genera and 26 Species. The vegetation group was approximately 3.9 ha which makes up 1.2% of the survey area.

Figure 5: Vegetation Group B within the survey area

4.2.2.3 Transitional Eucalyptus woodland (C)

This Low Woodland A (Muir, 1977) consisted of 16 Families, 27 Genera and 52 Species. The vegetation group was approximately 199.3 ha which makes up 58.5% of the survey area.

Figure 6: Vegetation Group C within the survey area

4.2.2.4 *Eucalyptus salmonophloia* creekline (D)

This Woodland (Muir, 1977) consisted of 11 Families,18 Genera and 31 Species. The vegetation group was approximately 5.4 ha which makes up 1.6% of the survey area.

Figure 7: Vegetation Group D within the survey area

4.2.2.5 *Eucalyptus ravida* woodland (E)

This Tree Mallee (Muir, 1977) consisted of 8 Families, 11 Genera and 15 Species. The vegetation group was approximately 2.8 ha which makes up 0.8% of the survey area.

Figure 8: Vegetation Group E within the survey area

4.2.2.6 *Eucalyptus yilgarnensis* over *Eremophila dempsteri* (F)

This Very Open Tree Mallee (Muir, 1977) consisted of 8 Families, 11 Genera and 18 Species. The vegetation group was approximately 3.7 ha which makes up 1.1% of the survey area.

Figure 9: Vegetation Group F within the survey area

4.2.2.7 *Eucalyptus griffithsii* over *Acacia acuminata* creekline (G)

This Tree Mallee (Muir, 1977) consisted of 14 Families, 18 Genera and 29 Species. The vegetation group was approximately 7.5 ha which makes up 2.2% of the survey area.

Figure 10: Vegetation Group G within the survey area

4.2.2.8 *Eucalyptus lesouefii* thicket (H)

This Low Forrest A (Muir, 1977) consisted of 7 Families, 9 Genera and 13 Species. The vegetation group was approximately 6.2 ha which makes up 1.8% of the survey area.

Figure 11: Vegetation Group H within the survey area

4.2.2.9 Mixed Eucalyptus woodland over sclerophyll shrubland on small rises (I)

This Low Woodland A (Muir, 1977) consisted of 14 Families, 18 Genera and 34 Species. The vegetation group was approximately 17.0 ha which makes up 5.0% of the survey area.

Figure 12: Vegetation Group I within the survey area

4.2.2.10 *Eucalyptus griffithsii* over *Acacia acuminata* (J)

This Tree Mallee (Muir, 1977) consisted of 15 Families, 19 Genera and 31 Species. The vegetation group was approximately 8.8 ha which makes up 2.6% of the survey area.

Figure 13: Vegetation Group J within the survey area

4.2.2.11 Eucalyptus woodland over *Melaleuca sheathiana* (K)

This Low Woodland A (Muir, 1977) consisted of 10 Families, 15 Genera and 20 Species. The vegetation group was approximately 31.5 ha which makes up 9.3% of the survey area.

Figure 14: Vegetation Group K within the survey area

4.2.2.12 Open *Eucalyptus salmonophloia* woodland (L)

This Woodland (Muir, 1977) consisted of 8 Families, 10 Genera and 14 Species. The vegetation group was approximately 5.0 ha which makes up 1.5% of the survey area.

Figure 15: Vegetation Group L within the survey area

4.2.2.13 Existing Disturbance

Existing disturbance within the survey area consisted of historic mining, exploration clearing and access roads and was approximately 40.2 ha which makes up 11.8% of the survey area.

Figure 16: Existing disturbance within the survey area

4.2.3 Weeds

Five weed species were recorded within the survey area. *Carrichtera annua* (Ward's Weed), *Centaurea melitensis* (Maltese Cockspur), *Lysimachia arvensis* (Pimpernel), *Salvia verbenaca* (Wild Sage) and *Sonchus oleraceus* (Common Sowthistle). None of these species are considered Declared Pests under the BAM Act (DPIRD, 2024).

4.2.4 Vegetation Condition

Evidence of historic exploration and access tracks was observed during the field assessment.

Overall, the condition of the vegetation was determined to range from "Completely Degraded" to "Very Good" with most of the area falling into the "Very Good" Category. Areas which were affected by mining, historic exploration and clearing were deemed in "Completely Degraded" condition. A map of the vegetation condition within the survey is depicted in Appendix 4.

5. DISCUSSION

The field assessment established that the condition of the vegetation in the proposed disturbance area ranged from “Completely Degraded” to “Very Good” with most of the area falling into the “ Very Good” Category. Areas which were affected by mining and historic exploration were deemed in “Completely Degraded” condition. No areas of vegetation were assessed to be in “Pristine” condition.

Five weed species were recorded within the survey area. *Carrichtera annua* (Ward’s Weed), Centaurea melitensis (Maltese Cockspur), Lysimachia arvensis (Pimpernel), Salvia verbenaca (Wild Sage) and Sonchus oleraceus (Common Sowthistle). None of these species are considered Declared Pests under the BAM Act (DPIRD, 2024).

No Priority or Threatened Flora were recorded in the survey area.

No PECs or TECs were recorded in the survey area.

No unique or restricted vegetation communities were identified, and all vegetation types/communities are common, widespread and well represented in the Eastern Goldfields subregion.

Any proposed disturbance/clearing of vegetation will result in a loss of some flora and vegetation. However, given the size of the area and the extent of the Beard (1990) vegetation association elsewhere, the impact on the vegetation and its component flora will not affect the conservation values of either, or create fragmentation or patches of remnant vegetation.

The following recommendations arise from the reconnaissance flora survey:

- Weed control measures should be implemented during and following earthworks; and
- Dust control measures should be implemented during earthworks.

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7. GLOSSARY

Acronyms:

BOM	Bureau of Meteorology, Australian Government
BSc	Bachelor of Science
CALM	Department of Conservation and Land Management (now DBCA)
CPS	Clearing Permit System (DWER)
COO	Coolgardie Bioregion (IBRA)
COO03	Eastern Goldfields Subregion (IBRA)
DBCA	Department of Biodiversity, Conservation and Attractions, Western Australia
DCCEEW	Department of Climate Control, Energy, the Environment and Water, Australian Government
DEMIRS	Department of Energy, Mines, Industry Regulation and Safety, Western Australia
DPAW	Department of Parks and Wildlife, Western Australia (now DBCA)
DPIRD	Department of Primary Industries and Regional Development, Western Australia
DRF	Declared Rare Flora (now classed as Threatened Flora)
DWER	Department of Water and Environmental Regulation, Western Australia
EPA	Environmental Protection Authority, Western Australia
EP Act	Environmental Protection Act 1986, Western Australia
EPBC Act	Environment Protection and Biodiversity Conservation Act 1999 (Commonwealth Act)
ESA	Environmentally Sensitive Area
GIS	Geographical Information System
ha	Hectare (10,000 square metres)
IBRA	Interim Biogeographic Regionalisation for Australia, DCCEEW
IUCN	International Union for the Conservation of Nature and Natural Resources – commonly known as the World Conservation Union
km	Kilometres
m	Metres
NVS	Native Vegetation Solutions
PEC	Priority Ecological Community, Western Australia
Ramsar	A wetland site designated of international importance under the Ramsar Convention (UNESCO)
TEC	Threatened Ecological Community
UNESCO	United Nations Educational, Scientific and Cultural Organization
WA	Western Australia
WAHERB	Western Australian Herbarium (DBCA)

Definitions:

DBCA (2019a) Conservation Codes for Western Australian Flora and Fauna. Department of Biodiversity, Conservation and Attractions, Western Australia, January 2019: -

T Threatened species:

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 *Biodiversity Conservation Act 2016* (BC Act).

Threatened fauna is that subset of 'Specially Protected Fauna' listed under schedules 1 to 3 of the *Wildlife Conservation (Specially Protected Fauna) Notice 2018* for Threatened Fauna.

Threatened flora is that subset of 'Rare Flora' listed under schedules 1 to 3 of the *Wildlife Conservation (Rare Flora) Notice 2018* for Threatened Flora.

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.

CR Critically endangered species

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".

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 *Wildlife Conservation (Specially Protected Fauna) Notice 2018* for critically endangered fauna or the *Wildlife Conservation (Rare Flora) Notice 2018* for critically endangered flora.

EN Endangered species

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".

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 *Wildlife Conservation (Specially Protected Fauna) Notice 2018* for endangered fauna or the *Wildlife Conservation (Rare Flora) Notice 2018* for endangered flora.

VU Vulnerable species

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".

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 *Wildlife Conservation (Specially Protected Fauna) Notice 2018* for vulnerable fauna or the *Wildlife Conservation (Rare Flora) Notice 2018* for vulnerable flora.

Extinct species:

Listed by order of the Minister as extinct under section 23(1) of the BC Act as extinct or extinct in the wild.

EX Extinct species

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).

Published as presumed extinct under schedule 4 of the *Wildlife Conservation (Specially Protected Fauna) Notice 2018* for extinct fauna or the *Wildlife Conservation (Rare Flora) Notice 2018* for extinct flora.

EW Extinct in the wild species

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).

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.

Specially protected species

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.

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.

MI Migratory species

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).

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 *Convention on the Conservation of Migratory Species of Wild Animals* (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.

Published as migratory birds protected under an international agreement under schedule 5 of the *Wildlife Conservation (Specially Protected Fauna) Notice 2018*.

CD Species of special conservation interest (conservation dependent fauna)

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).

Published as conservation dependent fauna under schedule 6 of the *Wildlife Conservation (Specially Protected Fauna) Notice 2018*.

OS Other specially protected species

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).

Published as other specially protected fauna under schedule 7 of the *Wildlife Conservation (Specially Protected Fauna) Notice 2018.*

P Priority Species

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.

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.

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.

Priority 1: Poorly-known species

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.

Priority 2: Poorly-known species

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.

Priority 3: Poorly-known species

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.

Priority 4: Rare, Near Threatened and other species in need of monitoring

(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.

(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.

(c) Species that have been removed from the list of threatened species during the past five years for reasons other than taxonomy.

Appendix 1: Relevant Government Database Search Results

Australian Government
Department of Climate Change, Energy, the Environment and Water

EPBC Act Protected Matters Report

This report provides general guidance on matters of national environmental significance and other matters protected by the EPBC Act in the area you have selected. Please see the caveat for interpretation of information provided here.

Report created: 01-May-2024

Summary

Matters of National Environment Significance

This part of the report summarises the matters of national environmental significance that may occur in, or may relate to, the area you nominated. Further information is available in the detail part of the report, which can be accessed by scrolling or following the links below. If you are proposing to undertake an activity that may have a significant impact on one or more matters of national environmental significance then you should consider the Administrative Guidelines on Significance.

World Heritage Properties:	None
National Heritage Places:	None
Wetlands of International Importance (Ramsar	None
Great Barrier Reef Marine Park:	None
Commonwealth Marine Area:	None
Listed Threatened Ecological Communities:	None
Listed Threatened Species:	7
Listed Migratory Species:	6

Other Matters Protected by the EPBC Act

This part of the report summarises other matters protected under the Act that may relate to the area you nominated. Approval may be required for a proposed activity that significantly affects the environment on Commonwealth land, when the action is outside the Commonwealth land, or the environment anywhere when the action is taken on Commonwealth land. Approval may also be required for the Commonwealth or Commonwealth agencies proposing to take an action that is likely to have a significant impact on the environment anywhere.

The EPBC Act protects the environment on Commonwealth land, the environment from the actions taken on Commonwealth land, and the environment from actions taken by Commonwealth agencies. As heritage values of a place are part of the 'environment', these aspects of the EPBC Act protect the Commonwealth Heritage values of a Commonwealth Heritage place. Information on the new heritage laws can be found at https://www.dcceew.gov.au/parks-heritage/heritage

A permit may be required for activities in or on a Commonwealth area that may affect a member of a listed threatened species or ecological community, a member of a listed migratory species, whales and other cetaceans, or a member of a listed marine species.

Commonwealth Lands:	1
Commonwealth Heritage Places:	None
Listed Marine Species:	10
Whales and Other Cetaceans:	None
Critical Habitats:	None
Commonwealth Reserves Terrestrial:	None
Australian Marine Parks:	None
Habitat Critical to the Survival of Marine Turtles:	None

Extra Information

This part of the report provides information that may also be relevant to the area you have

State and Territory Reserves:	1
Regional Forest Agreements:	None
Nationally Important Wetlands:	None
EPBC Act Referrals:	1
Key Ecological Features (Marine):	None
Biologically Important Areas:	None
Bioregional Assessments:	None
Geological and Bioregional Assessments:	None

Details

Matters of National Environmental Significance

Listed Threatened Species			[Resource Information]
Status of Conservation Dependent and Extinct are not MNES under the EPBC Act. Number is the current name ID.			
Scientific Name	Threatened Category	Presence Text	Buffer Status
BIRD			
Aphelocephala leucopsis Southern Whiteface [529]	Vulnerable	Species or species habitat likely to occur within area	In feature area
Calidris acuminata Sharp-tailed Sandpiper [874]	Vulnerable	Species or species habitat likely to occur within area	In feature area
Calidris ferruginea Curlew Sandpiper [856]	Critically Endangered	Species or species habitat may occur within area	In feature area
Falco hypoleucos Grey Falcon [929]	Vulnerable	Species or species habitat likely to occur within area	In feature area
Leipoa ocellata Malleefowl [934]	Vulnerable	Species or species habitat likely to occur within area	In feature area
Pezoporus occidentalis Night Parrot [59350]	Endangered	Species or species habitat may occur within area	In feature area
PLANT			
Tecticornia flabelliformis Bead Glasswort, Bead Samphire [82664]	Vulnerable	Species or species habitat likely to occur within area	In buffer area only

Listed Migratory Species			[Resource Information]
Scientific Name	Threatened Category	Presence Text	Buffer Status
Migratory Marine Birds			

Scientific Name	Threatened Category	Presence Text	Buffer Status
Apus pacificus			
Fork-tailed Swift [678]		Species or species habitat likely to occur within area	In feature area
Migratory Terrestrial Species			
Motacilla cinerea			
Grey Wagtail [642]		Species or species habitat may occur within area	In feature area
Migratory Wetlands Species			
Actitis hypoleucos			
Common Sandpiper [59309]		Species or species habitat may occur within area	In feature area
Calidris acuminata			
Sharp-tailed Sandpiper [874]	Vulnerable	Species or species habitat likely to occur within area	In feature area
Calidris ferruginea			
Curlew Sandpiper [856]	Critically Endangered	Species or species habitat may occur within area	In feature area
Calidris melanotos			
Pectoral Sandpiper [858]		Species or species habitat may occur within area	In feature area

Other Matters Protected by the EPBC Act

Commonwealth Lands [Resource Information]

The Commonwealth area listed below may indicate the presence of Commonwealth land in this vicinity. Due to the unreliability of the data source, all proposals should be checked as to whether it impacts on a Commonwealth area, before making a definitive decision. Contact the State or Territory government land department for further information.

Commonwealth Land Name	State	Buffer Status
Unknown		
Commonwealth Land - [52244]	WA	In buffer area only

Listed Marine Species [Resource Information]

Scientific Name	Threatened Category	Presence Text	Buffer Status
Bird			
Actitis hypoleucos			
Common Sandpiper [59309]		Species or species habitat may occur within area	In feature area

Scientific Name	Threatened Category	Presence Text	Buffer Status
Apus pacificus Fork-tailed Swift [678]		Species or species habitat likely to occur within area overfly marine area	In feature area
Bubulcus ibis as Ardea ibis Cattle Egret [66521]		Species or species habitat may occur within area overfly marine area	In feature area
Calidris acuminata Sharp-tailed Sandpiper [874]	Vulnerable	Species or species habitat likely to occur within area	In feature area
Calidris ferruginea Curlew Sandpiper [856]	Critically Endangered	Species or species habitat may occur within area overfly marine area	In feature area
Calidris melanotos Pectoral Sandpiper [858]		Species or species habitat may occur within area overfly marine area	In feature area
Chalcites osculans as Chrysococcyx osculans Black-eared Cuckoo [83425]		Species or species habitat likely to occur within area overfly marine area	In feature area
Merops ornatus Rainbow Bee-eater [670]		Species or species habitat may occur within area overfly marine area	In feature area
Motacilla cinerea Grey Wagtail [642]		Species or species habitat may occur within area overfly marine area	In feature area
Thinornis cucullatus as Thinornis rubricollis Hooded Plover, Hooded Dotterel [87735]		Species or species habitat may occur within area overfly marine area	In buffer area only

Extra Information

State and Territory Reserves			[Resource Information]
Protected Area Name	Reserve Type	State	Buffer Status
Ngadju	Indigenous Protected Area	WA	In buffer area only

EPBC Act Referrals				[Resource Information]
Title of referral	Reference	Referral Outcome	Assessment Status	Buffer Status
Not controlled action				
Improving rabbit biocontrol: releasing another strain of RHDV, sthrn two thirds of Australia	2015/7522	Not Controlled Action	Completed	In feature area

Caveat

1 PURPOSE

This report is designed to assist in identifying the location of matters of national environmental significance (MNES) and other matters protected by the Environment Protection and Biodiversity Conservation Act 1999 (Cth) (EPBC Act) which may be relevant in determining obligations and requirements under the EPBC Act.

The report contains the mapped locations of:

- World and National Heritage properties;
- Wetlands of International and National Importance;
- Commonwealth and State/Territory reserves;
- distribution of listed threatened, migratory and marine species;
- listed threatened ecological communities; and
- other information that may be useful as an indicator of potential habitat value.

2 DISCLAIMER

This report is not intended to be exhaustive and should only be relied upon as a general guide as mapped data is not available for all species or ecological communities listed under the EPBC Act (see below). Persons seeking to use the information contained in this report to inform the referral of a proposed action under the EPBC Act should consider the limitations noted below and whether additional information is required to determine the existence and location of MNES and other protected matters.

Where data are available to inform the mapping of protected species, the presence type (e.g. known, likely or may occur) that can be determined from the data is indicated in general terms. It is the responsibility of any person using or relying on the information in this report to ensure that it is suitable for the circumstances of any proposed use. The Commonwealth cannot accept responsibility for the consequences of any use of the report or any part thereof. To the maximum extent allowed under governing law, the Commonwealth will not be liable for any loss or damage that may be occasioned directly or indirectly through the use of, or reliance

3 DATA SOURCES

Threatened ecological communities

For threatened ecological communities where the distribution is well known, maps are generated based on information contained in recovery plans, State vegetation maps and remote sensing imagery and other sources. Where threatened ecological community distributions are less well known, existing vegetation maps and point location data are used to produce indicative distribution maps.

Threatened, migratory and marine species

Threatened, migratory and marine species distributions have been discerned through a variety of methods. Where distributions are well known and if time permits, distributions are inferred from either thematic spatial data (i.e. vegetation, soils, geology, elevation, aspect, terrain, etc.) together with point locations and described habitat; or modelled (MAXENT or BIOCLIM habitat modelling) using

Where little information is available for a species or large number of maps are required in a short time-frame, maps are derived either from 0.04 or 0.02 decimal degree cells; by an automated process using polygon capture techniques (static two kilometre grid cells, alpha-hull and convex hull); or captured manually or by using topographic features (national park boundaries, islands, etc.).

In the early stages of the distribution mapping process (1999-early 2000s) distributions were defined by degree blocks, 100K or 250K map sheets to rapidly create distribution maps. More detailed distribution mapping methods are used to update these distributions

4 LIMITATIONS

The following species and ecological communities have not been mapped and do not appear in this report:

- threatened species listed as extinct or considered vagrants;
- some recently listed species and ecological communities;
- some listed migratory and listed marine species, which are not listed as threatened species; and
- migratory species that are very widespread, vagrant, or only occur in Australia in small numbers.

The following groups have been mapped, but may not cover the complete distribution of the species:

- listed migratory and/or listed marine seabirds, which are not listed as threatened, have only been mapped for recorded
- seals which have only been mapped for breeding sites near the Australian continent

The breeding sites may be important for the protection of the Commonwealth Marine environment.

Refer to the metadata for the feature group (using the Resource Information link) for the currency of the information.

Acknowledgements

This database has been compiled from a range of data sources. The department acknowledges the following custodians who have contributed valuable data and advice:

-Office of Environment and Heritage, New South Wales
-Department of Environment and Primary Industries, Victoria
-Department of Primary Industries, Parks, Water and Environment, Tasmania
-Department of Environment, Water and Natural Resources, South Australia
-Department of Land and Resource Management, Northern Territory
-Department of Environmental and Heritage Protection, Queensland
-Department of Parks and Wildlife, Western Australia
-Environment and Planning Directorate, ACT
-Birdlife Australia
-Australian Bird and Bat Banding Scheme
-Australian National Wildlife Collection
-Natural history museums of Australia
-Museum Victoria
-Australian Museum
-South Australian Museum
-Queensland Museum
-Online Zoological Collections of Australian Museums
-Queensland Herbarium
-National Herbarium of NSW
-Royal Botanic Gardens and National Herbarium of Victoria
-Tasmanian Herbarium
-State Herbarium of South Australia
-Northern Territory Herbarium
-Western Australian Herbarium
-Australian National Herbarium, Canberra
-University of New England
-Ocean Biogeographic Information System
-Australian Government, Department of Defence
Forestry Corporation, NSW
-Geoscience Australia
-CSIRO
-Australian Tropical Herbarium, Cairns
-eBird Australia
-Australian Government – Australian Antarctic Data Centre
-Museum and Art Gallery of the Northern Territory
-Australian Government National Environmental Science Program
-Australian Institute of Marine Science
-Reef Life Survey Australia
-American Museum of Natural History
-Queen Victoria Museum and Art Gallery, Inveresk, Tasmania
-Tasmanian Museum and Art Gallery, Hobart, Tasmania
-Other groups and individuals

The Department is extremely grateful to the many organisations and individuals who provided expert advice and information on numerous draft distributions.

Please feel free to provide feedback via the Contact us page.

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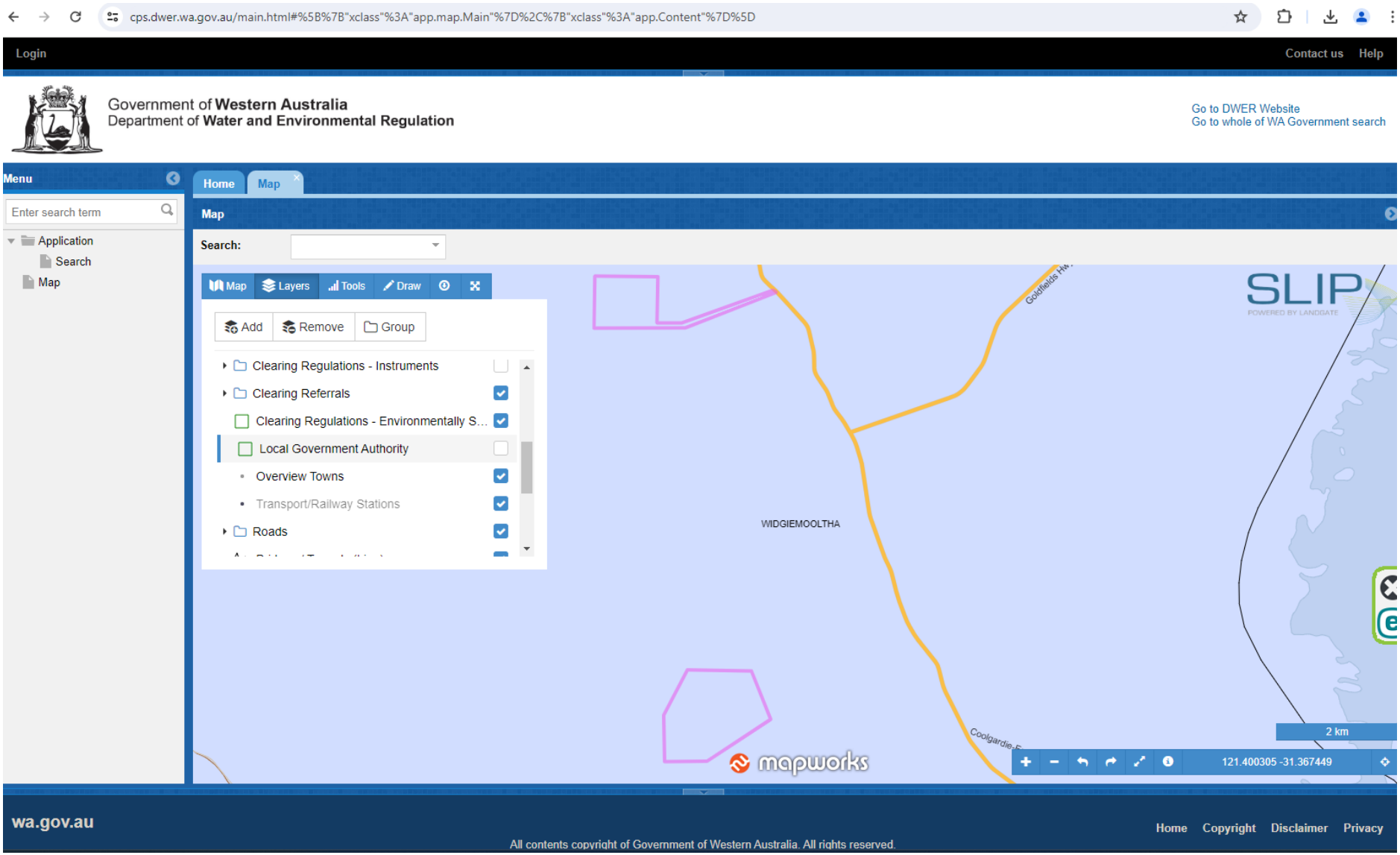
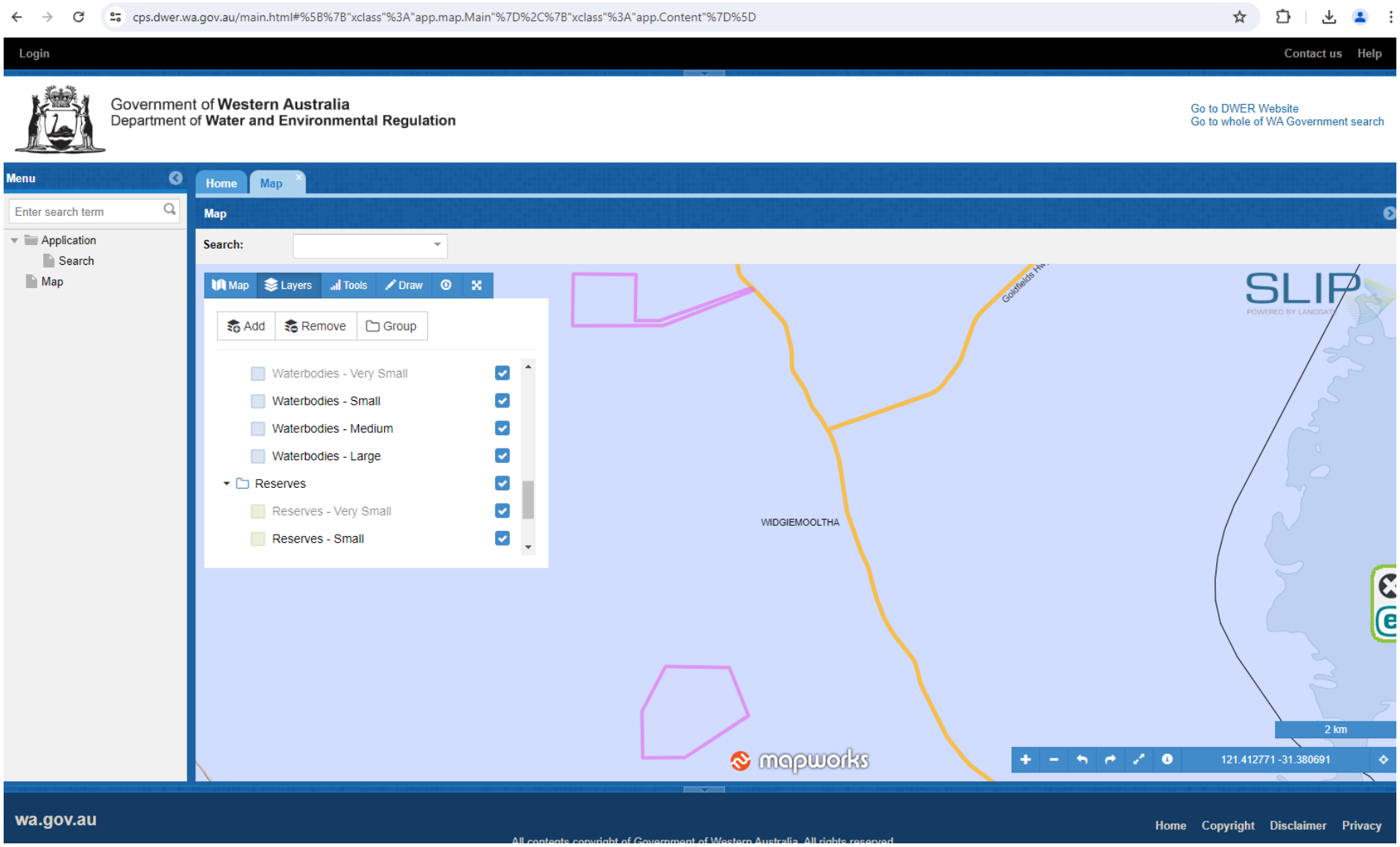


DWER's Clearing Permit System Map Viewer showing no ESA's (dark green shaded areas) within the survey area (DWER, 2024)



DWER Clearing Permit System Map Viewer showing no waterbodies within the survey area (DWER, 2024)

Appendix 2: Threatened Flora Databases Search Results

GIS information provided in the Search results (Reference: 39_0920FL) listed the following species within a 20 km radius of the survey area (DBCA, 2020a):

Taxon	Conservation Code	Comment (Post field work)
Acacia crenulata	P3	Unlikely- Possible habitat, extensively Searched
Acacia kerryana	P2	Unlikely- Possible habitat, extensively Searched
Acacia websteri	P1	Unlikely- Possible habitat, extensively Searched
Allocasuarina eriochlamys subsp. grossa	P3	Unlikely- Possible habitat, extensively Searched
Austrostipa blackii	P3	Unlikely- Possible habitat, extensively Searched
Austrostipa sp. Carlingup Road (S. Kern & R. Jasper LCH 18459)	P1	Unlikely- Possible habitat, extensively Searched
Calandrinia lefroyensis	P1	Unlikely- Possible habitat, extensively Searched
Chrysocephalum apiculatum subsp. norsemanense	P3	Unlikely- Possible habitat, extensively Searched
Cyathostemon divaricatus	P1	Unlikely- Unsuitable habitat
Eremophila acutifolia	P3	Unlikely- Possible habitat, extensively Searched
Eremophila annosicaulis	P3	Unlikely- Unsuitable habitat
Eremophila caerulea subsp. merrallii	P4	Unlikely- Possible habitat, extensively Searched
Eremophila veronica	P3	Unlikely- Possible habitat, extensively Searched
Lepidosperma sp. Parker Range (N. Gibson & M. Lyons 2094)	P1	Unlikely- Unsuitable habitat
Phebalium clavatum	P2	Unlikely- Unsuitable habitat
Philotheca apiculata	P1	Unlikely- Unsuitable habitat
Phlegmatospermum eremaeum	P3	Unlikely- Possible habitat, extensively Searched
Prostanthera splendens	P1	Unlikely- Unsuitable habitat
Pterostylis xerampelina	P1	Unlikely- Unsuitable habitat
Ptilotus rigidus	P1	Unlikely- Unsuitable habitat
Sowerbaea multicaulis	P4	Unlikely- Unsuitable habitat
Stylidium choreanthum	P3	Unlikely- Unsuitable habitat
Styphelia rectiloba	P3	Unlikely- Unsuitable habitat
Tecticornia flabelliformis	P1	Unlikely- Unsuitable habitat
Tecticornia mellarium	P1	Unlikely- Unsuitable habitat
Tetratheca spenceri	T	Unlikely- Unsuitable habitat
Thryptomene planiflora	P1	Unlikely- Unsuitable habitat
Xanthoparmelia xanthomelanoides	P2	Unlikely- Possible habitat, extensively Searched

Appendix 3: Vegetation Definitions

Vegetation Condition Definitions (Keighery, 1994)

Pristine (1). Pristine or nearly so, no obvious signs of disturbance.

Excellent (2). Vegetation structure intact, disturbance affecting individual species and weeds are non-aggressive species.

Very Good (3). Vegetation structure altered, obvious signs of disturbance.
For example, disturbance to vegetation structure caused by repeating fires, the presence of some more aggressive weeds, dieback, logging and grazing.

Good (4). Vegetation structure significantly altered by very obvious signs of multiple disturbance.
Retains basic vegetation structure or ability to regenerate it.
For example, disturbance to vegetation structure caused by frequent fires, the presence of some very aggressive weeds at high density, partial clearing, dieback and grazing.

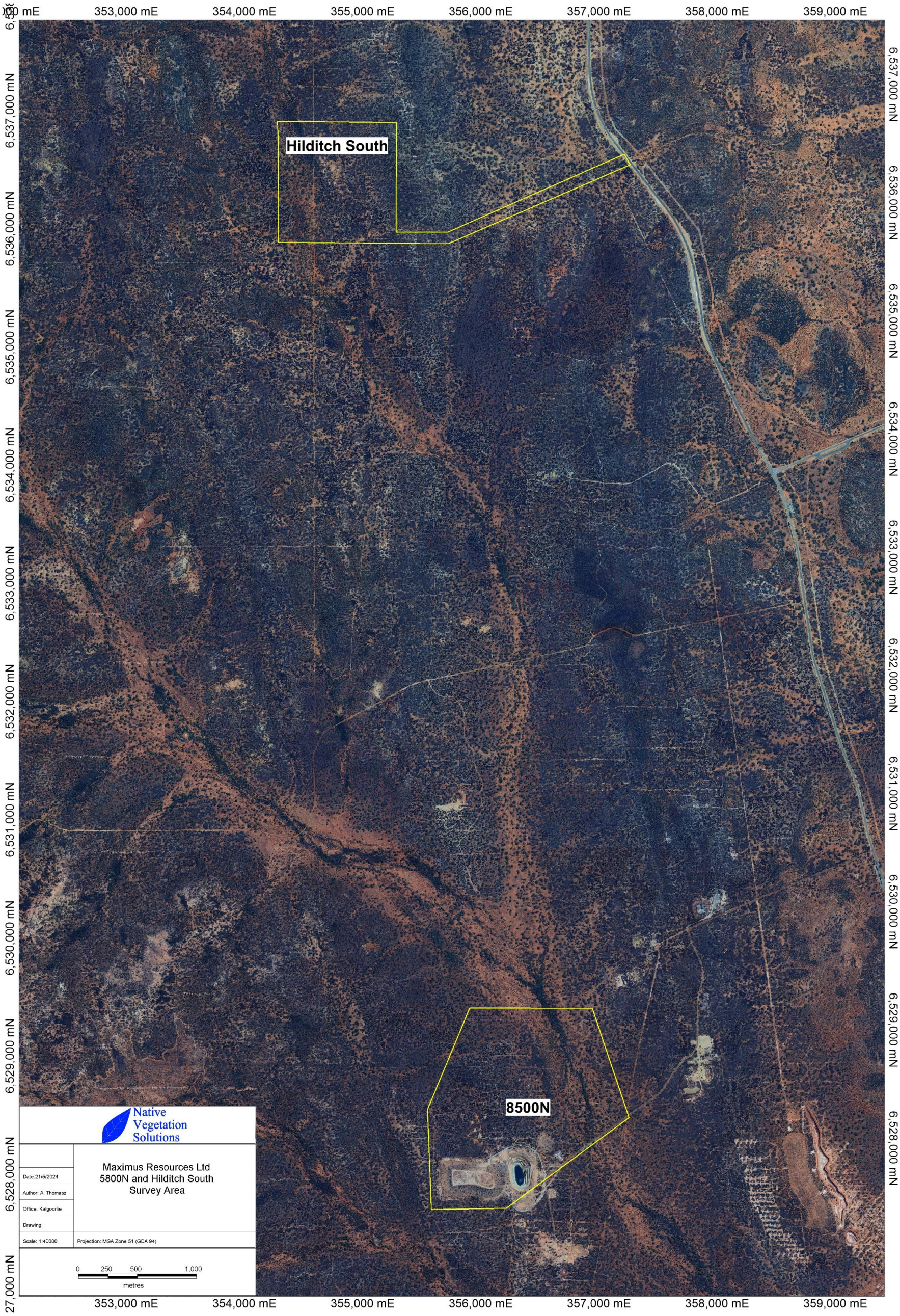
Degraded (5). Basic vegetation structure severely impacted by disturbance.
Scope for regeneration but not to a state approaching good condition without intensive management.
For example, disturbance to vegetation structure caused by very frequent fires, the presence of very aggressive weeds, partial clearing, dieback and grazing.

Completely Degraded (6). The structure of the vegetation is no longer intact and the area is completely or almost completely without native species.
These areas are often described as 'parkland cleared' with the flora compromising weed or crop species with isolated trees or shrubs.

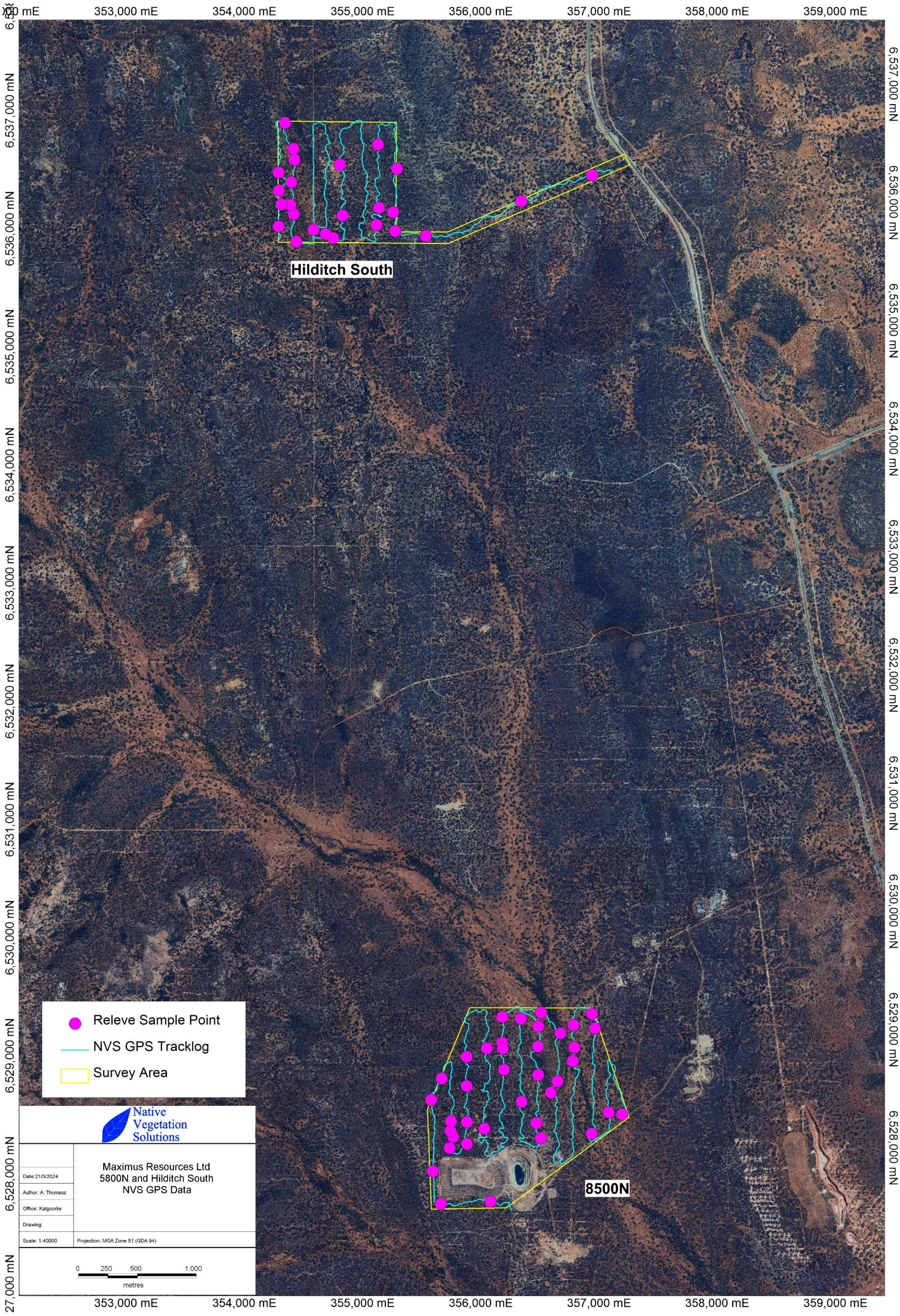
Vegetation Structure Definitions (Muir, 1977)

Life Form/Height Class	Canopy Cover			
	Dense 70-100% d	Mid-Dense 30-70% c	Sparse 10-30% i	Very Sparse 2-10% r
T Trees>30m	Dense Tall Forest	Tall Forest	Tall Woodland	Open Tall Woodland
M Trees 15-30m	Dense Forest	Forest	Woodland	Open Woodlnd
LA Trees 5-15m	Dense Low Forest A	Low Forest A	Low Woodland A	Open Low Woodland A
LB Trees<5m	Dense Low Forest B	Low Forest B	Low Woodland B	Open Low Woodland B
KT Mallee tree form	Dense Tree Mallee	Tree Mallee	Open Tree Mallee	Very Open Tree Mallee
KS Mallee shrub form	Dense Shrub Mallee	Shrub Mallee	Open Shrub Mallee	Very Open Shrub Mallee
S Shrubs>2m	Dense Thicket	Thicket	Scrub	Open Scrub
SA Shrubs 1.5-2.0m	Dense Heath A	Heath A	Low Scrub A	Open Low Scrub A
SB Shrubs 1.0-1.5m	Dense Heath B	Heath B	Low Scrub B	Open Low Scrub B
SC Shrubs 0.5-1.0m	Dense Low Heath C	Low Heath C	Dwarf Scrub C	Open Dwarf Scrub C
SD Shrubs 0.0-0.5m	Dense Low Heath D	Low Heath D	Dwarf Scrub D	Open Dwarf Scrub D
P Mat plants	Dense Mat Plants	Mat Plants	Open Mat Plants	Very Open Mat Plants
H Hummock Grass	Dense Hummock Grass	Mid-Dense Hummock Grass	Hummock Grass	Open Hummock Grass
GT Bunch grass >0.5m	Dense Tall Grass	Tall Grass	Open Tall Grass	Very Open Tall Grass
GL Bunch grass <0.5m	Dense Low Grass	Low Grass	Open Low Grass	Very Open Low Grass
J Herbaceous spp.	Dense Herbs	Herbs	Open Herbs	Very Open Herbs
VT Sedges >0.5m	Dense Tall Sedges	Tall Sedges	Open Tall Sedges	Very Open Tall Sedges
VL Sedges <0.5m	Dense Low Sedges	Low Sedges	Open Low Sedges	Very Open Low Sedges
X Ferns	Dense Ferns	Ferns	Open Ferns	Very Open Ferns
Mosses, liverwort	Dense Mosses	Mosses	Open Mosses	Very Open Mosses

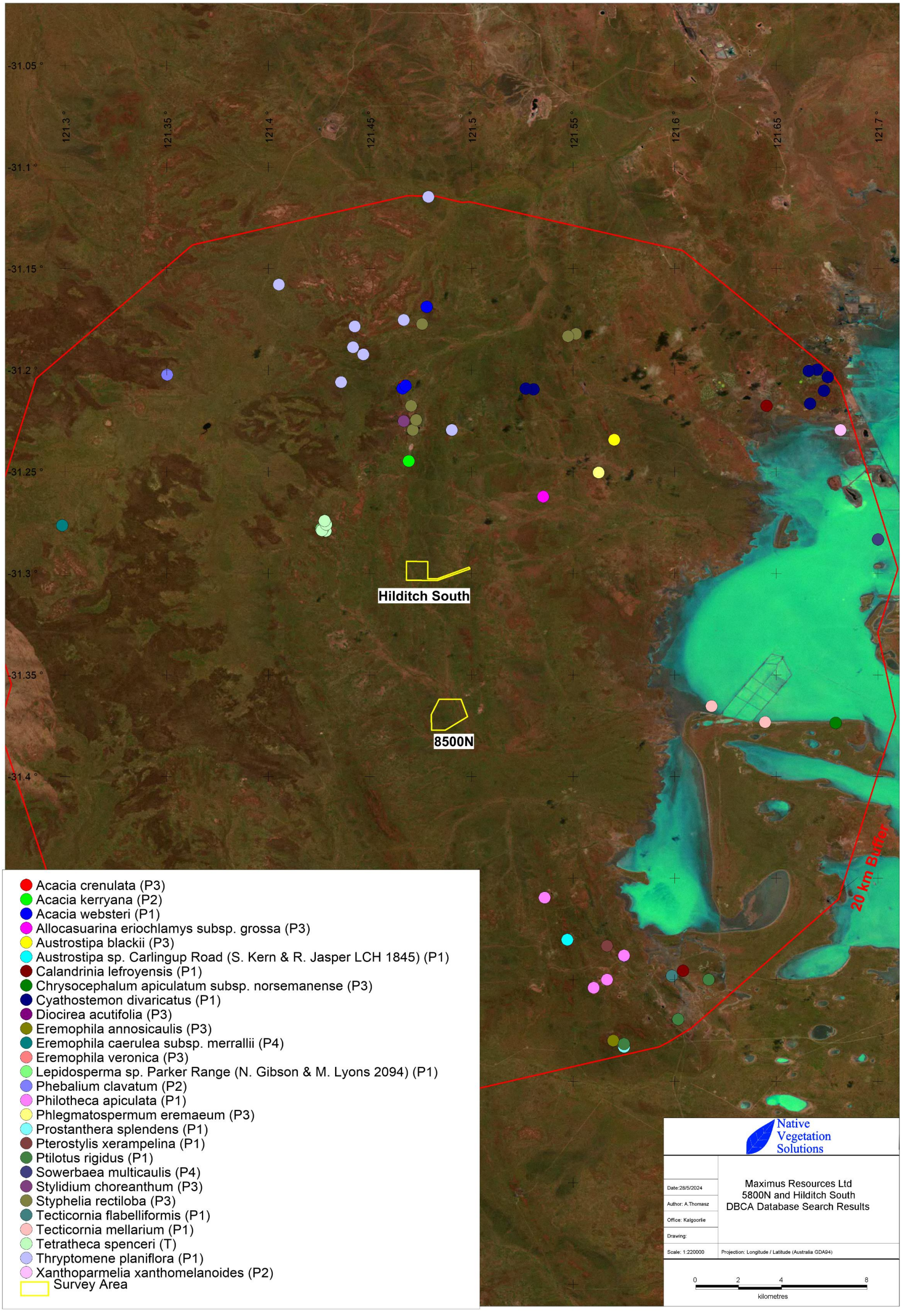
Appendix 4: Vegetation Mapping



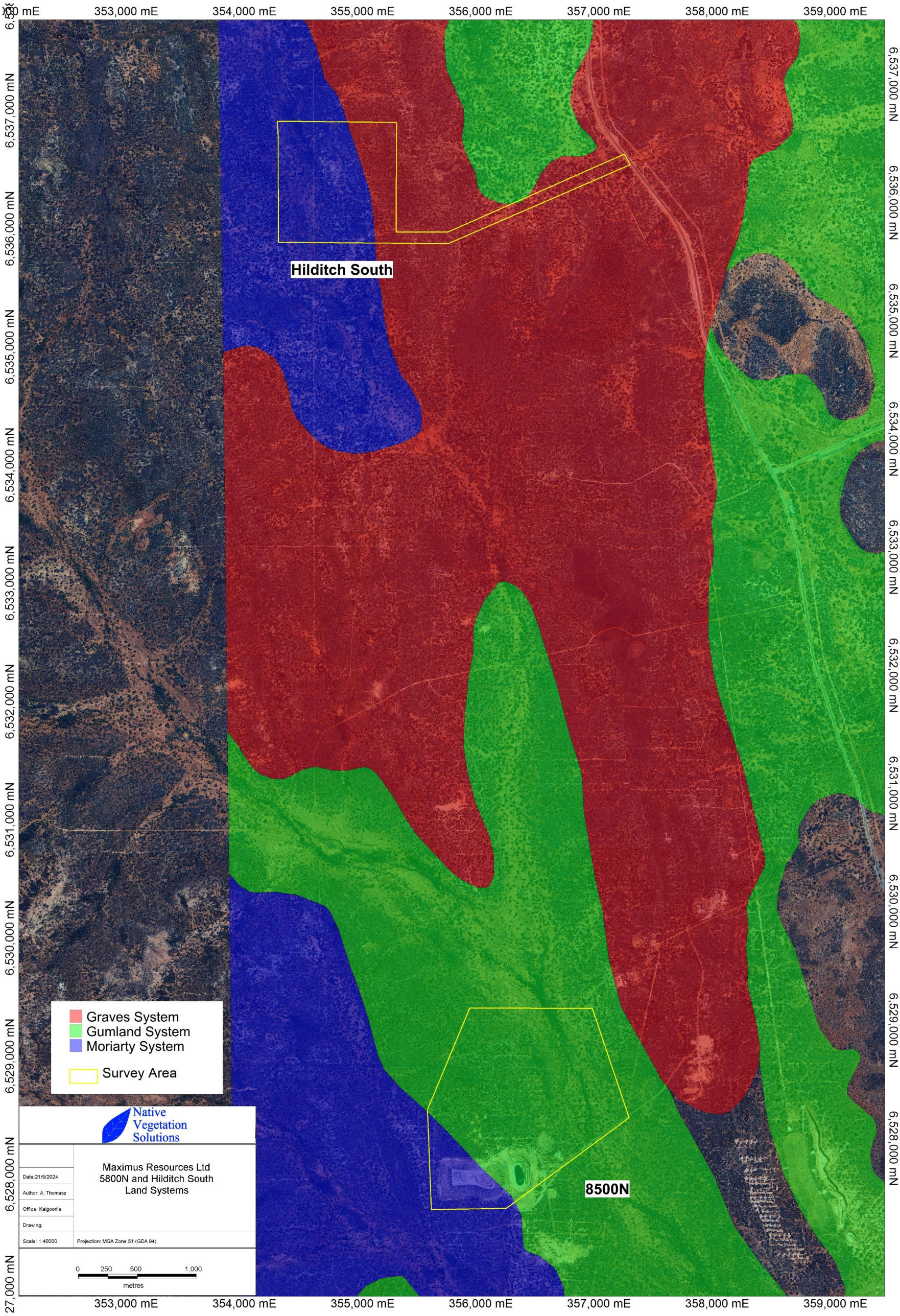
Map 1: Survey Area



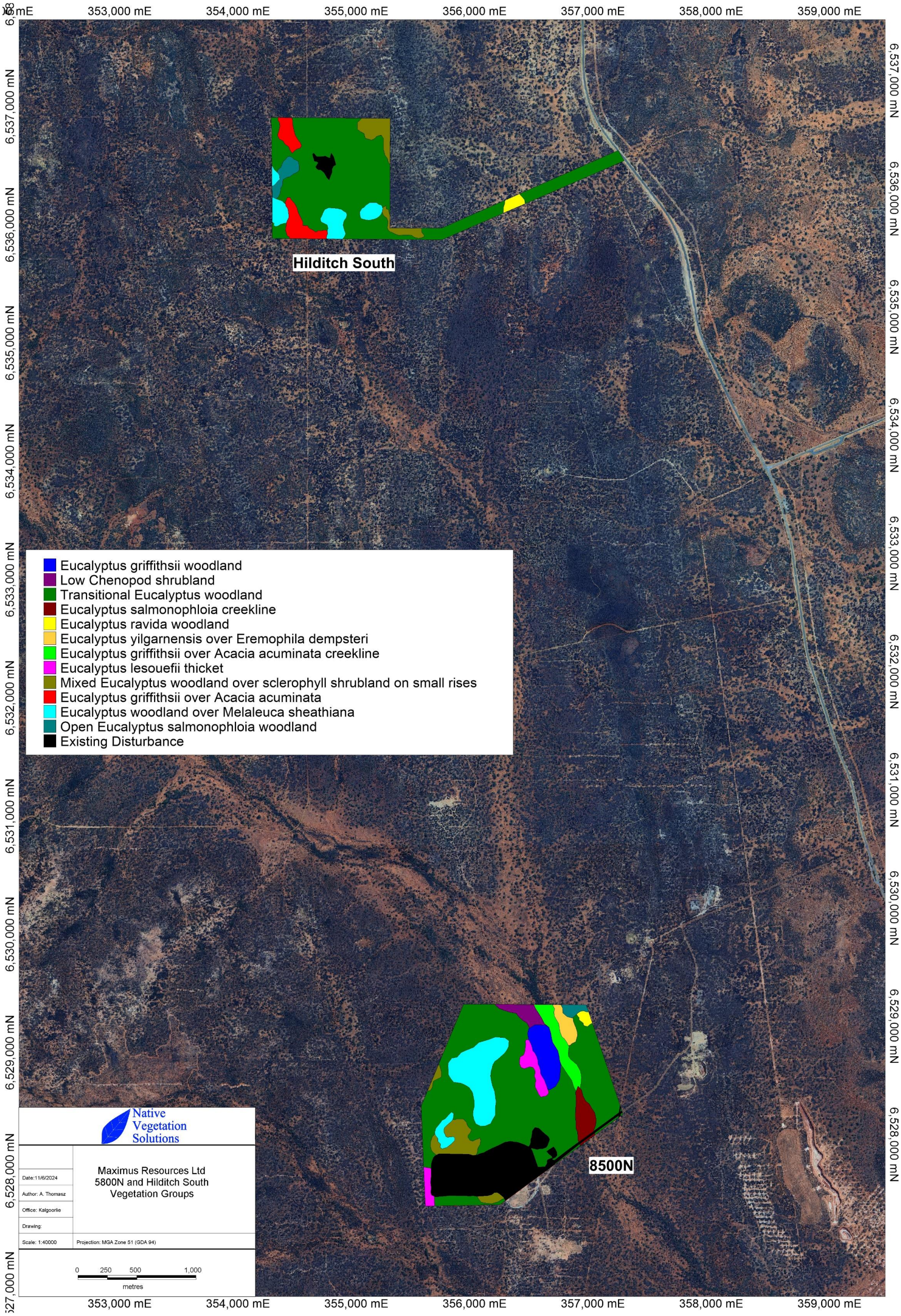
Map 2: NVS GP Data



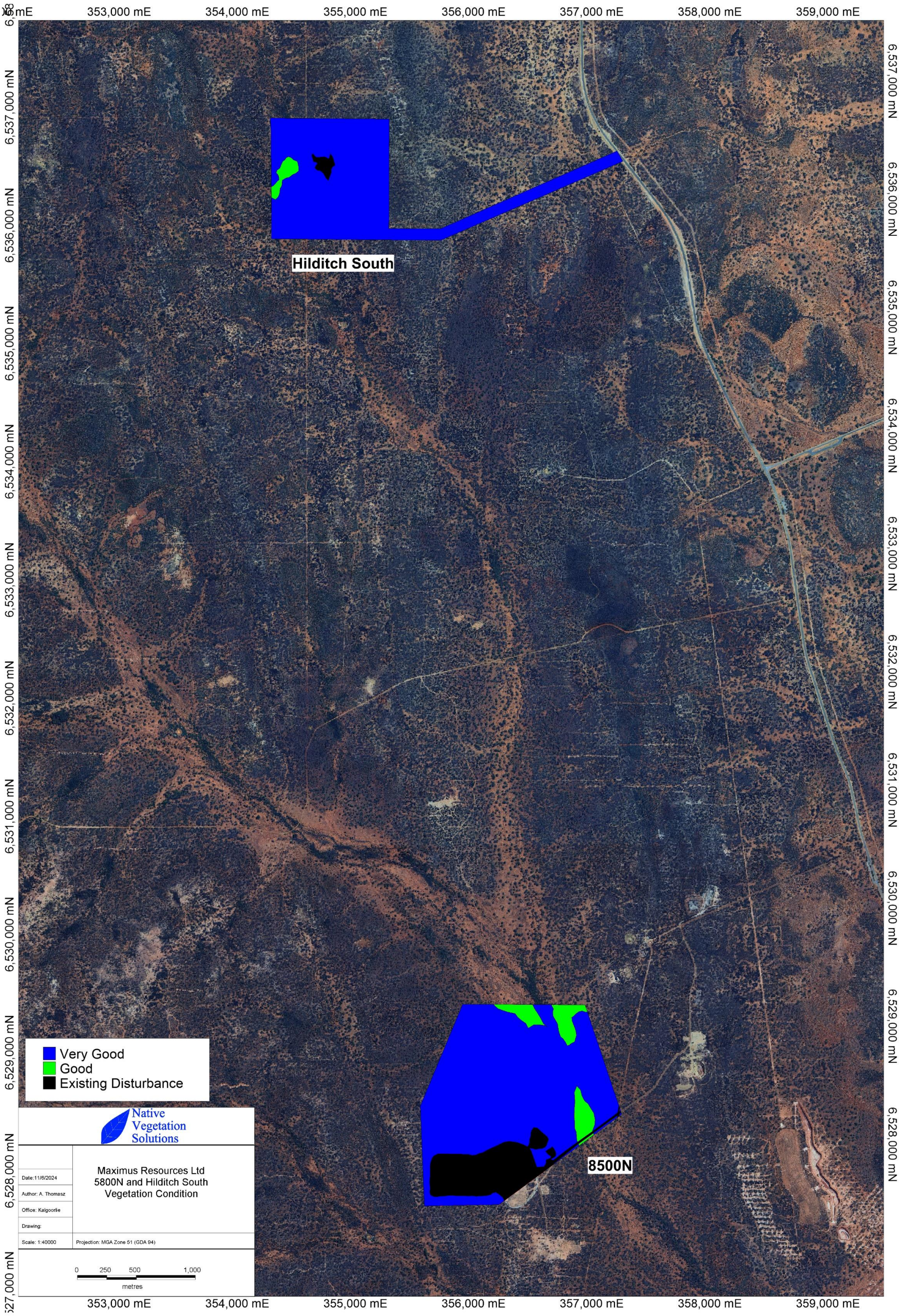
Map 3: DBCA Databases Search Results



Map 4: Land Systems



Map 5: Vegetation Groups



Map 6: Vegetation Condition

Appendix 5: Species List

Species List per Vegetation Group

Family	Genus	Taxon	A	B	C	D	E	F	G	H	I	J	K	L
Amaranthaceae	*Ptilotus*	*Ptilotus exaltatus*			*			*						
Amaranthaceae	*Ptilotus*	*Ptilotus obovatus*	*	*	*	*			*		*	*	*	
Apocynaceae	*Alyxia*	*Alyxia buxifolia*			*						*		*	
Apocynaceae	*Leichhardtia*	*Leichhardtia australis*	*	*	*	*								
Asteraceae	*Centaurea*	*Centaurea melitensis**		*										
Asteraceae	*Cratystylis*	*Cratystylis conocephala*			*		*	*						
Asteraceae	*Cratystylis*	*Cratystylis microphylla*			*									
Asteraceae	*Cratystylis*	*Cratystylis subspinescens*		*										*
Asteraceae	*Olearia*	*Olearia muelleri*			*					*	*		*	
Asteraceae	*Pimelea*	*Pimelea microcephala subsp. microcephala*							*					
Asteraceae	*Rhodanthe*	*Rhodanthe charsleyae*		*										
Asteraceae	*Sonchus*	*Sonchus oleraceus**		*										
Asteraceae	*Vittadinia*	*Vittadinia sulcata*		*				*	*			*		
Boraginaceae	*Halgania*	*Halgania andromedifolia*			*									
Brassicaceae	*Carrichtera*	*Carrichtera annua**		*	*	*		*	*			*		
Chenopodiaceae	*Atriplex*	*Atriplex nummularia subsp. spathulata*	*	*	*	*					*			*
Chenopodiaceae	*Atriplex*	*Atriplex stipitata*	*					*		*				
Chenopodiaceae	*Atriplex*	*Atriplex vesicaria*	*		*		*	*						*
Chenopodiaceae	*Chenopodium*	*Chenopodium gaudichaudianum*		*										
Chenopodiaceae	*Enchylaena*	*Enchylaena tomentosa var. tomentosa*	*	*	*	*	*	*					*	
Chenopodiaceae	*Maireana*	*Maireana brevifolia*				*								
Chenopodiaceae	*Maireana*	*Maireana georgei*						*					*	
Chenopodiaceae	*Maireana*	*Maireana pentatropis*			*									
Chenopodiaceae	*Maireana*	*Maireana pyramidata*	*	*	*	*		*						
Chenopodiaceae	*Maireana*	*Maireana sedifolia*			*	*	*	*						
Chenopodiaceae	*Maireana*	*Maireana thesioides*				*								
Chenopodiaceae	*Maireana*	*Maireana tomentosa*			*			*						
Chenopodiaceae	*Maireana*	*Maireana triptera*	*	*	*		*	*					*	*
Chenopodiaceae	*Rhagodia*	*Rhagodia drummondii*			*	*	*		*			*	*	
Chenopodiaceae	*Rhagodia*	*Rhagodia eremaea*			*				*			*		
Chenopodiaceae	*Sclerolaena*	*Sclerolaena densiflora*			*									
Chenopodiaceae	*Sclerolaena*	*Sclerolaena diacantha*			*	*			*			*	*	
Chenopodiaceae	*Sclerolaena*	*Sclerolaena eriacantha*			*									
Fabaceae	*Acacia*	*Acacia acuminata*	*		*	*					*	*		
Fabaceae	*Acacia*	*Acacia colletioides*									*			
Fabaceae	*Acacia*	*Acacia erinacea*			*						*		*	
Fabaceae	*Acacia*	*Acacia hemiteles*	*		*	*			*	*	*	*	*	*
Fabaceae	*Acacia*	*Acacia merrallii*									*			
Fabaceae	*Acacia*	*Acacia rendlei*			*						*			
Fabaceae	*Daviesia*	*Daviesia aphylla*	*		*		*			*				
Fabaceae	*Senna*	*Senna artemisioides subsp. artemisioides*				*			*			*		
Fabaceae	*Senna*	*Senna artemisioides subsp. filifolia*	*	*	*	*			*	*	*	*	*	
Fabaceae	*Senna*	*Senna cardiosperma*				*								
Frankeniaceae	*Frankenia*	*Frankenia interioris*												*
Frankeniaceae	*Frankenia*	*Frankenia setosa*			*		*	*						
Geraniaceae	*Erodium*	*Erodium crinitum*		*										
Goodeniaceae	*Goodenia*	*Goodenia ?havilandii*		*					*					
Goodeniaceae	*Goodenia*	*Goodenia ?mimuloides*		*										
Goodeniaceae	*Scaevola*	*Scaevola spinescens*			*	*	*				*		*	*
Haloragaceae	*Haloragis*	*Haloragis trigonocarpa*		*										
Hemerocallidaceae	*Dianella*	*Dianella revoluta var. divaricata*										*		
Lamiaceae	*Prostanthera*	*Prostanthera grylloana*										*		
Lamiaceae	*Salvia*	*Salvia verbenaca**		*										
Lamiaceae	*Westringia*	*Westringia rigida*			*						*			
Malvaceae	*Abutilon*	*Abutilon cryptopetalum*				*			*			*		
Malvaceae	*Abutilon*	*Abutilon otocarpum*							*			*		
Malvaceae	*Sida*	*Sida sp. Excedentifolia*				*								
Marsileaceae	*Marsilea*	*Marsilea drummondii*							*			*		
Myrtaceae	*Eucalyptus*	*Eucalyptus flocktoniae subsp. flocktoniae*											*	
Myrtaceae	*Eucalyptus*	*Eucalyptus griffithsii*	*						*			*		
Myrtaceae	*Eucalyptus*	*Eucalyptus lesouefii*			*					*	*			
Myrtaceae	*Eucalyptus*	*Eucalyptus oleosa subsp. oleosa*	*		*								*	
Myrtaceae	*Eucalyptus*	*Eucalyptus ravida*					*							
Myrtaceae	*Eucalyptus*	*Eucalyptus salmonophloia*			*	*			*					*
Myrtaceae	*Eucalyptus*	*Eucalyptus stricklandii*									*			
Myrtaceae	*Eucalyptus*	*Eucalyptus torquata*									*			
Myrtaceae	*Eucalyptus*	*Eucalyptus transcontinentalis*			*						*		*	
Myrtaceae	*Eucalyptus*	*Eucalyptus yilgarnensis*		*	*	*		*		*				

Family	*Genus*	*Taxon*	A	B	C	D	E	F	G	H	I	J	K	L
Myrtaceae	*Melaleuca*	*Melaleuca lateriflora*									*			
Myrtaceae	*Melaleuca*	*Melaleuca sheathiana*			*						*		*	
Poaceae	*Austrostipa*	*Austrostipa elegantissima*		*	*					*	*	*		
Poaceae	*Monachather*	*Monachather paradoxus*		*	*	*			*			*		
Primulaceae	*Lysimachia*	*Lysimachia arvensis**		*					*			*		
Proteaceae	*Grevillea*	*Grevillea acuaria*			*						*			
Proteaceae	*Grevillea*	*Grevillea nematophylla subsp. nematophylla*									*			
Rhamnaceae	*Cryptandra*	*Cryptandra aridicola*									*			
Rhamnaceae	*Trymalium*	*Trymalium myrtillus subsp. myrtillus*									*			
Santalaceae	*Exocarpos*	*Exocarpos aphyllus*	*		*	*	*	*	*	*	*	*	*	*
Santalaceae	*Santalum*	*Santalum acuminatum*			*				*		*	*		*
Santalaceae	*Santalum*	*Santalum spicatum*				*			*		*	*		
Sapindaceae	*Dodonaea*	*Dodonaea lobulata*			*						*	*		
Sapindaceae	*Dodonaea*	*Dodonaea microzyga subsp. acrolobata*										*		
Sapindaceae	*Dodonaea*	*Dodonaea stenozyga*									*			
Scrophulariaceae	*Eremophila*	*Eremophila alternifolia*	*			*								
Scrophulariaceae	*Eremophila*	*Eremophila caerulea subsp. caerulea*			*						*		*	
Scrophulariaceae	*Eremophila*	*Eremophila caperata*	*		*					*				
Scrophulariaceae	*Eremophila*	*Eremophila decipiens subsp. decipiens*	*	*	*	*		*	*	*		*		
Scrophulariaceae	*Eremophila*	*Eremophila dempsteri*			*		*	*	*			*		*
Scrophulariaceae	*Eremophila*	*Eremophila glabra subsp. glabra*							*			*		
Scrophulariaceae	*Eremophila*	*Eremophila interstans subsp. virgata*			*	*	*							*
Scrophulariaceae	*Eremophila*	*Eremophila ionantha*	*		*	*	*		*	*	*	*		
Scrophulariaceae	*Eremophila*	*Eremophila maculata subsp. brevifolia*			*	*			*			*		*
Scrophulariaceae	*Eremophila*	*Eremophila oldfieldii subsp. angustifolia*	*	*	*						*			
Scrophulariaceae	*Eremophila*	*Eremophila oppositifolia subsp. angustifolia*									*		*	
Scrophulariaceae	*Eremophila*	*Eremophila psilocalyx*									*			
Scrophulariaceae	*Eremophila*	*Eremophila scoparia*	*	*	*	*	*	*	*	*		*		*
Scrophulariaceae	*Eremophila*	*Eremophila sp. Mt Jackson*				*			*			*		
Solanaceae	*Solanum*	*Solanum lasiophyllum*							*					
Solanaceae	*Solanum*	*Solanum nummularium*											*	

Appendix 4: Hilditch Fauna Report (Terrestrial Ecosystems (2024a)

Basic Vertebrate Fauna Survey and Risk Assessment

Hillditch and 8500 Project Areas

Prepared for: Maximus Resources

Version 1. June, 2024

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EXECUTIVE SUMMARY

Maximus Resources proposes to establish a new operation focussed on two areas: Hillditch (~122ha) and 8500 (~220ha) which are ~20km south-west of Kambalda on the western side of the Coolgardie – Esperance Highway and 10km west of Lake Lefroy.

Terrestrial Ecosystems undertook a Basic vertebrate fauna survey and risk assessment of both project areas in April 2024. The methodology broadly followed the Environmental Protection Authority's (2020) *Technical Guidance Terrestrial Vertebrate Fauna Surveys for Environmental Impact Assessment* and included desktop searches and site assessment.

There are four broad fauna habitats: chenopod shrubland; closed Eucalypt woodland and Acacia shrubland; Eucalypt and tall Melaleuca woodland; and Eucalypt woodland over mixed shrubs as well as disturbed areas (e.g. tracks).

The site investigation recorded no evidence (e.g. mounds or tracks) of Malleefowl (listed as Vulnerable) in the area. There is a possibility that the Peregrine Falcon (listed as other specially protected fauna), the mallee form of the Western Rosella (Listed as Priority 4) and the Central Long-eared Bat (Listed as Priority 4) may infrequently be seen in the project area, but vegetation clearing and mining activities are unlikely to significantly impact on these species as they will readily move once vegetation clearing commences.

Clearing native vegetation in the project area is likely to result in the loss of small vertebrate fauna on-site that are unable to move away during the clearing process, however, this loss is not likely to be significant when viewed in a bioregional context. The few larger animals, such as kangaroos, large goannas and snakes, and most of the birds will move into adjacent areas once vegetation clearing commences, so potential impacts will be low. There may be an on-going loss of small native fauna to vehicle strikes on access tracks, but overall, this impact will be very low. Forced fauna migrants because of vegetation clearing increase competition for resources, which may result in the subsequent loss of migrants or local individuals. Individuals shifted out of their established activity areas are also vulnerable to predation until they have become established in their new areas.

Impacts on vertebrate fauna associated with clearing vegetation in the project area in a landscape or bioregional context are likely to be low as there are vast tracts of similar fauna habitat in adjacent areas. Feral predators, such as cats, are likely in a landscape context to have a much larger impact on the vertebrate fauna than clearing the vegetation and developing and operating a mine in this location.

Based on the available information, no *EPBC Act* listed species are likely to be significantly impacted by the proposed vegetation clearing and development in the project area; a referral is therefore not recommended.

Implementing the following recommendations will minimise and mitigate potential impacts of vegetation clearing and mining operations:

- an induction program that includes a component on managing fauna is mandatory for staff working in the project area;
- information on protecting fauna and reporting deaths and sightings of Malleefowl and other conservation significant species should be incorporated into the mine induction program;
- the impact of dust on adjacent vegetation and fauna habitat is managed against appropriate KPIs and in accordance with the clients' Construction Environmental Management Plan;
- all areas disturbed during mining are rehabilitated as soon as practical after they are no longer required;
- where possible, access routes are aligned to existing roads, tracks and other barriers or follow the boundaries of broad-scale vegetation associations in the area;
- pets are not permitted on the project;

- all waste and rubbish be contained in bins and regularly removed from the project or placed in land fill and suitably covered to exclude access to predator species;
- feeding of native fauna is prohibited;
- a feral cat control program is implemented in the project area and surrounds;
- a log of all on-site drill holes be maintained detailing when they were capped, how and by whom;
- a vertebrate fauna management plan is prepared and implemented for the life of the project; and
- where it is practical, mature Eucalypt trees with hollows should be avoided in the mine development program.

1. INTRODUCTION

1.1 BACKGROUND

Maximus Resources proposes to establish a new operation focussed on the two areas: Hillditch (~122ha) and 8500 (~220ha) which are ~20km south-west of Kambalda on the west side of the Coolgardie – Esperance Highway and 10km west of Lake Lefroy (Figure 1).

1.2 PROJECT OBJECTIVES AND SCOPE OF WORKS

Terrestrial Ecosystems was commissioned by Maximus Resources to undertake a Basic vertebrate fauna survey and risk assessment of the proposed Hillditch and 8500 project areas. The purpose of a Basic and targeted vertebrate fauna survey and assessment is to provide information to the proponent on the potential impacts on the vertebrate fauna assemblage in the project area to enable the proposed development to be adequately assessed. The methodology broadly follows that described in the Environmental Protection Authority (2020) *Technical Guidance Terrestrial Vertebrate Fauna Surveys for Environmental Impact Assessment*.

This Basic vertebrate fauna survey involved a desktop review and an on-site assessment with the objectives to:

- provide an indication of the vertebrate fauna assemblage (reptiles, amphibians, mammals and birds) on and near the project area, so that potential impacts on the fauna and fauna assemblage might be adequately assessed;
- identify the presence and/or potential risk of impacts on species of conservation significance that are present or likely to be present in the project area;
- assess the impact and environmental risks associated with the proposed development on the vertebrate fauna assemblage;
- determine if any additional surveys are required to assess the potential impact on vertebrate fauna assemblage in the project area including impacts on species of conservation significance; and
- make recommendations that avoid, mitigate or minimise potential impacts on resident fauna.

To achieve these objectives, Terrestrial Ecosystems:

- reviewed Terrestrial Ecosystems' database [includes Atlas of Living Australia and WA Museum records] to identify potential vertebrate fauna within the area;
- searched the DBCA's online database for Threatened and Priority Species;
- searched the Commonwealth Governments database of fauna of national environmental significance to identify species potentially occurring within the area that are protected under the *Environment Protection and Biodiversity Conservation Act 1999* (*EPBC Act 1999*) or international migratory bird agreements (JAMBA/CAMBA);
- reviewed previous fauna surveys conducted near the project area and in similar habitat;
- undertook a site visit to assess fauna habitat types and quality;
- searched the available habitat for Malleefowl (mounds, tracks and scats);
- undertook an assessment of the potential risks to the fauna associated with clearing additional areas of native vegetation;
- discussed the likelihood of *EPBC Act 1999* and *Biodiversity Conservation Act 2016* (*BC Act 2016*) listed species being present in the project area; and
- provided management recommendations to avoid, mitigate and minimise potential impacts on the fauna in the project area.

2. EXISTING ENVIRONMENT

2.1 LOCATION OF PROJECT AREA

The Hillditch and 8500 project areas are within the Coolgardie (COO3-Eastern Goldfields) Interim Biogeographic Regionalisation of Australia (IBRA) subregion. This subregion is a gently undulating plain on the Yilgarn Craton with calcareous soil being dominant (Cowan 2002). The subregion supports a diverse eucalypt woodland around the salt lakes, on the low ranges and in the broad valleys and mallee and Acacia thickets and shrub heaths on the plains (Cowan 2002). The sub-region is rich in endemic Acacias (Cowan 2002).

2.2 LAND USE HISTORY

The dominant land uses in this bioregion are pastoralism, crown reserves and mining. Mining and exploration are evident in many areas around Kalgoorlie, Kambalda, Widgiemooltha, Higginsville and Lake Lefroy, with numerous small abandoned and operational mines scattered throughout the landscape (Cowan 2002).

Many of the larger trees in the bioregion were removed decades ago to support the mining and power generation industries and these trees have often not been replaced by replanting programs.

2.3 CLIMATE

The project area is characterised as semi-arid. Chart 1 shows the average mean monthly maximum and minimum temperatures and rainfall for Coolgardie, the closest weather station (~60km north). Temperatures are highest in December–February and most rain comes in winter, with additional rain from summer thunderstorms. Winter rain is the result of low-pressure cells that move in an easterly direction from the south-west of the state, whereas summer rain is often from thunderstorms that move in from either the west or the north-west.

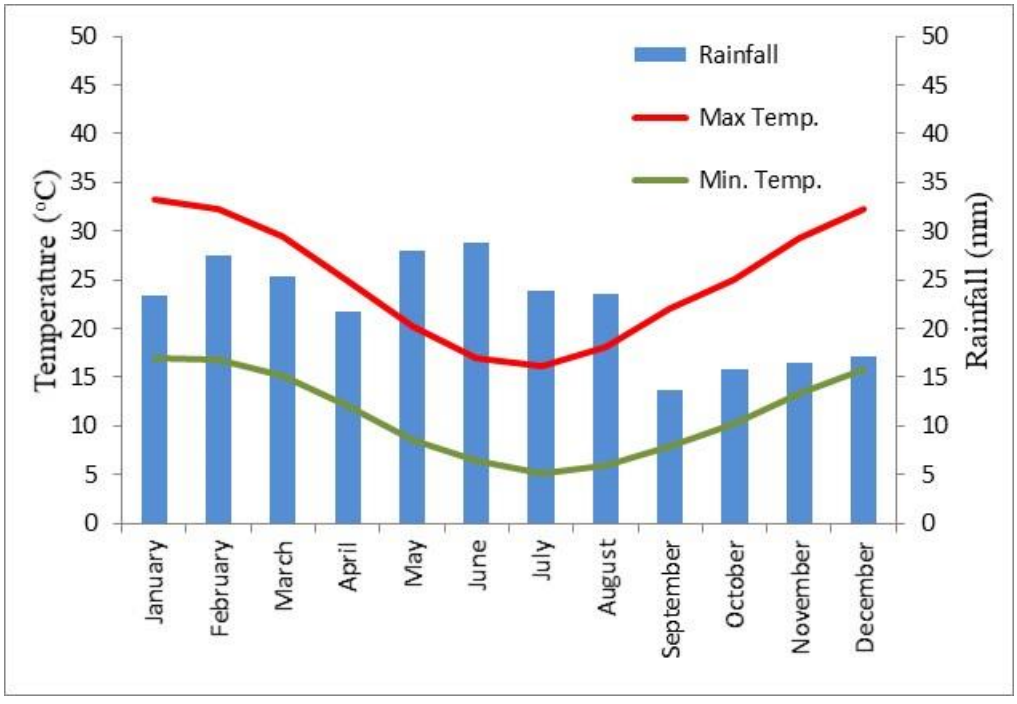

Chart 1. Climatic averages for Coolgardie

2.4 REGIONAL BIOLOGICAL FAUNA CONTEXT OF PROJECT AREA

The frogs, reptiles, mammals and birds in the vicinity of the project area have been surveyed for other environmental assessments and research purposes and are therefore known. Fauna surveys and assessments undertaken near the project area or in similar habitats that have been reviewed for this assessment include:

- ATA Environmental (2006a) *Fauna Assessment St Ives Cave Rocks Satellite Pit, Waste Dump and Haul Road*. Unpublished report for Jim's Seeds, Weeds and Trees, Ltd, Perth.
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- Harewood, G. (2010c) *Terrestrial Fauna Survey (Level 1) of the proposed Pistol Club Mine Area – Kambalda*. Unpublished report for Botanica Consulting. Bunbury.
- Harewood, G. (2010d) *Terrestrial Fauna Survey (Level 1) of the proposed West Idough Mine Area St Ives – Kambalda.* Unpublished report for Botanica Consulting. Bunbury.
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- Western Wildlife (2006) *St Ives Gold Fauna Survey; Spring 2005*. Unpublished report for Jim's Seeds, Weeds and Trees, Perth.
- Western Wildlife (2013) *Mt Henry Study Area Baseline Fauna Survey: Level 2 Fauna Survey 2012 & 2013 – Final Report*. Unpublished report for Panoramic Resources Limited, Perth.

The most relevant fauna survey data comes from the Western Australian Museum (WAM)/Department of Environment and Conservation's (DEC) eastern Goldfields survey of the Widgiemooltha-Zanthus survey area, and reports provided ATA Environmental (2006b), Bamford Consulting Ecologists (2010), Dames and Moore (1999), Keith Lindbeck and Associates (2007), Ninox Wildlife Consulting (2004b) and Western Wildlife (2006, 2013). The McKenzie *et al*. (1992) report is part of the WAM/DEC's Eastern Goldfields survey undertaken in the mid 1980's and the Chapman et al. (1991) report is the results of fauna surveys of four timber reserves that are all nearby. All the GHD reports (2010b, a, 2014, 2015b, a) and Terrestrial Ecosystems reports (2015a, d, b, c, 2017b, c, a, 2018b, 2021b, a, 2023, 2024) are desktop assessments of the vertebrate fauna. In addition, Terrestrial Ecosystems has included in the Thompson (2004) fauna survey data, data collected after Thompson's (2004) PhD was completed. Much of this work has been published or been presented at various workshops and conferences (Thompson 2001, Thompson and Thompson 2002, Thompson 2002, Thompson et al. 2003a, Thompson et al. 2003b, Thompson et al. 2003c, Thompson and Thompson 2003a, Thompson 2003c, a, b, Thompson and Thompson 2003b, Thompson and Thompson 2004a, Thompson 2004, Thompson and Thompson 2004b, Thompson and Thompson 2005a, Thompson and Thompson 2005c, b, Thompson et al. 2005a, b, Thompson and Thompson 2006a, Thompson and Thompson 2006b, Thompson and Thompson 2006d, c, Thompson and Thompson 2007a, b, Thompson and Thompson 2008).

Data in the Atlas of Living Australia and Western Australian Museum records has also been added to the information contained in Appendix B, and the compilation of the species lists for the project area.

The trapping effort employed during many of these surveys is now considered inadequate to assess species richness or assemblage structure (Thompson and Thompson 2023), however, they provide useful contextual information concerning the project area and compiling a species list.

These fauna surveys, when considered together, provide a near complete list of the vertebrate species likely to be found in the project area. The composition of vertebrate fauna assemblages varies from habitat-to-habitat and site-to-site within the bioregion, but the survey data contained in the appendices provides a good indication of the vertebrate fauna assemblage that is likely to be found in the area. These data also provide a good regional context and indicate the extent of fauna assemblage variation that might be anticipated from site-to-site and temporally.

2.5 GREAT WESTERN WOODLANDS

The Hillditch and 8500 project areas are situated within the Great Western Woodlands (Watson et al. 2008, pp. vi). The Great Western Woodlands represents the largest and most intact eucalypt woodland remaining in southern Australia and one of the best examples of its type in the world. It is home to an impressive 3,000 flowering plant species, 20 per cent of Australia's known flora, as well as a diverse range of animals dependent on its varied habitats (Department of Environment and Conservation 2010).

The Wilderness Society (Watson et al. 2008) argued the fauna and flora diversity in the area has evolved with the landscape during an unbroken biological lineage stretching back 250 million years. Although the woodlands are not recorded as a conservation significant area or habitat, its value is in its vastness and it being

relatively undisturbed when considered in a landscape context. The conservation strategy (Department of Environment and Conservation 2010) for the woodland as it relates to prospecting, exploration and mining is that there should be an improvement in native vegetation condition and connectedness and no net-loss of native vegetation. There are also expectations that the exploration and mining process contribute to the control and management of feral and pest animals and weeds and that the WA community benefits from compatible land uses which make a positive contribution to the conservation of the area's natural values. Mine development and management are expected to be sympathetic to these strategies and where practical address and incorporate them into its planning and operations.

2.6 FAUNA SPECIES AT RISK

Cowan (2002) reported the fauna species at risk in the Eastern Goldfields subregion as Malleefowl (*Leipoa ocellata*), Carpet Python (*Morelia imbricata*), Peregrine Falcon (*Falco peregrinus*) Chuditch (*Dasyurus geoffroii*) and Freckled Duck (*Stictonetta naevosa*). This report assesses the potential for these species to be found in the project area and the potential impact that exploration or mining development might have on these species, and other conservation significant fauna. Since 2002, the Night Parrot (*Pezoporus occidentalis*) has been rediscovered in Western Australia and is also considered a species at risk in the region, along with the Southern Whiteface (*Aphelocephala leucopsis*) that is now listed as Vulnerable.

3. METHODOLOGY

3.1 DATABASE SEARCHES

A review of the *EPBC Act 1999* list of protected species was undertaken to identify species of conservation interest to the Commonwealth Government using a search buffer of 50km around the project area (Appendix A). In addition, a desktop search of Terrestrial Ecosystems' fauna survey database was used to develop an appreciation of the vertebrate fauna assemblages in relevant sections of the bioregion near the project area. The DBCA threatened and priority species database was searched via the records in Dandjoo and other online resources.

Other more general texts were also used to provide supplementary information on vertebrates in the bioregion, including Tyler et al. (2000) for frogs; Storr et al. (1983, 1990, 1999, 2002) and Thompson and Thompson (2006d) for reptiles; Johnstone and Storr (1998, 2004) for birds; and Van Dyck and Strahan (2008) for mammals.

Collectively these sources of information were used to create lists of species expected to utilise the project area and broader bioregion. It should be noted that these lists will include species that have been recorded in the general region but are possibly vagrants and they will not generally be found in the project area due to a lack of suitable habitat (e.g. wetland and shore birds). Vagrants can be recorded almost anywhere. Many of the records are historical and the species is no longer present in the area (e.g. Malleefowl). Many of the bird, mammal, reptile and amphibian species have specific habitat requirements that may be present in the general area but not in the project area. Also, the ecology of many of these species is often not well understood and it can sometimes be difficult to indicate those species whose specific habitat requirements are not present in the project area. Therefore, many species will be included in the lists produced from database searches but will not be present in the actual project area.

There are errors in most databases, including Atlas of Living Australia. These errors occur because of a misidentification of individuals, taxonomic name changes and incorrect coordinates being entered into the database. Terrestrial Ecosystems was unable to verify the primary records, so it has used the information provided. Obvious errors have been removed but readers should appreciate that species lists, and fauna surveys reported in the appendices may include these errors.

3.2 SITE INSPECTION AND FAUNA HABITAT ASSESSMENT

A site visit was undertaken on 3 April 2024 to assess fauna habitat types and condition in the project area. This information included a description of the habitat structure, habitat condition, landform, soils and vegetation and time since last fire. The fauna habitat assessment had two foci:

- assessing fauna habitat types and their condition; and
- assessing the possible presence of and recording evidence of conservation significant fauna.

Tom Ramond, who undertook the site assessment, stopped at multiple locations within the project area and recorded a suite of data about the fauna habitat and its condition. This information included a description of the habitat structure, habitat condition, landform, soils and vegetation and time since last fire. Table 1 indicates the variables recorded at each location.

Table 1. Fauna habitat assessment variables

Observer's Name:			
Coordinates of the location as UTM (GDA94):			
Fire history – options			
☐	> 5 years		
☐	1-5 years		
☐	< 1 year		
Landform – options			
☐	Beach	☐	Lower slope
☐	Clay plain	☐	Mid slope
☐	Cliff	☐	Ridge
☐	Creek line	☐	River
☐	Dam	☐	Rocky outcrop / breakaway
☐	Drainage line	☐	Salt lake
☐	Dune crest	☐	Sand dune
☐	Dune slope	☐	Sand plain
☐	Dune swale	☐	Stony plain
☐	Escarpment	☐	Swamp
☐	Flat	☐	Undulating
☐	Gorge	☐	Upper slope
☐	Gully	☐	Wetland
☐	Intertidal / mangrove	☐	Water hole
☐	Lake / lake edge		
Habitat quality – options			
☐	*High quality fauna habitat* – These areas closely approximate the vegetation mix and quality that would have been in the area prior to any disturbance. The habitat has connectivity with other habitats and is likely to contain the most natural vertebrate fauna assemblage.		
☐	*Very good fauna habitat* - These areas show minimal signs of disturbance (e.g. grazing, clearing, fragmentation, weeds) and generally retain many of the characteristics of the habitat if it had not been disturbed. The habitat has connectivity with other habitats and fauna assemblages in these areas are likely to be minimally effected by disturbance.		
☐	*Good fauna habitat* – These areas showed signs of disturbance (e.g. grazing, clearing, fragmentation, weeds) but generally retain many of the characteristics of the habitat if it had not been disturbed. The habitat has connectivity with other habitats and fauna assemblages in these areas are likely to be affected by disturbance.		
☐	*Disturbed fauna habitat*– These areas showed signs of significant disturbance. Many of the trees, shrubs and undergrowth are cleared. These areas may be in the early succession and regeneration stages. Areas may show signs of significant grazing, containing weeds or have been damaged by vehicle or machinery. Habitats are fragmented or have limited connectivity with other fauna habitats. Fauna assemblages in these areas are likely to differ significantly from what might be expected in the area had the disturbance not occurred.		
☐	*Highly degraded fauna habitat* – These areas often have a significant loss of vegetation, an abundance of weeds, and a large number of vehicle tracks or are completely cleared. Limited or no fauna habitat connectivity. Fauna		

	assemblages in these areas are likely to be significantly different to what might have been in the area pre-disturbance.		
Soil Type – options			
☐	Sand	☐	Silty loam
☐	Loamy sand	☐	Sand clay loam
☐	Clayey sand	☐	Clay
☐	Clay loam	☐	Peat / organic
☐	Silty clay loam	☐	Stony
☐	Sandy loam		
Soil colour - options			
☐	Black	☐	Red
☐	Brown	☐	White
☐	Grey	☐	Yellow
☐	Orange		
Surface stones – options			
☐	None	☐	Boulders (>250mm)
☐	Pebbles (0-50mm)	☐	Rocks
☐	Cobbles (51-250)		

3.3 SURVEY AND REPORTING STAFF

Tom Raymond undertook the site investigation, fauna habitat assessment and search for Malleefowl and their mounds. The survey was undertaken with the support from Eren Reid from Native Vegetation Solutions. The habitat mapping was undertaken by Tom Raymond and Dr Scott Thompson and analysis by Dr Graham Thompson. Dr Graham Thompson drafted this report and Dr Scott Thompson reviewed the report before it was sent to the client.

Both senior scientists have appropriate relevant post-graduate qualifications, extensive experience in conducting fauna assessments in the Goldfields, have published research articles on biodiversity, fauna assemblages, conservation significant species, trapping techniques and temporal variations in trapped fauna assemblages and are therefore appropriately trained and experienced for the task of preparing this assessment.

Dr Scott Thompson is the only environmental practitioner in Western Australia who has independent specialist certification (CEnvP – Ecology Specialist) in combination with post-graduate tertiary qualifications and is a licenced pest management technician (LPMT). This unique set of skills and qualifications ensures Scott undertakes fauna surveys, assessments and control programs to the highest standard and quality assurance.

All staff have undertaken multiple assessments in the goldfields and are familiar with the habitat in the project area and surrounds. The qualifications and experience of the survey and reporting personnel are shown in Table 2.

Table 2. Project personnel and their qualifications

Name	Qualifications	Experience	Role
Dr Scott Thompson	BSc. (Env. Sc.), MSc. (Env. Mngt.), PhD (Env. Sc./Mngt), Cert III (Vertebrate Pest Mngt), Cert IV (WHS). CEnvP (Ecology Specialist)	> 20 years	Fauna habitat mapping and reviewing report
Dr Graham Thompson	Post Grad. Dip. (Zool.), PhD (Zoology), Cert III (Vertebrate Pest Mngt)	> 20 years	Habitat analysis and reporting
Tom Raymond	BA (Hons) Zoology	> 2 year	Field work, habitat analysis and mapping

3.4 TAXONOMY AND NOMENCLATURE

Taxonomy and nomenclature for fauna species used in this report are generally based on the WA Museum species lists. Terrestrial Ecosystems has presumed that the identifications referred to in the appendices or in reports used to provide local and regional comparative data are correct and it has only corrected obvious records where the nomenclature was known to be incorrect.

3.5 LIMITATIONS

Conclusions and management recommendations regarding the vertebrate fauna assemblage have been based on the data available in other fauna surveys nearby and a site visit. It is acknowledged that multiple surveys conducted in different seasons, repeated over several years are necessary to understand the vertebrate fauna in the project area.

Lists of species potentially in and around the project area have been compiled from records in the Western Australian Museum records, Atlas of Living Australia and reports of fauna surveys undertaken nearby. Some records in the Atlas of Living Australia and the Western Australian Museum are very old and those species may no longer present in the area. Terrestrial Ecosystems has not been able to see the primary data and is therefore not able to vouch for the accuracy of these records. All these sources of data are known to contain errors, and this should be considered when reading this assessment.

The *EPBC Act* online MNES database for terrestrial fauna includes historical records and places a wide buffer around previously known locations of threatened species and in its database (e.g. Chuditch). A search of this database will invariably include species that are either locally extinct or were never present in parts of the search area.

It is acknowledged that multiple surveys conducted in different seasons, repeated over several years are necessary to fully appreciate the fauna assemblage in a project area. The EPA (2020) *Technical Guidance Terrestrial Fauna Surveys* suggested that fauna surveys may be limited by many variables. Limitations associated with each of these variables are assessed in Table 3.

Table 3. Survey limitations

Possible limitations	Constraint	Comment
Availability of contextual information on the region	Yes, negligible	There is a reasonable amount of vertebrate fauna survey data available for similar habitats near the project area, however, the trapping effort is limited for many of these surveys.
Competency/experience of the survey team, including experience in the bioregion surveyed	No	The environmental scientists that undertook the field work, habitat mapping and reporting have appropriate qualifications, undertaken multiple surveys and assessments in the Goldfields, have published a book and multiple refereed journal articles based on fauna surveys in the region and are familiar with the vertebrate fauna in this bioregion.
Scope of the survey, e.g. where faunal groups were excluded from the survey	N/A	
Timing, weather and season	No	Weather was suitable for a site assessment.
Disturbance that may have affected results, e.g. fire, flood	No	Disturbances in the project area have been factored into this assessment.
The proportion of fauna identified, recorded or collected	N/A	
Adequacy of the survey intensity and proportion of survey achieved, e.g. the extent to which the area was surveyed	No	Basic survey requirements were met.
Access problems	No	The site was accessible.
Problems with data and analysis, including sampling biases	N/A	

N/A = not applicable, Significant = major impact on outcome of the assessment, Moderate = impacted parts of the assessment, Negligible = almost no impact on the assessment.

4. RESULTS

4.1 FAUNA HABITAT

Excluding the disturbed and cleared areas, there are the following four broad fauna habitats in the project area:

- Chenopod shrubland;
- Closed Eucalypt woodland and Acacia shrubland;
- Eucalypt and tall Melaleuca woodland; and
- Eucalypt woodland over mixed shrubs.

Plates 1-10 provide representative images of the fauna habitat types. There are also a few areas devoid of vegetation due to tracks or other anthropogenic factors.

The density of trees and shrubs in the relatively undisturbed areas varied across the project area. The fauna habitat quality varies from degraded to very good with the more degraded areas due to historical and recent exploration and mining activity. There are a few access tracks and old exploration grid lines in the area, but these are narrow and mostly only wheel tracks.

Plate 1. Chenopod shrubland

Plate 2. Chenopod shrubland

Plate 3. Closed Eucalypt woodland and Acacia shrubland

Plate 4. Closed Eucalypt woodland and Acacia shrubland

Plate 5. Eucalypt and tall Melaleuca woodland

Plate 6. Eucalypt and tall Melaleuca woodland

Plate 7. Eucalypt woodland over mixed shrubs

Plate 8. Eucalypt woodland over mixed shrubs

Plate 9. Disturbed area

Plate 10. Disturbed area

Forty-four habitat assessments were completed in the Hillditch and 59 in the 8500 project areas (Appendix D and Figure 2). The area has been lightly grazed by cattle with some areas showing signs of degradation (i.e. cattle tracks, chewed bushes and shrubs, etc). There was evidence of rabbits and other feral and pest fauna

(feral cats, donkey and wild dogs) in the area. Appendix D shows the results of the rapid fauna habitat assessment for the project area.

4.2 BIOREGIONAL VERTEBRATE FAUNA ASSEMBLAGE

Appendix B provides a summary of the fauna survey data that are available near the project area. There are appreciable differences in the recorded fauna assemblages within and among fauna surveys shown in Appendix B. These differences are partially due to the low survey effort deployed by some of the surveys and they also reflect variations in soils and vegetation as well as temporal variations in the fauna assemblages.

Tables 4-7 provide a list of vertebrate species potentially found near the project area that have been compiled based on the fauna survey report results shown in Appendix B.

Table 4. Birds potentially found in the region

Family	Species	Common Name
Casuariidae	*Dromaius novaehollandiae*	Emu
Columbidae	*Phaps chalcoptera*	Common Bronzewing
Cuculidae	*Chrysococcyx basalis*	Horsfield's Bronze-Cuckoo
	Chrysococcyx osculans	Black-eared Cuckoo
Aegothelidae	*Aegotheles cristatus*	Australian Owlet-nightjar
Podargidae	*Podargus strigoides*	Tawny Frogmouth
Caprimulgidae	*Eurostopodus argus*	Spotted Nightjar
Accipitridae	*Lophoictinia isura*	Square-tailed Kite
	Hieraaetus morphnoides	Little Eagle
	Aquila audax	Wedge-tailed Eagle
	Accipiter cirrocephalus	Collared Sparrowhawk
Cuculidae	*Heteroscenes pallidus*	Pallid Cuckoo
Strigidae	*Ninox boobook*	Southern Boobook
Meropidae	*Merops ornatus*	Rainbow Bee-eater
Falconidae	*Falco cenchroides*	Nankeen Kestrel
	Falco berigora	Brown Falcon
	Falco peregrinus	Peregrine Falcon
Timaliidae	*Zosterops lateralis*	Silvereye
Psittaculidae	*Polytelis anthopeplus*	Regent Parrot
	Barnardius zonarius	Australian Ringneck
	Platycercus icterotis	Western Rosella
	Glossopsitta porphyrocephala	Purple-crowned Lorikeet
Climacteridae	*Climacteris rufus*	Rufous Treecreeper
Maluridae	*Malurus pulcherrimus*	Blue-breasted Fairywren
	Malurus splendens	Splendid Fairywren
	Malurus leucopterus	White-winged Fairywren
Meliphagidae	*Purnella albifrons*	White-fronted Honeyeater
	Manorina flavigula	Yellow-throated Miner
	Acanthagenys rufogularis	Spiny-cheeked Honeyeater
	Anthochaera carunculata	Red Wattlebird
	Gavicalis virescens	Singing Honeyeater
	Ptilotula ornata	Yellow-plumed Honeyeater
	Epthianura albifrons	White-fronted Chat
	Lichmera indistincta	Brown Honeyeater
	Nesoptilotis leucotis	White-eared Honeyeater
	Melithreptus brevirostris	Brown-headed Honeyeater
Pardalotidae	*Pardalotus striatus*	Striated Pardalote
Acanthizidae	*Pyrrholaemus brunneus*	Redthroat
	Acanthiza apicalis	Inland Thornbill
	Acanthiza chrysorrhoa	Yellow-rumped Thornbill
	Acanthiza uropygialis	Chestnut-rumped Thornbill
	Smicrornis brevirostris	Weebill
Pomatostomidae	*Pomatostomus superciliosus*	White-browed Babbler
Cinclosomatidae	*Cinclosoma castanotum*	Chestnut Quail-thrush

Family	Species	Common Name
Campephagidae	*Coracina novaehollandiae*	Black-faced Cuckooshrike
Neosittidae	*Daphoenositta chrysoptera*	Varied Sittella
Oreoicidae	*Oreoica gutturalis*	Crested Bellbird
Pachycephalidae	*Colluricincla harmonica*	Grey Shrikethrush
	Pachycephala inornata	Gilbert's Whistler
	Pachycephala pectoralis	Golden Whistler
Artamidae	*Artamus personatus*	Masked Woodswallow
	Artamus cinereus	Black-faced Woodswallow
	Artamus cyanopterus	Dusky Woodswallow
	Cracticus torquatus	Grey Butcherbird
	Cracticus nigrogularis	Pied Butcherbird
	Gymnorhina tibicen	Australian Magpie
	Strepera versicolor	Grey Currawong
Rhipiduridae	*Rhipidura leucophrys*	Willie Wagtail
Monarchidae	*Grallina cyanoleuca*	Magpie-lark
Corvidae	*Corvus bennetti*	Little Crow
	Corvus coronoides	Australian Raven
Petroicidae	*Microeca fascinans*	Jacky Winter
	Petroica goodenovii	Red-capped Robin
	Eopsaltria australis	Eastern Yellow Robin
	Eopsaltria griseogularis	Western Yellow Robin
Locustellidae	*Cincloramphus mathewsi*	Rufous Songlark
Hirundinidae	*Petrochelidon nigricans*	Tree Martin
Dicaeidae	*Dicaeum hirundinaceum*	Mistletoebird
Motacillidae	*Anthus novaeseelandiae*	Australasian Pipit

Table 5. Amphibians potentially found in the region

Family	Species	Common Name
Limnodynastidae	*Neobatrachus kunapalari*	Wheatbelt Frog
	Neobatrachus pelobatoides	Humming Frog
	Neobatrachus sudelli	Sudell's Frog
	Neobatrachus sutor	Shoemaker Frog

Table 6. Mammals potentially found in the region

Family	Species	Common Name
Tachyglossidae	*Tachyglossus aculeatus*	Short-beaked Echidna
Canidae	*Canis lupus*	Dingo/Wild dog
Molossidae	*Austronomus australis*	White-striped Freetail Bat
Vespertilionidae	*Chalinolobus gouldii*	Gould's Wattled Bat
	Chalinolobus morio	Chocolate Wattled Bat
	Nyctophilus geoffroyi	Lesser Long-eared Bat
	Vespadelus regulus	Southern Forest Bat
Dasyuridae	*Sminthopsis crassicaudata*	Fat-tailed Dunnart
	Sminthopsis dolichura	Little Long-tailed Dunnart
	Sminthopsis gilberti	Gilbert's Dunnart
Burramyidae	*Cercartetus concinnus*	Southwestern Pygmy Possum
Macropodidae	*Macropus fuliginosus*	Western Grey Kangaroo
	Osphranter robustus	Euro
Leporidae	*Oryctolagus cuniculus*	Rabbit
Muridae	*Mus musculus*	House Mouse
	Notomys alexis	Spinifex Hopping Mouse
	Notomys mitchellii	Mitchell's Hopping Mouse
	Pseudomys bolami	Bolam's Mouse
	Pseudomys hermannsburgensis	Sandy Inland Mouse

Table 7. Reptiles potentially found in the region

Family	Species	Common Name
Agamidae	*Ctenophorus adelaidensis*	Western Heath Dragon
	Ctenophorus chapmani	Chapman's Dragon
	Ctenophorus cristatus	Crested Dragon
	Ctenophorus salinarum	Saltpan Dragon
	Ctenophorus scutulatus	Lozenge-marked Dragon
	Moloch horridus	Thorny Devil
	Pogona minor	Western Bearded Dragon
	Tympanocryptis cephalus	Pebble Dragon
Carphodactylidae	*Underwoodisaurus milii*	Barking Gecko
Diplodactylidae	*Amalosia reticulata*	Reticulated Velvet Gecko
	Crenadactylus ocellatus	Clawless Gecko
	Diplodactylus granariensis	Wheatbelt Stone Gecko
	Diplodactylus pulcher	Beautiful Gecko
	Hesperoedura reticulata	Reticulated Velvet Gecko
	Lucasium maini	Main's Ground Gecko
	Strophurus assimilis	Goldfields Spiny-tailed Gecko
	Strophurus intermedius	Southern Spiny-tailed Gecko
Elapidae	*Brachyurophis semifasciata*	Half-girdled Snake
	Suta gouldii	Gould's Snake
	Pseudonaja modesta	Ringed Brown Snake
	Simoselaps bertholdi	Jan's Banded Snake
Gekkonidae	*Gehyra variegata*	Variegated Gehyra
	Heteronotia binoei	Bynoe's Gecko
Pygopodidae	*Delma butleri*	Unbanded Delma
	Delma fraseri	Fraser's Delma
	Delma nasuta	Sharp-snouted Delma
	Lialis burtonis	Burton's Legless Lizard
	Pygopus lepidopodus	Common Scaly-foot
Scincidae	*Cryptoblepharus buchananii*	Buchanan's Snake-eyed Skink
	Ctenotus atlas	Southern Mallee Ctenotus
	Ctenotus schomburgkii	Barred Wedgesnout Ctenotus
	Ctenotus uber	Spotted Ctenotus
	Cyclodomorphus branchialis	Common Slender Bluetongue
	Cyclodomorphus melanops	Spinifex Slender Blue-tongue
	Egernia multiscutata	Southern Sand-skink
	Egernia richardi	Bright Crevice-skink
	Hemiergis initialis	South-western Earless Skink
	Hemiergis millewae	Triodia Earless Skink
	Lerista picturata	Southern Robust Slider
	Lerista terdigitata	Robust Mulch Slider
	Lerista timida	Timid Slider
	Lerista tridactyla	Dark-backed Mulch Slider
	Liopholis inornata	Desert Skink
	Liopholis multiscutata	Bull Skink
	Menetia greyii	Common Dwarf Skink
	Morethia adelaidensis	Saltbush Morethia Skink
	Morethia butleri	Woodland Morethia Skink
	Morethia obscura	Shrubland Pale-flecked Morethia
	Tiliqua rugosa	Bobtail
Typhlopidae	*Anilios bituberculatus*	Prong-snouted Blind Snake
Varanidae	*Varanus gouldii*	Gould's Goanna

4.3 CONSERVATION SIGNIFICANT FAUNA

Conservation significant fauna are protected by the Commonwealth *EPBC Act 1999*, and this list includes species covered by international treaties such as the Japan-Australia Migratory Bird Agreement (JAMBA) and China-Australia Migratory Bird Agreement (CAMBA), and the Western Australia (WA) *BC Act 2016*. The *BC Act 2016* provides for the publishing of the *Wildlife Conservation (Specially Protected Fauna) Notice* that lists species under multiple categories. DBCA also maintains a list of fauna that require monitoring under four priorities based on the current knowledge of their distribution, abundance and threatening processes. The *EPBC Act 1999* and *BC Act 2016* imply legislative requirements for the management of anthropogenic impacts to minimise the effects of disturbances on species and their habitats. Priority species have no statutory protection, other than the DBCA wishes to monitor potential impacts on these species. Environmental consultants and proponents of developments are encouraged to avoid and minimise impacts on these species. Definitions of the significant fauna under the *BC Act 2016* are provided in Appendix C.

Results of the Commonwealth *EPBC Act 1999* protected matters database search are provided in Appendix A.

The fauna species that have special status in either State or Commonwealth government legislation or are on the DBCA Priority species list and are potentially present in the vicinity of the project area are listed in Table 8. The project area is west of Lake Lefroy which occasionally contains water and is therefore intermittently utilised by wetland and shorebirds. Although they were recorded in the search of the MNES online database, migratory species that typically would be found around the edges of salt lakes, clay pans, estuaries and marshes have been excluded from Table 8 as there is no suitable habitat nearby.

One migratory, one threatened and two priority species potentially occur in the project area or surrounds. The following is an assessment of the likelihood of each of the species listed in Table 8 being found in the project area.

Table 8. Assessment of the potential presence of a conservation significant fauna species in the project area

Species	DBCA Schedule / Priority	Status under Commonwealth EPBC Act	Comment on the potential presence of a species
Pezoporus occidentalis Night Parrot	Critically Endangered	Endangered	Not recorded in other surveys in the area, habitat is not suitable, and the closest recent record is ~550km away, so it is **highly unlikely** to be in the project area.
Falco hypoleucos Grey Falcon	Vulnerable	Vulnerable	Not recorded in other surveys in the area, so it is **highly unlikely** to be in the project area.
Dasyurus geoffroii Chuditch	Vulnerable	Vulnerable	**Highly unlikely** to be in the project area due to a lack of recent regional records, feral predators and the openness of the vegetation.
Aphelocephala leucopsis Southern Whiteface	Vulnerable	Vulnerable	**Potentially** present in the project area.
Leipoa ocellata Malleefowl	Vulnerable	Vulnerable	No mounds, tracks or birds were recorded during the field surveys. The Malleefowl is therefore **unlikely** to be a resident species in the project area.
Apus pacificus Fork-tailed Swift	Migratory	Migratory	Infrequent visitor to the general region but **highly unlikely** to utilise the project area.
Motacilla cinerea Grey Wagtail	Migratory	Migratory	Suitable habitat is not present in the project area, so it is **highly unlikely** to be present.
Falco peregrinus Peregrine Falcon	OS		**Potentially** present in the project area.

Species	DBCA Schedule / Priority	Status under Commonwealth EPBC Act	Comment on the potential presence of a species
Platycercus icterotis xanthogenys Western Rosella (inland)	P4		**Potentially** present in the project area.
Aspidites ramsayi Woma	P1		Not previously recorded in other surveys in the vicinity of the project area and is rarely recorded across the region, so it is **unlikely** to be in the project area.
Nyctophilus major tor Central Long-eared Bat	P4		There are records of this species in the vicinity of the project area so it is **potentially** present.
Acanthophis antarcticus Southern Death Adder	P3		There is a lack of regional records, so it is **unlikely** to be in the project area.

Night Parrot (*Pezoporus occidentalis*) – Critically endangered under the *BC Act 2016* and Endangered under the *EPBC Act 1999*

The Night Parrot is a small, arid-adapted, nocturnal, ground-feeding parrot (Johnstone and Storr 1998, Threatened Species Scientific Committee 2016). Its length is 22-25cm with a body mass of approximately 104g (Threatened Species Scientific Committee 2016), although it was suggested that they were semi-nomadic, the Night Parrots in south-western Queensland appear to be sedentary (Murphy 2015).

The Night Parrot was probably originally distributed over much of semi-arid and arid Australia (Garnett et al. 1993, Threatened Species Scientific Committee 2016). Records in north-west and western Queensland in the early 1990-2000s were in a broad cross section of the habitats available (Garnett et al. 1993, Cupitt and Cupitt 2008, Boles et al. 2016). There have been recent sightings in the Pilbara in 1980, 2005 and 2017, central WA in 1979, north-eastern South Australia in 1979, western Queensland (including Pullen-Pullen-Mt Windsor-Diamantina population) in 1980, 1990, 1993, 2006 and 2013-17 (Davis and Metcalf 2008, Garnett et al. 2011, Charalambous 2016, Pickrell 2016, AG staff 2017, Palaszxzuk and Miles 2017, Rykers 2017, AG staff 2018), Pilbara in 2017 (Jones 2017) and the northern Goldfields (Jackett et al. 2017). Garnett et al. (2011) suggested that there were between 50-250 mature individuals in less than 5% of its previous range. Prior to 2007 there were very few records of the Night Parrot (Plate 11).

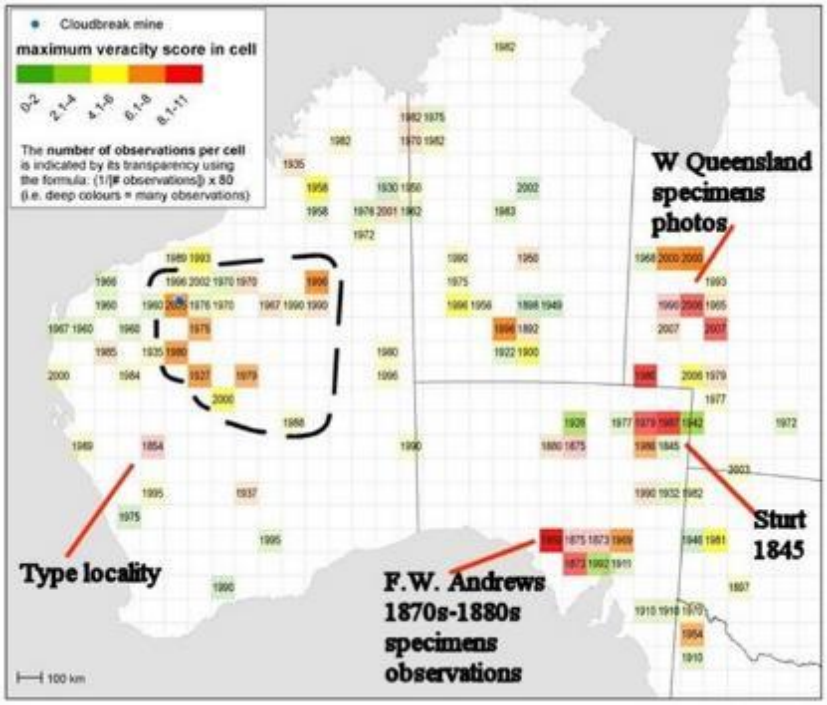

Plate 11. Map of historical Night Parrot records compiled by S. Murphy *et al.*, including records to 2007

(taken from https://www.dpaw.wa.gov.au/plants-and-animals/threatened-species-and-communities/threatened-animals/night-parrot)

Wilson's (1937) summary of observations provided information on the early records of Night Parrots' preferred habitat and breeding sites. Recent information indicates its preferred habitat appears to be in Triodia grasslands, chenopod shrublands, shrubby samphire and floristically diverse habitats dominated by large-seeded species (Threatened Species Scientific Committee 2016, McCarthy 2017, Murphy et al. 2017b). At Pullen Pullen Reserve it nests in large, more or less ring-shaped Triodia, and the nest consists of a tunnel (25-30º and 0º to the ground; 20-33cm long) through an apron of dead spinifex leaves that leads to a chamber under a live hummock, with a shallow depression (3-4cm) excavated into the gravelly/sandy soil (Murphy et al. 2017a). In the northern Goldfields the nest was again in a spinifex hummock, it was circular, with an excavated depression (~1.5-2.0cm) in sandy substrate (Hamilton et al. 2017, Jackett et al. 2017). The entrance tunnel was 62cm long, and was downward sloping (27º) with the entrance 28cm above the ground (Hamilton et al. 2017). It has clutches of two to four sub-elliptical, white eggs with a lustrous appearance (Murphy et al. 2017a). Breeding followed significant rains in March for the observations in Pullen-Pullen Reserve and in April in the northern Goldfields (Hamilton et al. 2017, Murphy et al. 2017a), but it is thought that breeding generally occurs between April and October (Murphy et al. 2017a).

Murphy et al. (2017b) placed a GPS tag on Night Parrots and reported that the two birds called at dusk from their diurnal roosts among spinifex hummocks and then flew to more floristically diverse habitats dominated by large-seeded, prolifically seeding species to feed.

The project area is in the medium priority area for Night Parrots based on the Department of Parks and Wildlife (2017) assessment of where they might be found.

There are no mature spinifex hummocks in the project area and a reasonably high density of feral fauna. As the preferred roosting and nesting sites for Night Parrots are not present in the project area, there is a significant threatening process for the species in the area (i.e. feral cats), and it is >500km from the nearest records, it is Terrestrial Ecosystems' assessment that Night Parrots are not present in the project area and will therefore not be impacted by any proposed development.

Grey Falcon (*Falco hypoleucos*) - Vulnerable under the *BC Act 2016* and *EPBC Act 1999*

The Grey Falcon occurs in arid and semi-arid Australia, including the Murray-Darling Basin, Eyre Basin, central Australia and Western Australia (Threatened Species Scientific Committee 2020) where it frequents timbered lowland plains, particularly acacia shrublands that are crossed by tree-lined water courses, but has been seen in in treeless areas and frequents tussock grassland and open woodland.

This species is sparsely recorded throughout much of arid, semi-arid Australia and inland Australia. Their range has been reduced to northern WA, with only rare occurrences south of 26°S ((Schoenjahn et al. 2019)). When sighted, Grey Falcons have been in areas where annual rainfall is less than 500mm, except when wet years are followed by drought, which is when the species can become marginally more widespread (Threatened Species Scientific Committee 2020). They have also been sighted outside of breeding season in Derby, Western Australia ((Schoenjahn et al. 2019)). There have been sightings further south, however, a lot of Grey Falcon sightings are believed to be misidentifications ((Schoenjahn et al. 2019)). A map of recorded sightings in Western Australia is shown in Plate 12.

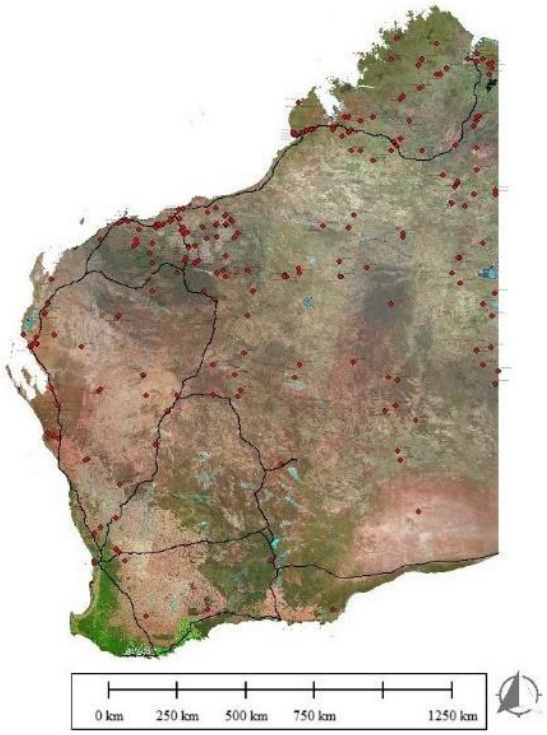

Plate 12. Grey Falcon records in Terrestrial Ecosystems' threatened species database

This species was not seen during the site visit, and if it was present, then would move away once disturbed.

Chuditch (*Dasyurus geoffroii*) – Vulnerable under the *BC Act 2016* and *EPBC Act 1999*

The Chuditch is the largest extant carnivorous marsupial in WA. It is usually active from dusk to dawn. Formally known from over 70% of Australia, the Chuditch now has a patchy distribution throughout the Jarrah forest and mixed Karri/Marri/Jarrah forest of south-west WA and other isolated areas. Chuditch are solitary animals for most of their life and den in hollow logs, burrows, culverts, etc. and have also been recorded in tree hollows and rock cavities. Chuditch are opportunistic feeders, and forage primarily on the ground at night. Their diet can include other mammals, birds, lizards, bird and reptile eggs but the majority is a mixture of large invertebrates (e.g. spiders, scorpions and crickets).

How *et al*. (1988) reported Chuditch being found near the Norseman-Lake King Road and near Mount Holland. DBCA records show that one specimen was recorded in 1974 in Kambalda East. There are records south of Southern Cross and Marvel Loch and there have been other old sightings east of Kambalda and near Norseman, but none recently. As the project area is outside of its current known geographic distribution it is unlikely that the Chuditch would be found in the project area.

Southern Whiteface (*Aphelocephala leucopsis*) - Vulnerable under the *EPBC Act 1999*

The Southern Whiteface is a recent addition to the *EPBC Act* listing of vulnerable species. It is a small bird found in the arid and semi-arid interior from the WA coast near Hamelin Bay through the Great Victoria Desert into the arid areas of South Australia, Victoria, NSW and Queensland (Johnstone and Storr 2004, Department of Climate Change Energy the Environment and Water 2023).

The Southern Whiteface occurs across an area of over 4,910,000km^2 across Australia. However within this area it's area of occupancy is estimated to be 34.400-140,000km^2 (Ehmke et al. 2021). In Western Australia it can be found as far north as Carnarvon down to the south coast and from the WA west coast near Hamelin Bay through the Great Victoria Desert into the arid areas of South Australia, see Plate 13.

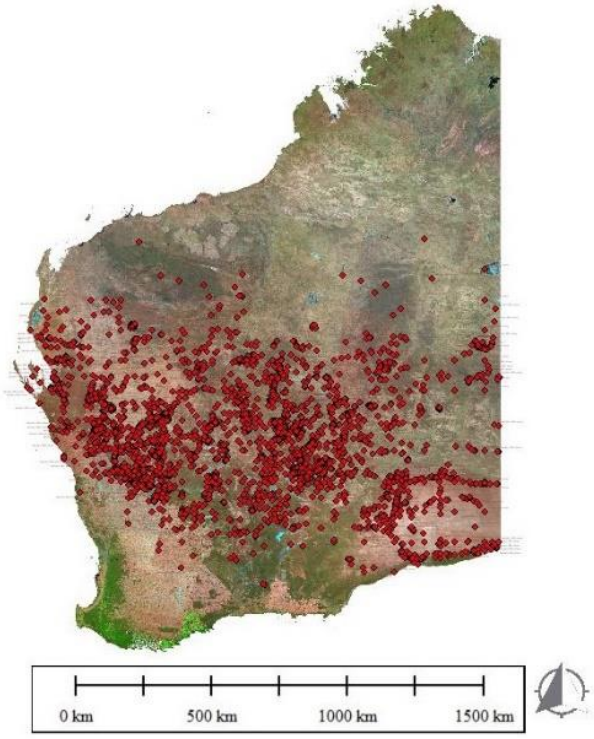

Plate 13. Southern Whiteface records in Terrestrial Ecosystems' threatened species database

In WA the Southern Whiteface has been found in a number of IBRA's during surveys (Plate 13) including but not exclusive to the Pilbara, Carnarvon, Gascoyne, Yalgoo, Murchison, Coolgardie, Little Sandy Desert, Gibson Desert, Great Victoria Dessert, Central Ranges, Geraldton Sand Plains, Avon Wheatbelt, Nullarbor, and Mallee.

It is found in open woodlands and shrublands with an understorey of grasses and low shrubs (Department of Climate Change Energy the Environment and Water 2023). It forages on the ground, feeding on insects, spiders and seeds, mostly found in the leaf-litter (Johnstone and Storr 2004, Department of Climate Change Energy the Environment and Water 2023).

It was recorded by Ninox Wildlife Consulting (1998) in the Randalls project area and is likely to be found in the region and project area. This bird will readily move to adjacent areas if it is disturbed. There is an abundance

of similar fauna habitats present in adjacent areas, so the proposed clearing of vegetation and development is unlikely to be a significant impact on this bird.

Malleefowl (*Leipoa ocellata)* – Vulnerable under the *BC Act* 2016 and *EPBC Act 1999*

Malleefowl are large, ground-dwelling birds that rarely fly unless alarmed or are perching for the night. Historically, Malleefowl have been found in mallee regions of southern Australia from approximately the 26th parallel of latitude southwards. Prior to vegetation clearing for agriculture, Malleefowl were abundant in the WA Wheatbelt. Vegetation clearing for agriculture also opened adjacent bushland to predators, and in the south-west of WA, Malleefowl often only persist in isolated remnant patches of native vegetation. Sheep and other herbivores (e.g. goats, kangaroos) grazing in remnant vegetation removes or thins the undergrowth, and they also compete with Malleefowl for herbaceous foods and can cause changes to the structure and floristic diversity of foraging habitats (Benshemesh 2007).

With colonisation, the natural geographical range of the Malleefowl has contracted and this contraction is predicted to continue (Parsons et al. 2008). This contraction is primarily attributed to use of land for grazing and introduced predators (e.g. foxes: Benshemesh 2007, Parsons et al. 2008). Recent records of Malleefowl are shown in Plate 14.

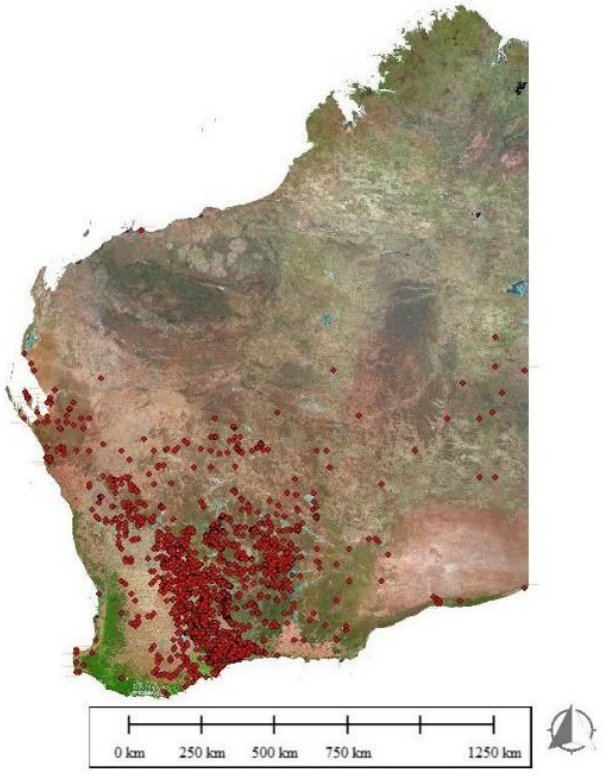

Plate 14. Malleefowl records in Terrestrial Ecosystems' threatened species database

Malleefowl and their eggs are vulnerable to predation by foxes, and newly hatched chicks are vulnerable to foxes, cats and raptors (Priddel and Wheeler 1990, 1997, Benshemesh and Burton 1999, Benshemesh 2007, Lewis and Hines 2014). Their abundance in the Goldfields is low and they are sparsely distributed, favouring those areas that are more densely vegetated. Malleefowl build distinctive nests that comprise a large mound of soil/rock covering a central core of leaf litter. These nest mounds range in diameter but can span more than five metres and may be up to one metre high. Malleefowl are generally monogamous and once breeding commences they pair for life. The presence of nest mounds provides an indication of the presence of Malleefowl in the area. It forages on the ground, feeding on insects, spiders and seeds, mostly found in the leaf-litter (Johnstone and Storr 2004, Department of Climate Change Energy 2023).

Malleefowl have been observed in the bioregion, however, Terrestrial Ecosystems is not aware of any records of active breeding mounds in the vicinity of the project area. No mounds, tracks or scats were recorded during the site investigation. The open fauna habitat and the It is found in open woodlands and shrublands with an understorey of grasses and low shrubs (Department of Climate Change Energy 2023).

Malleefowl have been found in mallee regions of southern Australia from approximately the 26th parallel of latitude southwards. Malleefowl are now only found throughout these regions in fragmented patches due to clearing of habitat for agriculture, increased fire frequency, competition with exotic herbivores (sheep, rabbits, cattle, goats) and kangaroos, predation by foxes and cats, inbreeding as a result of fragmentation and possibly hunting for food.

Some disused Malleefowl mounds were recorded in other regional surveys, however, no active or inactive mounds were recorded in the project area during the searches. The substrate was suitable for recording Malleefowl tracks, but none were found. Given the absence of any Malleefowl mounds and tracks and the presence of feral cats and wild dogs, Terrestrial Ecosystems' assessment is that the Malleefowl is unlikely to reside in the area but may be observed as a transient moving through the project area.

Fork-tailed Swift (*Apus pacificus*) - Migratory species under the *EPBC Act 1999* and *BC Act 2016*

This species breeds in the northeast and mid-east Asia and winters in Australia and southern New Guinea. It is a visitor to most parts of Western Australia, beginning to arrive in the Kimberley in late September, in the Pilbara in November and in the southwest land division in mid-December, and leaving by late April. The Fork-tailed Swift is an almost exclusively aerial species, foraging and sleeping on the wing. It rarely comes to ground, usually only for breeding. It is common in the Kimberley, uncommon to moderately common near northwest, west and southeast coasts and rare to scarce elsewhere. It is rarely seen in the Goldfields (Plate 15).

Terrestrial Ecosystems' assessment is that the Fork-tailed Swift may infrequently be seen in the project area. However, the proposed vegetation clearing is unlikely to significantly impact on this species as it will move away to other areas if it is disturbed, and it is essentially an aerial species and therefore unlikely to come to the ground in the project area.

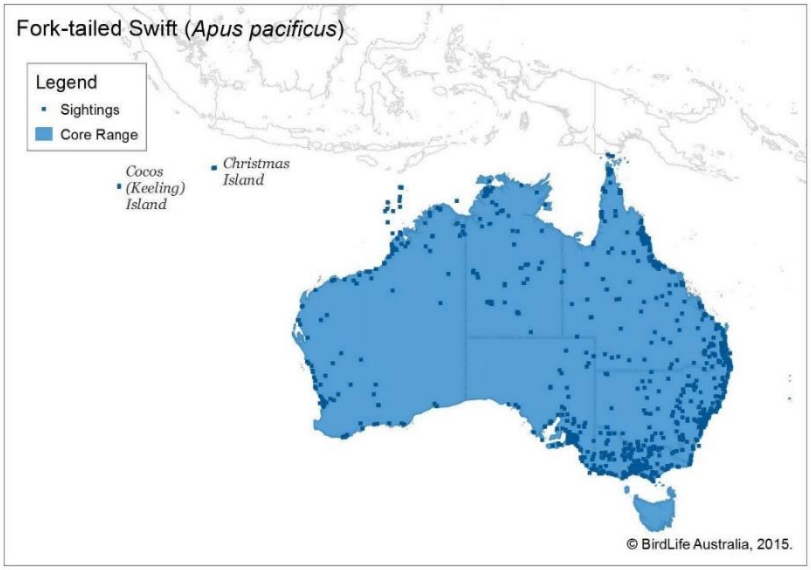

Plate 15. Range and actual reported sightings of the Fork-tailed Swift

(taken from http://www.environment.gov.au/biodiversity/threatened/publications/epbc-act-referral-guidelines-migratory-birds)

Grey Wagtail (*Motacilla cinerea*) - Migratory species under the *EPBC Act 1999* and *BC Act 2016*

The Grey Wagtail is a small yellow breasted bird with a grey back and head. Johnstone and Storr (2004) reported this migratory species as breeding in Palearctic from western Europe and north-west Africa to eastern Asia and wintering in Africa, south-east Asia, Indonesia, the Philippines, New Guinea and Australia. Its preferred habitat in Australia is banks and rocks in fast-running fresh water including rivers, streams and creeks where it feeds on insects. The Atlas of Living Australia records two sightings on the south-coast of Western Australia and none around the project area (Plate 16).

It is highly unlikely to be seen in the project area due to a lack of records and suitable habitat.

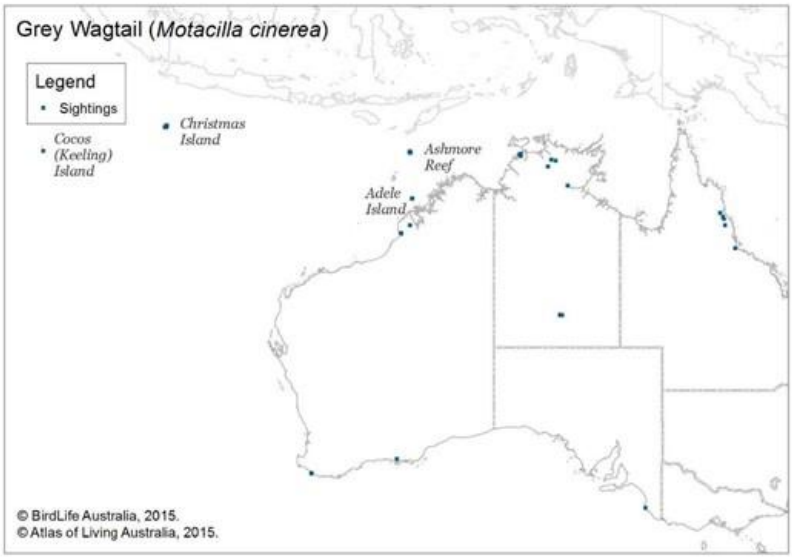

Plate 16. Reported sightings of the Grey Wagtail

(taken from http://www.environment.gov.au/biodiversity/threatened/publications/epbc-act-referral-guidelines-migratory-birds)

Peregrine Falcon (*Falco peregrinus*) - Otherwise specially protected under the *BC Act 2016*

The Peregrine Falcon is uncommon, although widespread throughout much of Australia excluding the extremely dry areas and has a wide and patchy distribution. It shows habitat preference for areas near cliffs along coastlines, rivers and ranges and within woodlands along watercourses and around lakes. Nesting sites include ledges along cliffs, granite outcrops and quarries, hollow trees near wetlands and old nests of other large bird species. There is no evidence to suggest any change in status in the last 50 years.

The Peregrine Falcon may infrequently be seen in the project area, given that Dell and How (1984) recorded it in their survey, however, the proposed vegetation clearing and mining operations is unlikely to have a significant impact on this species as it will readily move away from disturbance and there are abundant areas of similar habitat in the region.

Western Rosella (*Platycercus icterotis xanthogenys*) – Priority 4 with the DBCA

The mallee form of the Western Rosella is found mostly in eucalypt and *Casuarina* woodland and shrub lands, especially Wandoo, Flooded Gums and Salmon Gums (Johnstone and Storr 1998). This species was sighted by Dames and Moore (1999) around Lake Lefroy, Outback Ecology Services (2009) at Randalls and it was reported by Dell and How (1984) in the biological survey of Widgiemooltha. A search of online databases indicated that they have been recorded in the vicinity of Kalgoorlie.

It is possible that this species could be infrequently seen in the project area. However, given that the project area represents a small fraction of similar habitat in adjacent areas, vegetation clearing is unlikely to have a significant impact on this species, as it will readily move to adjacent areas if disturbed.

Woma (*Aspidites ramsayi*) - Priority 1 species with DBCA

The southern Woma python was once recorded in a crescent shaped geographic distribution from Shark Bay to Kitchener in WA. However, it is now mostly only found on the two extremes of this distribution with a small population east of the wheatbelt in relatively dense shrubs on a sandy substrate.

In Western Australia it is found in arid woodland or shrubland areas, typically on sand plains. It has not been recorded recently near the project area, so it is improbable the Woma python is present in the project area and therefore impacted by the proposed development.

Central Long-eared Bat (*Nyctophilus major tor*) – Priority 4 with the DBCA

Records in the Atlas of Living Australia indicate this species has been found west of Kalgoorlie and in other areas in the Goldfields and the Wheatbelt. It roosts in tree cavities, foliage and under loose bark.

Given that project area represents a small fraction of similar habitat in the general area, vegetation clearing is unlikely to have a significant impact on this species.

Southern Death Adder (*Acanthophis antarcticus*) - Priority 3 species with DBCA

The Southern Death Adder is found in variety of habitat from rainforest, shrublands and heaths. The distribution map in the Atlas of Living Australia indicates that they have not been recorded around the project area.

It is highly improbable the Southern Death Adder is present in the project area and therefore impacted by the proposed development.

5. DISCUSSION

5.1 ADEQUACY OF THE FAUNA SURVEY DATA FOR FAUNA HABITATS REPRESENTED IN THE PROJECT AREA

The EPA's (2020) *Technical Guidance – Terrestrial Vertebrate Fauna Surveys for Environmental Impact Assessment* indicated that the level of fauna assessment should be determined considering the following criteria:

- level of existing regional knowledge;
- type and comprehensiveness of recent local surveys;
- degree of existing disturbance or fragmentation at the regional scale;
- extent, distribution and significance of habitats;
- significance of species likely to be present;
- sensitivity of the environment to the proposed activities; and
- scale and nature of impact.

The project area is ~342ha in an area with a reasonable appreciation of the vertebrate fauna assemblage. Data are available from fauna surveys undertaken by the Western Australian Museum (WAM)/Department of Environment Conservation (DEC) eastern Goldfields survey of the Widgiemooltha-Zanthus survey area, ATA Environmental (2006b), Bamford Consulting Ecologists (2010), Dames and Moore (1999), Keith Lindbeck and Associates (2007), Ninox Wildlife Consulting (2004b) and Western Wildlife (2006, 2013) provide a good indication of the vertebrate fauna assemblage in the project area. The Hall and McKenzie (1993) report is part of the WAM/DEC's Eastern Goldfields survey undertaken in the mid 1980's and the Chapman et al. (1991) report is the results of fauna surveys of four timber reserves that are all nearby. In addition, Thompson (2004) has provided in excess of 120,000 pit/funnel trap-nights of data in fauna habitats that are present in the project area, so the results of this survey alone are much more comprehensive than is typically undertaken for a detailed fauna assessment.

Although the project area is moderately large, given the fauna survey data that are available nearby and the level of existing disturbance in the project area, there is sufficient information on the fauna assemblages to enable potential impacts to be assessed and additional broadscale trapping surveys and assessments are not recommended. It is unlikely that further survey effort or a detailed vertebrate fauna survey in the project area will provide new species not previously identified for this area, identify conservation significant fauna or provide additional information that would alter the assessment of potential impacts. However, as with all surveys, until it is completed the outcome is unknown.

5.1.1 Amphibians

Amphibians typically found in eucalypt woodlands in the Goldfields are listed in Table 5 and Appendix B. Frogs are normally only detected immediately after rainfall or around semi-permanent pools. It is likely that *Neobatrachus sutor*, *Pseudophryne occidentalis* and *Neobatrachus kunapalari* could be found in the general area. These species, other than *P. occidentalis*, burrow into the ground and aestivate between rainfall events. *Pseudophryne occidentalis* find shelter under rocks and in crevices during the dry periods and enter temporary ponds to breed after major rainfall events. All three species have a wide-spread distribution and are abundant. Exploration and mining activity in the project area is likely to result in a loss of individuals within the disturbed area, however, is unlikely to have a significant impact on these species when assessed in a regional context.

There are no conservation significant amphibians in the Goldfields.

5.1.2 Reptiles

Reptile species richness in the project area will be comparable with similar eucalypt woodlands elsewhere in the bioregion. The list provided in Table 7 and Appendix B represents species likely to be found over a large area of diverse habitat types. Eucalypt woodlands over shrubs would typically support up to 40 species of reptiles (Thompson 2004), but many of these would be in low abundance. There are no characteristics of the reptile assemblage anticipated to be in the project area that indicated that there are reptiles of conservation significance or different to that in the neighbouring areas and given that there were large expanses of similar habitat in adjacent areas, development of the project area is unlikely to have significant impact on reptiles when assessed in a regional context.

Fauna habitats in the project area will be like adjacent areas, so the loss of reptiles during vegetation clearing is unlikely to be significant in a bioregional context.

Clearing of vegetation in the project area is unlikely to significantly impact on the reptile fauna in a bioregion context.

5.1.3 Birds

Avian species richness in the Goldfields is influenced by rainfall (Craig and Chapman 2003) and is generally higher in woodlands compared with chenopod shrublands and more sparsely vegetated areas. The list provided in Table 4 and Appendix B represents species likely to be found over a large area of diverse habitat types. Eucalypt woodlands over shrubs would typically support up to 50-70 species of birds, but many of these would be in very low abundance and are only present after significant rainfall. Birds typically move from an area once vegetation clearing commences, so the impact is relatively low if the area is small. However, eggs and chicks in nests are often lost during the clearing process.

Semi-arid and arid areas of inland Australia support a diverse range of transient and nomadic species that move through large areas in search of available resources. Heavy rain that is followed by flowering and seeding of many plant species is often sufficient to draw many of these nomadic species to the general area. These species move on to other areas once the resource is depleted or better resources are available in adjacent areas.

The project area is likely to support a similar assemblage to that present in the adjacent areas (McKenzie and Hall 1992, Ninox Wildlife Consulting 2004b, ATA Environmental 2006b, Western Wildlife 2006, Keith Lindbeck and Associates 2007, Bamford Consulting Ecologists 2010, Terrestrial Ecosystems 2012b, a, Western Wildlife 2013). There are no bird species of conservation significance likely to be impacted in the project area, as the Southern Whiteface, Western Rosella and Peregrine Falcon, if present in the project area, would move to adjacent areas is disturbed. Many of the arid adapted birds are nomadic and move around the arid interior often in search of water and resources and the Peregrine Falcon will normally have a very large home range. Development of the project area, particularly when similar habitat exists in the adjacent areas, is unlikely to significantly impact on any conservation significant species of bird. All birds will readily shift to other areas when there is a disturbance.

Predation by feral cats, foxes and wild dogs has significantly reduced the abundance of Malleefowl in the Goldfields and there are only a few remaining small populations, mostly in areas of dense shrubland, as the dense vegetation provides the adult birds with some protection from predators. There are no active Malleefowl mounds and no secondary evidence (i.e. tracks) of their presence in the project area.

Terrestrial Ecosystems' view is that the proposed development is unlikely to significantly impact on the avian fauna of the bioregion.

5.1.4 Mammals

The diversity of small terrestrial mammals potentially caught in the project area would be low due the sparsely vegetated and degraded habitat and presence of feral and pest fauna. Although, records of Numbats (*Myrmecobius fasciatus*), Burrowing Bettongs (*Bettongia lesueur*) and Bilbies (*Macrotis lagotis*) are shown in the Atlas of Living Australia and historical Western Australian Museum records (Appendix A), they are no longer present in this region, having been predated on by foxes, cats and dogs many years ago. None of the mammals potentially found in the project area are of conservation significance and the loss of small mammals during vegetation clearing is unlikely to be significant in a bioregional context.

It was noted during the site visit that rabbits, feral cats, and dogs are in the project area and surrounds.

Terrestrial Ecosystems' view is that the development of the project area is unlikely to significantly impact on the mammal fauna of the bioregion.

5.2 BIODIVERSITY VALUE

An ecological assessment of a site should consider its biodiversity value at the genetic, species and ecosystem levels, and its ecological functional value at the ecosystem level. There are inadequate data to assess the ecological value at the genetic level, however, this is not an issue as there are no conservation significant species potentially in the project area that require this level of analysis.

Fauna habitat represented in the project area is abundant and in similar condition in adjacent areas. Therefore, the fauna assemblage that is present in the project area will also be present in adjacent areas. The available fauna survey data (Appendix B) provides an indication of the vertebrate fauna that are potentially in the project area.

5.2.1 Ecological functional value at the ecosystem level

Small sections of the project area have been disturbed by pastoral and access tracks with the consequence that these areas will have a depleted vertebrate fauna assemblage. Other than these small areas of disturbance, the most significant impact on vertebrate fauna in the project area and surrounds will have been feral cats.

This site is unlikely to support a conservation significant ecosystem, and conservation significant species in the project area will readily move once vegetation clearing commences.

5.2.2 Maintenance of threatened ecological communities

No threatened ecological fauna communities were identified in the project area.

5.2.3 Condition of fauna habitat

Some of the project area has been disturbed due to historical development activity (i.e. tracks, exploration, etc). There is also evidence of disturbance by cattle and the presence of rabbits and feral cats. There is recent evidence of exploration activity, however, it is mainly near existing degraded areas. The uncleared fauna habitat present in the project area is generally like many square kilometres of adjacent habitat. The clearing of vegetation is therefore unlikely to have a significant impact on the vertebrate fauna when considered in a bioregional context.

5.2.4 Ecological linkages

The project area does not provide an important ecological linkage or fauna movement corridor.

5.2.5 Size and scale of the proposed disturbance

The project area is a small (i.e. 342ha) proportion of similar fauna habitat found in the adjacent areas and bioregion. Given the available fauna survey data for these habitat types, no additional surveys are recommended.

5.2.6 Abundance and distribution of similar habitat in the adjacent areas

Fauna habitats present in the project area are abundant in adjacent areas. It is therefore likely that the fauna assemblage in the project area is like the many square kilometres of similar habitat in adjacent areas and the bioregion.

5.2.7 Potential impacts on ecosystem function

Clearing native vegetation is likely to result in the loss of small vertebrate fauna on-site that are unable to move away during the clearing process. The few larger animals, such as kangaroos and large goannas, and most of the birds will move into adjacent areas once development commences. Shifting animals into adjacent areas will increase the pressure on resources in those areas and it is likely that there will be some disruption to the ecosystems in these areas for a short period until a balance is restored.

Impacts associated with clearing vegetation and development in the project area in a landscape or bioregional context on the vertebrate fauna are likely to be low as the proposed disturbance area is very small relative to the quantity of similar habitat in the bioregion.

6. POTENTIAL ENVIRONMENTAL IMPACTS

Development of the area will potentially affect vertebrate fauna in numerous ways, including death/injury of fauna during vegetation clearing, impacts with vehicles and the loss of habitat.

Although there are anticipated short term impacts on fauna, they are not likely to result in significant impacts on fauna habitat and fauna assemblages in the long term. The overall impact on fauna species and species of conservation significance will be minimal provided the recommended management procedures are implemented and adhered to.

6.1 DIRECT IMPACTS

6.1.1 Animal deaths during the clearing process and displacement of fauna

Clearing vegetation and activities associated with a mine site development will result in the loss of some small fauna that retreat to burrows, such as reptiles and mammals. Nocturnal species are unlikely to be active when most of the land clearing and construction work is taking place which may result in these individuals being adversely impacted when they attempt to escape. This loss of vegetation is unlikely to have a significant impact when considered in a bioregional context. Larger terrestrial animals and avian species will most often move to adjacent areas. These species will be required to establish new activity areas and home ranges, and this could result in the temporary displacement of resident species.

Clearing linear corridors and other areas increases fauna habitat edges. Small mammals can respond both positively and negatively to edges depending on their ecological traits (Laurance 1991, 1994, Goosem and Marsh 1997, Goosem 2000). Edge and disturbance effects can lead to altered and most often higher levels of predation, restricting or increasing fauna movements and altering assemblage structure (Oxley et al. 1974, Paton 1994, Baker et al. 1998, Temple 1998, Luck et al. 1999, Goosem et al. 2001). Goldingay and Whelan (1997) and Clarke and Oldland (2007) reported that edge effects can extend up to 150-200m from the edge for some species, meaning the impact area on vertebrate fauna is likely to be larger than the cleared footprint.

6.1.2 Reduction or loss of activity areas and closure of burrows

Clearing vegetation and associated development activities are likely to destroy reptile and mammal burrows or foraging habitat that are currently in use or could be used again. Clearing vegetation that forms part of the activity area of individuals has the potential to force these animals into adjacent areas. These areas may offer fewer resources placing individuals under survival pressure. It could also cause individuals to move into the territories of other individuals increasing competition for resources. Forced relocations could increase the possibility of predation.

6.2 INDIRECT IMPACTS

In addition to the obvious impact of vegetation clearing there can be an equally significant or greater impact in the adjacent areas because of 'edge effects'. Edge effects can lead to the disruption of ecological processes such as predation and dispersal, animal movements and can change assemblage structure. The consequence is that the impact area will always be much larger than the cleared area however, the sparseness of the vegetation will mean that edge effects are likely to be low in the project area. Vehicle tracks also have the propensity to develop weed infestations which can impact on natural fauna habitats. Cleared corridors can also provide improved predator access to areas, enhance the invasion of pest species into areas and may act as inhibitors or disrupt fauna migration and movement patterns.

There are numerous potential threats associated with vegetation clearing and development that could have an impact on the vertebrate fauna in the project area. Some of these are discussed below.

6.2.1 Habitat fragmentation

In addition to direct impacts of vegetation clearing, infrastructure including tracks, has the potential to fragment habitat. Cleared linear tracks of land are 'unnatural' in much of the habitat. These linear structures that partition existing activity areas, isolate sections of established communities and may alter long and medium-term patterns of movement around established home ranges particularly for small mammals and reptiles. A reduction in the population because of this development would be difficult to detect given our current knowledge of the spatial ecology for most of the small mammals known to be in the area.

The sparseness of the vegetation in most of the project area will mean that the effect of habitat fragmentation is likely to be low.

6.2.2 Introduced fauna and weeds

Increased habitat fragmentation and human activity often results in an increase in the abundance of introduced species such as the house mice (*Mus musculus*), feral cats (*Felis catus*) and wild dogs (*Canis lupus*). This increase may be due to a decline in habitat health, increased road kills, poor disposal of waste and easier access to areas via tracks.

House mice, feral cats and wild dog are known to be established in the area. In many situations they have become a 'naturalised' species in the Australian bush. Increases in wild dog or cat numbers can have a detrimental impact on native fauna because they predate on and compete with native species, disrupting the natural balance. The feral cat is a particularly damaging predator on native fauna and any increase in their numbers could have a detrimental effect on local native fauna (Kinnear 1993, Bamford 1995, Woinarski et al. 2017, Woinarski et al. 2018, Murphy et al. 2019); hence it is important to ensure that populations of the feral predators, such as cats are under control.

Infrastructure known to support feral species, such as rubbish disposal sites and bins, and permanent water should be managed to minimise increases in these populations.

Introduced plant species can successfully and rapidly invade areas of cleared native vegetation or otherwise disturbed by humans. Introduced plant species may replace native species that provide shelter or foraging areas for native fauna. Major changes to the structure of vegetation will alter the fauna habitat and consequently may influence fauna species composition. Preparing and implementing a weed management plan will largely reduce their threat to native fauna species.

6.2.3 Road fauna deaths

An increase in road fauna deaths is likely to occur where new roads / tracks are constructed or upgraded affecting kangaroos, nocturnal birds and ground dwelling large carnivorous predators. Species such as goannas and raptors are attracted to carrion on road verges and therefore, there is an increased propensity for these species to be killed by vehicles. Given the size of the project area, the impacts of road fauna deaths are likely to be low.

6.2.4 Fire

Increased human activity is often associated with an altered fire regime which leads to a degradation of natural ecosystems. Fire has been identified as one of the threatening processes for some conservation significant species as numerous small mammal and bird species rely on long unburnt vegetation.

Large and widespread fires are unlikely to be a significant threat to native fauna species in and adjacent to the project area due to the sparseness of the vegetation.

6.2.5 Anthropogenic activity

Unnatural noises, vibrations, artificial light sources, and vehicle and human movement in an area may be sufficient to force individuals or fauna species to move from adjacent areas or alter their activity periods. This form of disturbance is likely to occur during the initial vegetation clearing and when development activity commences. The overall impact is likely to be confined to a relatively small area and is unlikely to be a significant impact.

6.2.6 Dust

Dust generated from shifting topsoil and increased vehicle traffic can potentially degrade surrounding vegetation, reducing its ability to absorb sunlight and influencing photosynthetic rates. Degradation of these areas may potentially render habitat unsuitable for fauna. Dust suppression and management programs are an essential component of minimising impacts on fauna in areas adjacent to the operation. An effective dust management and monitoring program is required.

7. VERTEBRATE FAUNA RISK ASSESSMENT

7.1 RISK ASSESSMENT

Fauna surveys to support Environmental Impact Assessments (EIA) are part of the environmental risk assessment undertaken to consider what potential impacts a development might have on the biodiversity on a particular area and region. Potential impacts on fauna from the proposed development are identified and briefly described above. Tables 9, 10 and 11 provide a summary of the risk assessment associated with this project.

Any risk assessment is a product of the likelihood of an impact occurring and the consequences of that impact. Likelihood and consequences are categorised and described below. The assessed risk level (likelihood x consequences) is then calculated as the overall risk for the development. This is followed by an assessment of the acceptability of the risk associated with each of the impacts. Disturbances and vegetation clearing have an impact on the fauna at multiple scales – site, local, landscape and regional. Each of these is considered in the risk assessment. This assessment should be considered in the context of the summary in Table 11.

Table 9. Fauna impact risk assessment descriptors

Likelihood		
Level	Description	Criteria
A	Rare	The environmental event may occur, or one or more conservation significant species may be present in exceptional circumstances.
B	Unlikely	The environmental event could occur, or one or more conservation significant species could be present at some time.
C	Moderate	The environmental event should occur, or one or more conservation significant species should be present at some time.
D	Likely	The environmental event will probably occur, or one or more conservation significant species will be present in most circumstances.
E	Almost certain	The environmental event is expected to occur, or one or more conservation significant species is expected be present in most circumstances.
Consequences		
Level	Description	Criteria
1	Insignificant	Insignificant impact on fauna of conservation significance or regional biodiversity, and the loss of individuals will be insignificant in the context of the availability of similar fauna or fauna assemblages in the area.
2	Minor	Impact on fauna localised and no significant impact on species of conservation significance in the project area. Loss of species at the local scale.
3	Moderate	An appreciable loss of fauna in a regional context or a limited impact on species of conservation significance in the project area.
4	Major	Significant impact on conservation significant fauna or their habitat in the project area and/or regional biodiversity and/or a significant loss in the biodiversity at the landscape scale.
5	Catastrophic	Loss of species at the regional scale and/or a significant loss of species categorised as 'vulnerable' or 'endangered' under the EPBC Act (1999) at a regional scale.
Acceptability of Risk		
Level of risk	Management Action Required	
Low	No action required.	
Moderate	Avoid if possible, routine management with internal audit and review of monitoring results annually.	
High	Externally approved management plan to reduce risks, monitor major risks annually with external audit and review of management plan outcomes annually. May a referral to the Commonwealth under the EPBC Act 1999.	
Extreme	Unacceptable, project should be redesigned or not proceed.	

Table 10. Levels of acceptable risk

		Likelihood				
		Rare or very low (A)	Unlikely or low (B)	Moderate (C)	Likely (D)	Almost certain (E)
Consequence	Insignificant (1)	Low	Low	Low	Low	Low
	Minor (2)	Low	Low	Low	Moderate	Moderate
	Moderate (3)	Low	Moderate	Moderate	High	High
	Major (4)	Moderate	Moderate	High	High	Extreme
	Catastrophic (5)	Moderate	High	High	Extreme	Extreme

Table 11. A risk assessment of the impact of ground disturbance activity on fauna

			Before management				With management		
	Potential impacts		Inherent risk			Risk controls	Residual risk		
Factor			Likelihood	Consequence	Significance		Likelihood	Consequence	Significance
Fauna survey data	Inadequate survey data to adequately assess the risks	Unknown loss of fauna, fauna of conservation significance, and fauna assemblages, and an incomplete fauna assessment.	B	2	Low				
	Inadequacy of comparative data	Limits on the availability of comparative data reduced the capacity to assess the uniqueness of the fauna assemblages in the project area.	B	2	Low				
Clearing vegetation	Loss of fauna habitat – local scale	Loss of terrestrial fauna in the project area.	E	2	Mod	Where possible, reduce the extent of clearing and leave large Eucalypt trees.	E	1	Low
	Loss of fauna habitat – landscape scale	Loss of some fauna during vegetation clearing.	B	1	Low				
	Loss of fauna habitat – regional scale	Small loss of some fauna from the region.	B	1	Low				
	Loss of a threatened ecological fauna community	Loss of an undetected threatened ecological fauna community.	A	3	Low				
	Habitat fragmentation	Fauna movement restricted resulting in the death of fauna and a loss of biodiversity.	A	2	Low				
Death or loss of conservation significant fauna	Loss of a unique terrestrial fauna ecosystem	Loss of an ecosystem containing fauna with high species richness, high abundance and numerous top of the food chain predators.	A	2	Low				
	Night Parrot	Loss of a Night Parrot or small population of Night Parrots	A	3	Low				
	Malleefowl	Loss of a Malleefowl or small population of Malleefowl	A	2	Low				
	Southern Whiteface	Loss of a Southern Whiteface or small population of Southern Whiteface	A	3	Low				
	Grey Falcon	Loss of a Grey Falcon or small population of Grey Falcon	A	2	Low				

			Before management				With management		
	Western Rosella	Loss of a Western Rosella or small population of Western Rosella	A	2	Low				
	Central Long-eared Bat	Loss of a Central Long-eared Bat or small population of Central Long-eared Bat	B	2	Low				
	Fork-tailed Swift	Loss of a Fork-tailed Swift or small population of Fork-tailed Swift	A	2	Low				
	Peregrine Falcon	Loss of a Peregrine Falcon	A	2	Low				
Human impacts	Increase or spread of weeds	Changed vegetation and a resulting loss of fauna habitat.	E	2	Mod	Implement weed management protocols.	D	2	Low
	Road kills	Animals being killed by vehicles as they cross roads	E	1	Low	Limiting speeds.	E	1	Low
	Increase in feral fauna; specifically cats	Increased predation on the native fauna	C	3	Mod	Implementation of a feral animal control program(s)	C	2	Low
	Dust	Increased potential for dust	E	2	Mod	Implement dust management protocols	C	2	Low

7.2 NATIVE VEGETATION CLEARING PRINCIPLES AS THEY PERTAIN TO VERTEBRATE FAUNA

The *Environmental Protection Act (1986)* outlines 10 principles that are to be used in the assessment of native vegetation clearing permit applications which are also applicable for other assessments and approvals (Table 12). Where possible, native vegetation should not be cleared if any of the following principles are compromised.

Table 12. Assessment of impact using the native vegetation clearing principles

Principle	Response
It comprises a high level of biological diversity.	Clearing vegetation will not compromise a high level of biodiversity and the fauna assemblage in the project area would be like that in the many square kilometres of undistributed habitat in adjacent areas. Most of the fauna habitat in project area is in good condition, but the vertebrate fauna assemblage would have been impacted over many years by feral cats. There is a possibility the project area supports a small population of Southern Whiteface, but these bush birds will readily move if disturbed, so any impacts would not be significant. The inland form of the Western Rosella and the Peregrine Falcon could potentially be present in the project area but both species will readily move if disturbed and any impacts would not be significant.
It comprises the whole or a part of, or is necessary for the maintenance of, a significant habitat for fauna indigenous to Western Australia.	Although vegetation clearing for exploration and subsequent mining operations would result in the loss of fauna habitat, this loss would not be significant when viewed in a bioregional context because of its abundance in adjacent areas.
It includes, or is necessary for the continued existence or, rare flora.	N/A
It comprises the whole or a part of, or is necessary for the maintenance of, a threatened ecological community.	The area does not contain a threatened ecological fauna community.
It is significant as a remnant of native vegetation in an area that has been extensively cleared.	The area is not a remnant.
It is growing in, or in association with, an environment associated with a watercourses or wetland.	The area does not contain a natural wetland or salt lake.
The clearing of the vegetation is likely to cause appreciable land degradation.	N/A
The clearing of the vegetation is likely to have an impact on the environmental values of any adjacent or nearby conservation area.	Clearing of vegetation is unlikely to impact on the environmental values of the bioregion.
The clearing of the vegetation is likely to cause deterioration in the quality of surface or underground water.	N/A
The clearing of the vegetation is likely to cause, or exacerbate the incidence of flooding.	N/A

7.3 REFERRAL UNDER THE EPBC ACT

Based on the available information, the proposed project is unlikely to significantly impact on a conservation significant vertebrate fauna species, so a referral under the *EPBC Act 1999* is not recommended.

8. SUMMARY

Maximus Resources proposes to establish a new operation focussed on two areas: Hillditch (~122ha) and 8500 (~220ha) which are ~20km south-west of Kambalda on the western side of the Coolgardie – Esperance Highway and 10km west of Lake Lefroy.

Terrestrial Ecosystems undertook a Basic vertebrate fauna survey and risk assessment of both project areas in April 2024. The methodology broadly followed the Environmental Protection Authority's (2020) *Technical Guidance Terrestrial Vertebrate Fauna Surveys for Environmental Impact Assessment* and included desktop searches and site assessment.

There are four broad fauna habitats: chenopod shrubland; closed Eucalypt woodland and Acacia shrubland; Eucalypt and tall Melaleuca woodland; and Eucalypt woodland over mixed shrubs as well as disturbed areas (e.g. tracks).

The site investigation recorded no evidence (e.g. mounds or tracks) of Malleefowl (listed as Vulnerable) in the area. There is a possibility that the Peregrine Falcon (listed as other specially protected fauna), the mallee form of the Western Rosella (Listed as Priority 4) and the Central Long-eared Bat (Listed as Priority 4) may infrequently be seen in the project area, but vegetation clearing and mining activities are unlikely to significantly impact on these species as they will readily move once vegetation clearing commences.

Clearing native vegetation in the project area is likely to result in the loss of small vertebrate fauna on-site that are unable to move away during the clearing process, however, this loss is not likely to be significant when viewed in a bioregional context. The few larger animals, such as kangaroos, large goannas and snakes, and most of the birds will move into adjacent areas once vegetation clearing commences, so potential impacts will be low. There may be an on-going loss of small native fauna to vehicle strikes on access tracks, but overall, this impact will be very low. Forced fauna migrants because of vegetation clearing increase competition for resources, which may result in the subsequent loss of migrants or local individuals. Individuals shifted out of their established activity areas are also vulnerable to predation until they have become established in their new areas.

Impacts on vertebrate fauna associated with clearing vegetation in the project area in a landscape or bioregional context are likely to be low as there are vast tracts of similar fauna habitat in adjacent areas. Feral predators, such as cats, are likely in a landscape context to have a much larger impact on the vertebrate fauna than clearing the vegetation and developing and operating a mine in this location.

Based on the available information, no *EPBC Act* listed species are likely to be significantly impacted by the proposed vegetation clearing and development in the project area; a referral is therefore not recommended.

9. MANAGEMENT STRATEGIES

The purpose of this section is to identify generic management and mitigation strategies to address the potential impacts of development in the project area. Specific management and mitigation strategies to address potential impacts should be addressed in the recommended Vertebrate Fauna Management Protocols and Construction Environmental Management Plan.

9.1 INDUCTION AND AWARENESS

All contractors and staff involved in vegetation clearing, development and ongoing operations should be made aware of the possible presence and issues associated with terrestrial fauna in the area through the induction process.

> **Recommendation 1:** An induction program that includes a component on managing fauna is a mandatory for staff working in the project area.
>
> **Recommendation 2:** Information on protecting fauna and reporting deaths and sightings of feral fauna or conservation significant species should be incorporated into the induction program.

9.2 DUST

Dust generated from vegetation clearing and development could potentially degrade surrounding vegetation, reducing its ability to absorb sunlight, and influencing photosynthetic rates. Degradation of these areas will potentially render habitat unsuitable for fauna. Dust suppression and management programs are an essential component of minimising disturbance impacts on fauna.

> **Recommendation 3:** The impact of dust on adjacent vegetation and fauna habitat is managed against appropriate KPIs and in accordance with the clients' dust management protocols

9.3 MINIMISING HABITAT FRAGMENTATION

Loss of vegetation and habitat may contribute to the decline in the number of fauna on and in the vicinity of project area. Where possible, access routes should be aligned to existing tracks and other barriers or follow the boundaries of broad-scale vegetation associations in the area to minimise the impact on the terrestrial fauna, which are often dependent upon specific habitat types. Clearing should be minimised wherever possible and fragmentation of remnant vegetation should be avoided wherever possible. Once areas are no longer required then they should be rehabilitated.

> **Recommendation 4:** All areas disturbed during exploration are rehabilitated as soon as practical after they are no longer required.
>
> **Recommendation 5:** Where possible, access routes are aligned to existing roads, tracks and other barriers or follow the boundaries of broad-scale vegetation associations in the area.

9.4 MINIMISING SECONDARY IMPACTS TO FAUNA AND FAUNA HABITAT

Pets and feral animals have the potential to impact on fauna. Pets should not be permitted on site and feral and pest fauna numbers monitored and controlled. To be effective, management of feral and pest species needs to be undertaken in collaboration with the landowner, pastoralist, and neighbouring tenement holders.

All rubbish likely to attract animals should be suitably contained and disposed of so as not to encourage the feeding of fauna around the site.

Based on regional data it is highly probable that the project area currently supports a population of feral cats. Reducing the impacts of feral cats will reduce the stress on fauna and fauna assemblages in the area.

Increased activity will result in increased traffic and a consequential increase in the fauna deaths on tracks and roads. Limiting vehicle speeds on access roads can reduce collisions with fauna, particularly larger animals such as kangaroos and emus. Dead animals on the road also have the propensity to attract raptors, goannas and even cattle, which are then likely to be killed.

Recommendation 6: Pets are not permitted on site.

Recommendation 7: All waste and rubbish be contained in bins and regularly removed from the project or placed in land fill and suitably covered to exclude access to predator species.

Recommendation 8: Feeding of native fauna is prohibited.

Recommendation 9: Feral animal management is undertaken in cooperation with neighbouring operations.

9.5 UNCAPPED DRILL HOLES

Uncapped drill holes can pose a serious threat to small animals, including ground dwelling reptiles, frogs and small mammals. A log of all on-site drill holes should be maintained detailing when they were capped, how and by whom. All drill holes should be temporarily capped on completion of drilling and permanently capped or closed as soon as possible after exploration activities have ceased.

Recommendation 10: A log of all on-site drill holes be maintained detailing when they were capped, how and by whom.

9.6 VERTEBRATE FAUNA MANAGEMENT PROTOCOL

Vertebrate fauna management protocols should be implemented that avoid, mitigate and minimise impacts on fauna during the vegetation clearing, infrastructure development and operational phase. These protocols deal with the method of vegetation clearing, reducing fauna deaths on the roads, the impacts of artificial light spill, vibration, dust, feral species management, monitoring and recording conservation species, monitoring impacts on fauna in adjacent areas, staff inductions, etc.

Management of secondary impacts to habitat and fauna should be addressed in Vertebrate Fauna Management Protocols. These should include:

- Control and reduction methods for feral and pest fauna;
- Management of pets on site;
- Habitat fragmentation and barriers to fauna movement;
- Vegetation clearing and development protocols;
- Vehicle impacts on vertebrate fauna (short and long term);
- Vehicle speed limits on site; and
- Anthropogenic activity.

Recommendation 11: Vertebrate fauna management protocols are prepared and implemented for the life of the operation.

9.7 MATURE EUCALYPT TREES WITH HOLLOWS

Mature Salmon Gums with hollows provide nesting opportunities for a variety of birds (e.g. parrots and owls) and diurnal retreat sites for mammals and reptiles (e.g. carpet python) and are therefore of ecological importance in the landscape. Where it is practical for these mature Salmon Gums to be avoided in the development, then that should be done.

> **Recommendation 12:** Where it is practical, mature Eucalypt trees with hollows should be avoided in the development program.

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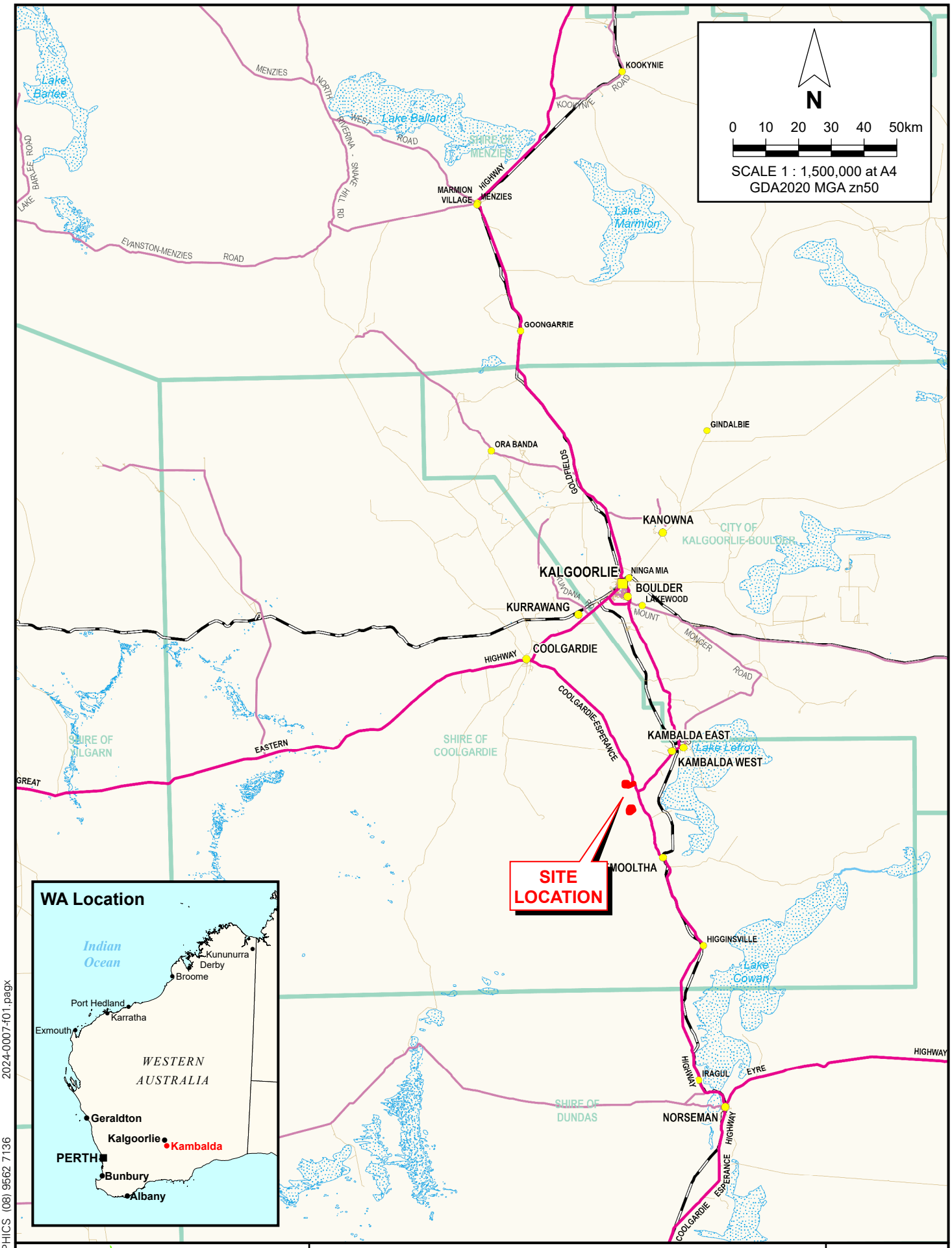
Figures

Basic Vertebrate Fauna Survey and Risk Assessment
Hillditch and 8500 Project Areas



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TERRESTRIAL ECOSYSTEMS

Drawn: S. Thompson

Date: 28 Apr 2024

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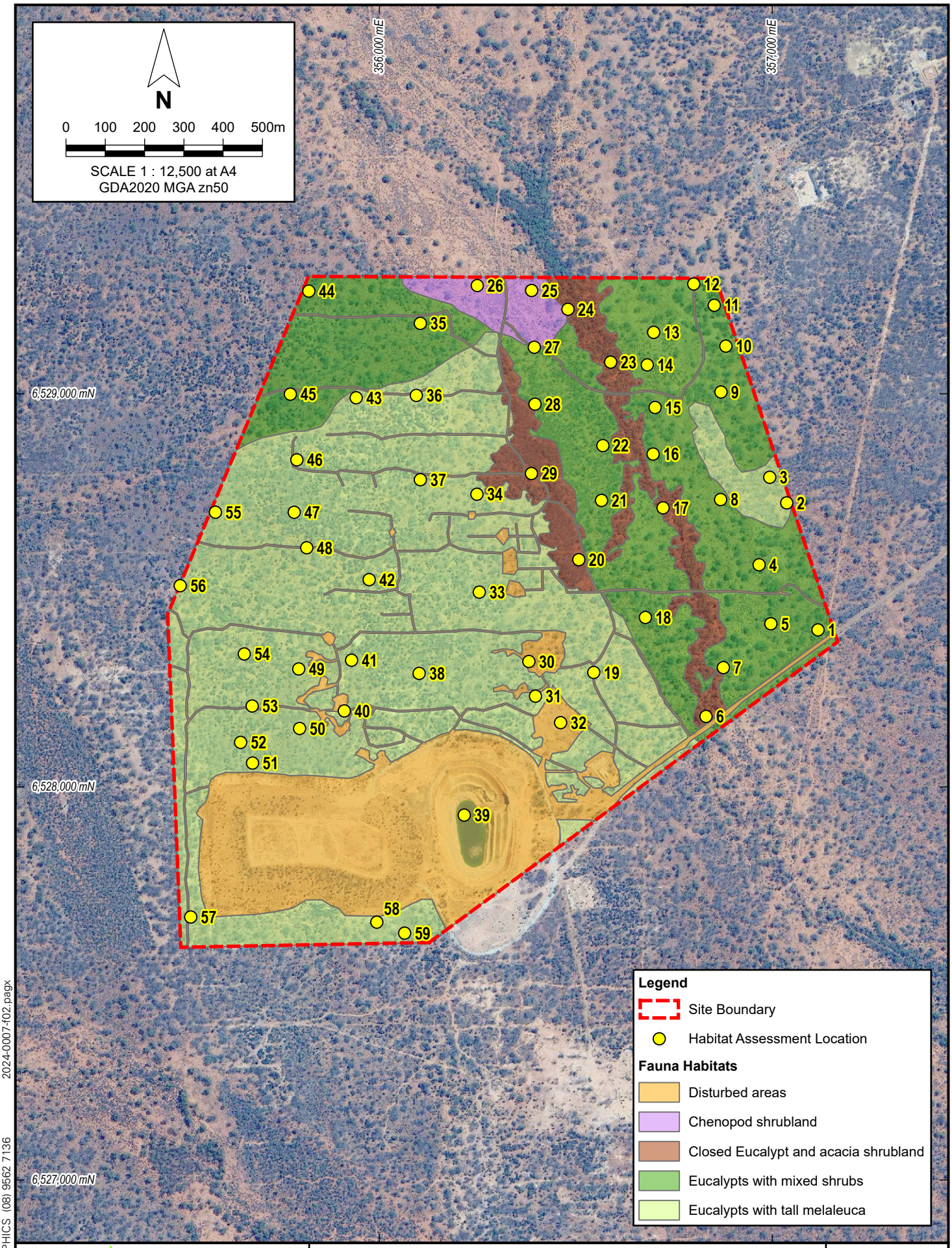
BASIC VERTEBRATE FAUNA SURVEY AND ASSESSMENT
HILLDITCH AND 8500 PROJECT AREAS

REGIONAL LOCATION

Figure 1

Job: 2024-0007



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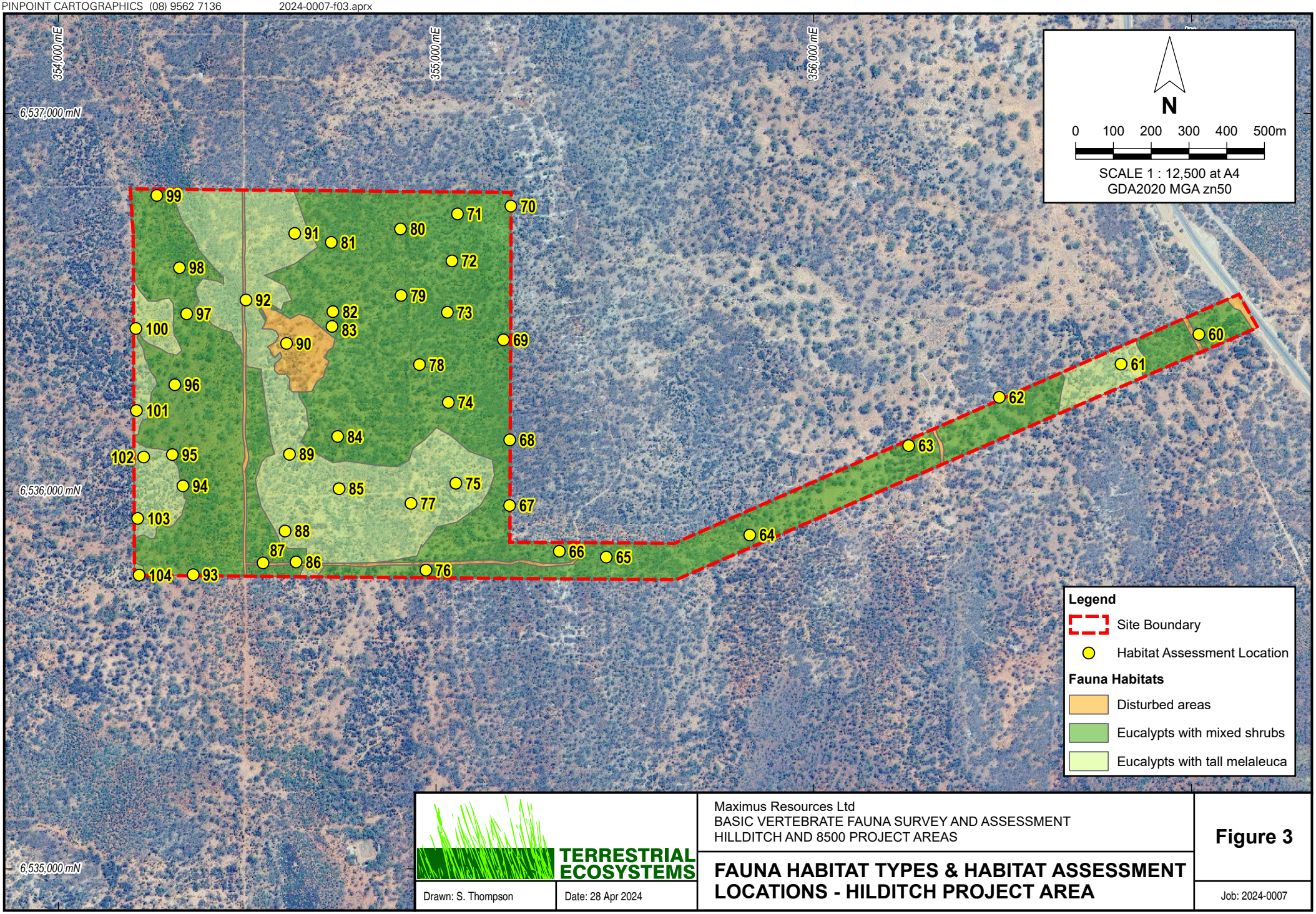
BASIC VERTEBRATE FAUNA SURVEY AND ASSESSMENT
HILLDITCH AND 8500 PROJECT AREAS

FAUNA HABITAT TYPES & HABITAT ASSESSMENT LOCATIONS - 8500 PROJECT AREA

Figure 2

Job: 2024-0007



TERRESTRIAL ECOSYSTEMS

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HILLDITCH AND 8500 PROJECT AREAS

FAUNA HABITAT TYPES & HABITAT ASSESSMENT LOCATIONS - HILLDITCH PROJECT AREA

Figure 3

Job: 2024-0007

Appendix A.
Results of the EPBC Act Protected Matters Search

Basic Vertebrate Fauna Survey and Risk Assessment
Hilldditch and 8500 Project Areas

EPBC Act Protected Matters Report

This report provides general guidance on matters of national environmental significance and other matters protected by the EPBC Act in the area you have selected. Please see the caveat for interpretation of information provided here.

Report created: 17-Apr-2024

Summary

Matters of National Environment Significance

This part of the report summarises the matters of national environmental significance that may occur in, or may relate to, the area you nominated. Further information is available in the detail part of the report, which can be accessed by scrolling or following the links below. If you are proposing to undertake an activity that may have a significant impact on one or more matters of national environmental significance then you should consider the Administrative Guidelines on Significance.

World Heritage Properties:	None
National Heritage Places:	None
Wetlands of International Importance (Ramsar	None
Great Barrier Reef Marine Park:	None
Commonwealth Marine Area:	None
Listed Threatened Ecological Communities:	None
Listed Threatened Species:	9
Listed Migratory Species:	6

Other Matters Protected by the EPBC Act

This part of the report summarises other matters protected under the Act that may relate to the area you nominated. Approval may be required for a proposed activity that significantly affects the environment on Commonwealth land, when the action is outside the Commonwealth land, or the environment anywhere when the action is taken on Commonwealth land. Approval may also be required for the Commonwealth or Commonwealth agencies proposing to take an action that is likely to have a significant impact on the environment anywhere.

The EPBC Act protects the environment on Commonwealth land, the environment from the actions taken on Commonwealth land, and the environment from actions taken by Commonwealth agencies. As heritage values of a place are part of the 'environment', these aspects of the EPBC Act protect the Commonwealth Heritage values of a Commonwealth Heritage place. Information on the new heritage laws can be found at https://www.dcceew.gov.au/parks-heritage/heritage

A permit may be required for activities in or on a Commonwealth area that may affect a member of a listed threatened species or ecological community, a member of a listed migratory species, whales and other cetaceans, or a member of a listed marine species.

Commonwealth Lands:	2
Commonwealth Heritage Places:	None
Listed Marine Species:	10
Whales and Other Cetaceans:	None
Critical Habitats:	None
Commonwealth Reserves Terrestrial:	None
Australian Marine Parks:	None
Habitat Critical to the Survival of Marine Turtles:	None

Extra Information

This part of the report provides information that may also be relevant to the area you have

State and Territory Reserves:	5
Regional Forest Agreements:	None
Nationally Important Wetlands:	None
EPBC Act Referrals:	2
Key Ecological Features (Marine):	None
Biologically Important Areas:	None
Bioregional Assessments:	None
Geological and Bioregional Assessments:	None

Details

Matters of National Environmental Significance

Listed Threatened Species		[Resource Information]
Status of Conservation Dependent and Extinct are not MNES under the EPBC Act. Number is the current name ID.		
Scientific Name	Threatened Category	Presence Text
BIRD		
Aphelocephala leucopsis Southern Whiteface [529]	Vulnerable	Species or species habitat likely to occur within area
Calidris acuminata Sharp-tailed Sandpiper [874]	Vulnerable	Species or species habitat likely to occur within area
Calidris ferruginea Curlew Sandpiper [856]	Critically Endangered	Species or species habitat may occur within area
Falco hypoleucos Grey Falcon [929]	Vulnerable	Species or species habitat likely to occur within area
Leipoa ocellata Malleefowl [934]	Vulnerable	Species or species habitat known to occur within area
Pezoporus occidentalis Night Parrot [59350]	Endangered	Species or species habitat may occur within area
MAMMAL		
Dasyurus geoffroii Chuditch, Western Quoll [330]	Vulnerable	Species or species habitat may occur within area
PLANT		

Scientific Name	Threatened Category	Presence Text
Gastrolobium graniticum		
Granite Poison [14872]	Endangered	Species or species habitat may occur within area
Tecticornia flabelliformis		
Bead Glasswort, Bead Samphire [82664]	Vulnerable	Species or species habitat known to occur within area

Listed Migratory Species [Resource Information]

Scientific Name	Threatened Category	Presence Text
Migratory Marine Birds		
Apus pacificus		
Fork-tailed Swift [678]		Species or species habitat likely to occur within area
Migratory Terrestrial Species		
Motacilla cinerea		
Grey Wagtail [642]		Species or species habitat may occur within area
Migratory Wetlands Species		
Actitis hypoleucos		
Common Sandpiper [59309]		Species or species habitat may occur within area
Calidris acuminata		
Sharp-tailed Sandpiper [874]	Vulnerable	Species or species habitat likely to occur within area
Calidris ferruginea		
Curlew Sandpiper [856]	Critically Endangered	Species or species habitat may occur within area
Calidris melanotos		
Pectoral Sandpiper [858]		Species or species habitat may occur within area

Other Matters Protected by the EPBC Act

Commonwealth Lands [Resource Information]

The Commonwealth area listed below may indicate the presence of Commonwealth land in this vicinity. Due to the unreliability of the data source, all proposals should be checked as to whether it impacts on a Commonwealth area, before making a definitive decision. Contact the State or Territory government land department for further information.

Commonwealth Land Name	State
Unknown	

Commonwealth Land Name	State
Commonwealth Land - [52244]	WA
Commonwealth Land - [52233]	WA

Listed Marine Species [Resource Information]

Scientific Name	Threatened Category	Presence Text
Bird		
Actitis hypoleucos Common Sandpiper [59309]		Species or species habitat may occur within area
Apus pacificus Fork-tailed Swift [678]		Species or species habitat likely to occur within area overfly marine area
Bubulcus ibis as Ardea ibis Cattle Egret [66521]		Species or species habitat may occur within area overfly marine area
Calidris acuminata Sharp-tailed Sandpiper [874]	Vulnerable	Species or species habitat likely to occur within area
Calidris ferruginea Curlew Sandpiper [856]	Critically Endangered	Species or species habitat may occur within area overfly marine area
Calidris melanotos Pectoral Sandpiper [858]		Species or species habitat may occur within area overfly marine area
Chalcites osculans as Chrysococcyx osculans Black-eared Cuckoo [83425]		Species or species habitat likely to occur within area overfly marine area
Merops ornatus Rainbow Bee-eater [670]		Species or species habitat may occur within area overfly marine area

Scientific Name	Threatened Category	Presence Text
Motacilla cinerea		
Grey Wagtail [642]		Species or species habitat may occur within area overfly marine area
Thinornis cucullatus as Thinornis rubricollis		
Hooded Plover, Hooded Dotterel [87735]		Species or species habitat may occur within area overfly marine area

Extra Information

State and Territory Reserves		[Resource Information]
Protected Area Name	Reserve Type	State
Burra	Conservation Park	WA
Kambalda	Nature Reserve	WA
Ngadju	Indigenous Protected Area	WA
Scahill Timber Reserve	5(1)(g) Reserve	WA
Yallari Timber Reserve	5(1)(h) Reserve	WA

EPBC Act Referrals			[Resource Information]
Title of referral	Reference	Referral Outcome	Assessment Status
Not controlled action			
Gold Mining Developments on Lake Lefroy	2010/5402	Not Controlled Action	Completed
Improving rabbit biocontrol: releasing another strain of RHDV, sthrn two thirds of Australia	2015/7522	Not Controlled Action	Completed

Caveat

1 PURPOSE

This report is designed to assist in identifying the location of matters of national environmental significance (MNES) and other matters protected by the Environment Protection and Biodiversity Conservation Act 1999 (Cth) (EPBC Act) which may be relevant in determining obligations and requirements under the EPBC Act.

The report contains the mapped locations of:

- World and National Heritage properties;
- Wetlands of International and National Importance;
- Commonwealth and State/Territory reserves;
- distribution of listed threatened, migratory and marine species;
- listed threatened ecological communities; and
- other information that may be useful as an indicator of potential habitat value.

2 DISCLAIMER

This report is not intended to be exhaustive and should only be relied upon as a general guide as mapped data is not available for all species or ecological communities listed under the EPBC Act (see below). Persons seeking to use the information contained in this report to inform the referral of a proposed action under the EPBC Act should consider the limitations noted below and whether additional information is required to determine the existence and location of MNES and other protected matters.

Where data are available to inform the mapping of protected species, the presence type (e.g. known, likely or may occur) that can be determined from the data is indicated in general terms. It is the responsibility of any person using or relying on the information in this report to ensure that it is suitable for the circumstances of any proposed use. The Commonwealth cannot accept responsibility for the consequences of any use of the report or any part thereof. To the maximum extent allowed under governing law, the Commonwealth will not be liable for any loss or damage that may be occasioned directly or indirectly through the use of, or reliance

3 DATA SOURCES

Threatened ecological communities

For threatened ecological communities where the distribution is well known, maps are generated based on information contained in recovery plans, State vegetation maps and remote sensing imagery and other sources. Where threatened ecological community distributions are less well known, existing vegetation maps and point location data are used to produce indicative distribution maps.

Threatened, migratory and marine species

Threatened, migratory and marine species distributions have been discerned through a variety of methods. Where distributions are well known and if time permits, distributions are inferred from either thematic spatial data (i.e. vegetation, soils, geology, elevation, aspect, terrain, etc.) together with point locations and described habitat; or modelled (MAXENT or BIOCLIM habitat modelling) using

Where little information is available for a species or large number of maps are required in a short time-frame, maps are derived either from 0.04 or 0.02 decimal degree cells; by an automated process using polygon capture techniques (static two kilometre grid cells, alpha-hull and convex hull); or captured manually or by using topographic features (national park boundaries, islands, etc.).

In the early stages of the distribution mapping process (1999-early 2000s) distributions were defined by degree blocks, 100K or 250K map sheets to rapidly create distribution maps. More detailed distribution mapping methods are used to update these distributions

4 LIMITATIONS

The following species and ecological communities have not been mapped and do not appear in this report:

- threatened species listed as extinct or considered vagrants;
- some recently listed species and ecological communities;
- some listed migratory and listed marine species, which are not listed as threatened species; and
- migratory species that are very widespread, vagrant, or only occur in Australia in small numbers.

The following groups have been mapped, but may not cover the complete distribution of the species:

- listed migratory and/or listed marine seabirds, which are not listed as threatened, have only been mapped for recorded
- seals which have only been mapped for breeding sites near the Australian continent

The breeding sites may be important for the protection of the Commonwealth Marine environment.

Refer to the metadata for the feature group (using the Resource Information link) for the currency of the information.

Acknowledgements

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-Department of Environment and Primary Industries, Victoria
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-Department of Environment, Water and Natural Resources, South Australia
-Department of Land and Resource Management, Northern Territory
-Department of Environmental and Heritage Protection, Queensland
-Department of Parks and Wildlife, Western Australia
-Environment and Planning Directorate, ACT
-Birdlife Australia
-Australian Bird and Bat Banding Scheme
-Australian National Wildlife Collection
-Natural history museums of Australia
-Museum Victoria
-Australian Museum
-South Australian Museum
-Queensland Museum
-Online Zoological Collections of Australian Museums
-Queensland Herbarium
-National Herbarium of NSW
-Royal Botanic Gardens and National Herbarium of Victoria
-Tasmanian Herbarium
-State Herbarium of South Australia
-Northern Territory Herbarium
-Western Australian Herbarium
-Australian National Herbarium, Canberra
-University of New England
-Ocean Biogeographic Information System
-Australian Government, Department of Defence
Forestry Corporation, NSW
-Geoscience Australia
-CSIRO
-Australian Tropical Herbarium, Cairns
-eBird Australia
-Australian Government – Australian Antarctic Data Centre
-Museum and Art Gallery of the Northern Territory
-Australian Government National Environmental Science Program
-Australian Institute of Marine Science
-Reef Life Survey Australia
-American Museum of Natural History
-Queen Victoria Museum and Art Gallery, Inveresk, Tasmania
-Tasmanian Museum and Art Gallery, Hobart, Tasmania
-Other groups and individuals

The Department is extremely grateful to the many organisations and individuals who provided expert advice and information on numerous draft distributions.

Please feel free to provide feedback via the Contact us page.

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Appendix B. Vertebrate Fauna Recorded in Biological Surveys in the Region

Basic Vertebrate Fauna Survey and Risk Assessment
Hilldditch and 8500 Project Areas

B.1 VERTEBRATE FAUNA ASSESSMENTS

		Surveys	A	B													C						D			
Family	Species	Common name		WZ18	WZ6	WZ3	WZ7	WZ23	WZ22	WZ25	WZ26	WZ16	WZ2	WZ18a	WZ40	WZ27	Site 15	Site 11	Site 14	Site 16	Site 13	Site 12	Site 14	Site 12	Site 13	Site 16
Amphibians																										
Limnodynastidae	*Neobatrachus kunapalari*	Wheatbelt Frog	X																							
	Neobatrachus pelobatids	Humming Frog	X																							
	Neobatrachus sudelli	Sudell's Frog		1	1																					
	Neobatrachus sutor	Shoemaker Frog	X		1												1									
Myobatrachidae	*Pseudophryne occidentalis*	Western Toadlet	X	3	1	4	2																			
Reptiles																										
Agamidae	*Ctenophorus adelaidensis*	Western Heath Dragon						1																		
	Ctenophorus chapmani	Chapman's Dragon	X																							
	Ctenophorus cristatus	Crested Dragon	X	1	1	1	1	2	3	6	1							5	1				1	1		
	Ctenophorus salinarum	Saltpan Dragon	X									4													2	
	Ctenophorus scutulatus	Lozenge-marked Dragon																		3						1
	Moloch horridus	Thorny Devil	X	1	1					1																
	Pogona minor	Western Bearded Dragon	X		1					2	3								3	2	1		1	1	1	
	Tympanocryptis cephalus	Pebble Dragon																		1						
Carphodactylidae	*Underwoodisaurus milii*	Barking Gecko	X	5			1	2			3											1		1		2
Diplodactylidae	*Amalosia reticulata*	Reticulated Velvet Gecko								21																
	Diplodactylus granariensis	Wheatbelt Stone Gecko	X	5						3													2			
	Diplodactylus pulcher	Beautiful Gecko	X	1		2	1		1																	1
	Hesperoedura reticulata	Reticulated Velvet Gecko	X																							
	Lucasium maini	Main's Ground Gecko	X	26		3			1										2							
	Strophurus assimilis	Goldfields Spiny-tailed Gecko	X																						1	
	Strophurus intermedius	Southern Spiny-tailed Gecko		1																						
Elapidae	*Brachyurophis semifasciata*	Half-girdled Snake	X			1																				1
	Suta gouldii	Gould's Snake	X		1	1		3	1															1		
	Pseudonaja modesta	Ringed Brown Snake																						1		
	Simoselaps bertholdi	Jan's Banded Snake	X							1														1		
Gekkonidae	*Gehyra variegata*	Variegated Gehyra	X	25	1	7			3	10	3		3						2	1			1	1		
	Heteronotia binoei	Bynoe's Gecko	X	4	2	2	1	19	4		6												1		2	
Pygopodidae	*Delma butleri*	Unbanded Delma	X																							
	Delma fraseri	Fraser's Delma	X					1																		
	Delma nasuta	Sharp-snouted Delma									3															

		Surveys	A	B													C						D			
Family	Species	Common name		WZ18	WZ6	WZ3	WZ7	WZ23	WZ22	WZ25	WZ26	WZ16	WZ2	WZ18a	WZ40	WZ27	Site 15	Site 11	Site 14	Site 16	Site 13	Site 12	Site 14	Site 12	Site 13	Site 16
	Lialis burtonis	Burton's Legless Lizard	X								1															
	Pygopus lepidopodus	Common Scaly-foot	X		1																					
Scincidae	*Cryptoblepharus buchananii*	Buchanan's Snake-eyed Skink	X		2			1	1	1	2												1	2		
	Ctenotus atlas	Southern Mallee Ctenotus	X	5						6										1						
	Ctenotus schomburgkii	Barred Wedgesnout Ctenotus	X		1		1	4		4	1						1						3			
	Ctenotus uber	Spotted Ctenotus																								1
	Cyclodomorphus branchialis	Common Slender Bluetongue			2						1															
	Cyclodomorphus melanops	Spinifex Slender Blue-tongue	X																							
	Egernia multiscutata	Southern Sand-skink		1	1				1																	
	Egernia richardi	Bright Crevice-skink	X	1	3		1		1																	
	Hemiergis initialis	South-western Earless Skink	X		2				3	5	1											1				
	Hemiergis millewae	Triodia Earless Skink	X								2															
	Lerista picturata	Southern Robust Slider	X						3	1													1	2		
	Lerista sp.			7	3	1	1		5	2	3												1	2	5	5
	Lerista terdigitata	Robust Mulch Slider									1															
	Lerista timida	Timid Slider	X																							
	Lerista tridactyla	Dark-backed Mulch Slider	X																							
	Liopholis inornata	Desert Skink	X																1							
	Liopholis multiscutata	Bull Skink	X																							
	Menetia greyii	Common Dwarf Skink	X	1	1	3	1				3												1			
	Morethia adelaidensis	Saltbush Morethia Skink	X																		4				1	
	Morethia butleri	Woodland Morethia Skink	X	4		1	1	2			1		1				1		3		1	2				
	Morethia obscura	Shrubland Pale-flecked Morethia	X					1			1											1		2		
	Tiliqua rugosa	Bobtail	X					1		1		3							2							
Typhlopidae	*Anilios bituberculatus*	Prong-snouted Blind Snake				1																				
Varanidae	*Varanus gouldii*	Gould's Goanna	X								1						1									
Birds																										
Casuariidae	*Dromaius novaehollandiae*	Emu			2		9																			
Columbidae	*Phaps chalcoptera*	Common Bronzewing					36							1									1			
Cuculidae	*Chrysococcyx basalis*	Horsfield's Bronze-Cuckoo			1		1	2		1				3	3											
	Chrysococcyx osculans	Black-eared Cuckoo			3	2	1	2						1	2											
Aegothelidae	*Aegotheles cristatus*	Australian Owlet-nightjar												1	1											
Podargidae	*Podargus strigoides*	Tawny Frogmouth													1											
Caprimulgidae	*Eurostopodus argus*	Spotted Nightjar												1												
Accipitridae	*Lophoictinia isura*	Square-tailed Kite						2	1						1											

		Surveys	A	B													C						D			
Family	Species	Common name		WZ18	WZ6	WZ3	WZ7	WZ23	WZ22	WZ25	WZ26	WZ16	WZ2	WZ18a	WZ40	WZ27	Site 15	Site 11	Site 14	Site 16	Site 13	Site 12	Site 14	Site 12	Site 13	Site 16
	Hieraaetus morphnoides	Little Eagle									1			2	1											
	Aquila audax	Wedge-tailed Eagle									1															
	Accipiter cirrocephalus	Collared Sparrowhawk					2					1		3												
Cuculidae	*Heteroscenes pallidus*	Pallid Cuckoo				2			3		2			1												
Strigidae	*Ninox boobook*	Southern Boobook												9												
Meropidae	*Merops ornatus*	Rainbow Bee-eater						2	2		1													1		1
Falconidae	*Falco cenchroides*	Nankeen Kestrel								1																
	Falco berigora	Brown Falcon									1			2	1											
	Falco peregrinus	Peregrine Falcon					1																			
Timaliidae	*Zosterops lateralis*	Silvereye					3		3																	
Psittaculidae	*Polytelis anthopeplus*	Regent Parrot			2			2						26												
	Barnardius zonarius	Australian Ringneck			1		15	3		5				27	2									1		
	Platycercus icterotis	Western Rosella													2											
	Glossopsitta porphyrocephala	Purple-crowned Lorikeet			7	7	13	41	54	9	2			78	13								1	1	1	1
Climacteridae	*Climacteris rufus*	Rufous Treecreeper	X					3	1	2	3			7										1		
Maluridae	*Malurus pulcherrimus*	Blue-breasted Fairywren			22			3																		
	Malurus splendens	Splendid Fairywren	X																							
	Malurus leucopterus	White-winged Fairywren																							1	
Meliphagidae	*Purnella albifrons*	White-fronted Honeyeater	X		8			3	1	1													1			1
	Manorina flavigula	Yellow-throated Miner	X					6		6				4	2									1		
	Acanthagenys rufogularis	Spiny-cheeked Honeyeater	X												1								1	1		1
	Anthochaera carunculata	Red Wattlebird	X			2	26	24	28	5	3			82	4	4								1		1
	Gavicalis virescens	Singing Honeyeater	X					1															1			1
	Ptilotula ornata	Yellow-plumed Honeyeater	X		186	7		86	81	4				256	47								1	1		1
	Epthianura albifrons	White-fronted Chat					2																			
	Lichmera indistincta	Brown Honeyeater	X		46	23	23		4					21									1	1		1
	Nesoptilotis leucotis	White-eared Honeyeater	X		11	1	1	4	8	8	3			3	3	2							1			1
	Melithreptus brevirostris	Brown-headed Honeyeater	X		8		1	4		9	6			2	2											
Pardalotidae	*Pardalotus striatus*	Striated Pardalote	X		4			30	14	23	4			25	29	7							1	1		1
Acanthizidae	*Pyrrholaemus brunneus*	Redthroat	X		21	1	18	9	5	3				3	10								1			1
	Acanthiza apicalis	Inland Thornbill	X		25		19	21	10	15				4	33								1			1
	Acanthiza chrysorrhoa	Yellow-rumped Thornbill	X																					1		
	Acanthiza uropygialis	Chestnut-rumped Thornbill	X				7		5	13				6									1			1
	Smicrornis brevirostris	Weebill	X		6	3		62	72	131	13			38	73	11							1	1		1
Pomatostomidae	*Pomatostomus superciliosus*	White-browed Babbler	X					5			7															1

		Surveys	A	B													C						D			
Family	Species	Common name		WZ18	WZ6	WZ3	WZ7	WZ23	WZ22	WZ25	WZ26	WZ16	WZ2	WZ18a	WZ40	WZ27	Site 15	Site 11	Site 14	Site 16	Site 13	Site 12	Site 14	Site 12	Site 13	Site 16
Cinclosomatidae	*Cinclosoma castanotum*	Chestnut Quail-thrush	X		2			1	5																	1
Campephagidae	*Coracina novaehollandiae*	Black-faced Cuckooshrike	X		1		2	1	1	1				3	1											
Neosittidae	*Daphoenositta chrysoptera*	Varied Sittella	X						8	9																
Oreoicidae	*Oreoica gutturalis*	Crested Bellbird	X		2		2	5	1	5	1	1		4	4								1			1
Pachycephalidae	*Colluricincla harmonica*	Grey Shrikethrush	X		6			1	5	6				3	3								1	1		1
	Pachycephala inornata	Gilbert's Whistler	X			1			1																	
	Pachycephala pectoralis	Golden Whistler	X		19			1	3	4					2											
Artamidae	*Artamus personatus*	Masked Woodswallow												12												
	Artamus cinereus	Black-faced Woodswallow	X																							
	Artamus cyanopterus	Dusky Woodswallow	X					13	2	1				6	1	2								1		
	Cracticus torquatus	Grey Butcherbird	X		2				3	5				7	2									1	1	
	Cracticus nigrogularis	Pied Butcherbird	X		1		2							23												
	Gymnorhina tibicen	Australian Magpie	X																							
	Strepera versicolor	Grey Currawong	X					3	2	15				5												1
Rhipiduridae	*Rhipidura leucophrys*	Willie Wagtail	X				1				1			1		1										
Monarchidae	*Grallina cyanoleuca*	Magpie-lark	X																							
Corvidae	*Corvus bennetti*	Little Crow								25																
	Corvus coronoides	Australian Raven	X																							1
Petroicidae	*Microeca fascinans*	Jacky Winter			1					8	1			2	1	2							1			
	Petroica goodenovii	Red-capped Robin					4		1	1				1	2								1			1
	Eopsaltria australis	Eastern Yellow Robin							4																	
	Eopsaltria griseogularis	Western Yellow Robin	X																							
Locustellidae	*Cincloramphus mathewsi*	Rufous Songlark	X																							
Hirundinidae	*Petrochelidon nigricans*	Tree Martin												14												
Dicaeidae	*Dicaeum hirundinaceum*	Mistletoebird	X					1						6	1											
Motacillidae	*Anthus novaeseelandiae*	Australasian Pipit										9														
Mammals																										
Tachyglossidae	*Tachyglossus aculeatus*	Short-beaked Echidna						1	1																	
Canidae	*Canis lupus*	Dingo	X																							
Molossidae	*Austronomus australis*	White-striped Freetail Bat	X	1							2					1										
Vespertilionidae	*Chalinolobus gouldii*	Gould's Wattled Bat	X	3							4					1										
	Chalinolobus morio	Chocolate Wattled Bat	X	1																						
	Nyctophilus geoffroyi	Lesser Long-eared Bat	X	1																						
	Vespadelus regulus	Southern Forest Bat	X	1	1						5	1														
Dasyuridae	*Sminthopsis crassicaudata*	Fat-tailed Dunnart	X		1						1	1								1	3				3	

		Surveys	A	B													C						D			
Family	Species	Common name		WZ18	WZ6	WZ3	WZ7	WZ23	WZ22	WZ25	WZ26	WZ16	WZ2	WZ18a	WZ40	WZ27	Site 15	Site 11	Site 14	Site 16	Site 13	Site 12	Site 14	Site 12	Site 13	Site 16
	Sminthopsis dolichura	Little Long-tailed Dunnart	X																	2				1		1
	Sminthopsis gilberti	Gilbert's Dunnart																				1				
Burramyidae	*Cercartetus concinnus*	Southwestern Pygmy Possum																		1				3		1
Macropodidae	*Macropus fuliginosus*	Western Grey Kangaroo		1		1		1	1		1	1														
	Osphranter robustus	Euro		1			1																			
Leporidae	*Oryctolagus cuniculus*	Rabbit	X	1			1				1	1														
Muridae	*Mus musculus*	House Mouse	X	1															1	1					4	
	Notomys alexis	Spinifex Hopping Mouse															1									
	Notomys mitchellii	Mitchell's Hopping Mouse															1						1			
	Pseudomys bolami	Bolam's Mouse	X																							
	Pseudomys hermannsburgensis	Sandy Inland Mouse																	1	1						

A Atlas of Living Australia

B Dell, J. and How, R. (1984) Vertebrate fauna. In The Biological Survey of the Eastern Goldfields of Western Australia, *Records of the Western Australian Museum*, Supplement No 18, 57-89.

C ATA Environmental (2006b) *Vertebrate Fauna Assessment St Ives Gold Mine*. Unpublished report for Jim's Seeds, Weeds and Trees, Ltd, Kalgoorlie.

D Western Wildlife (2006) *St Ives Gold Fauna Survey; Spring 2005*. Unpublished report for Jim's Seeds, Weeds and Trees, Perth.

Appendix C. Definitions of Significant Fauna under the WA Biodiversity Conservation Act 2016 and Priority Species

Basic Vertebrate Fauna Survey and Risk Assessment
Hilldditch and 8500 Project Areas

APPENDIX C
DEFINITIONS OF SIGNIFICANT FAUNA UNDER THE WA BIODIVERSITY CONSERVATION ACT 2016

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 Threatened Species

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 *Biodiversity Conservation Act 2016* (BC Act).

Threatened fauna is that subset of 'Specially Protected Fauna' listed under schedules 1 to 3 of the *Wildlife Conservation (Specially Protected Fauna) Notice 2018* for Threatened Fauna.

Threatened flora is that subset of 'Rare Flora' listed under schedules 1 to 3 of the *Wildlife Conservation (Rare Flora) Notice 2018* for Threatened Flora.

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.

CR Critically endangered species

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*".

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 *Wildlife Conservation (Specially Protected Fauna) Notice 2018* for critically endangered fauna or the *Wildlife Conservation (Rare Flora) Notice 2018* for critically endangered flora.

[1] The definition of flora includes algae, fungi and lichens

[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).

EN Endangered species

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*".

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 *Wildlife Conservation (Specially Protected Fauna) Notice 2018* for endangered fauna or the *Wildlife Conservation (Rare Flora) Notice 2018* for endangered flora.

VU Vulnerable species

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*".

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 *Wildlife Conservation (Specially Protected Fauna) Notice 2018* for vulnerable fauna or the *Wildlife Conservation (Rare Flora) Notice 2018* for vulnerable flora.

Extinct Species

Listed by order of the Minister as extinct under section 23(1) of the BC Act as extinct or extinct in the wild.

EX Extinct species

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).

Published as presumed extinct under schedule 4 of the *Wildlife Conservation (Specially Protected Fauna) Notice 2018* for extinct fauna or the *Wildlife Conservation (Rare Flora) Notice 2018* for extinct flora.

EW Extinct in the wild species

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).

Currently there are no threatened fauna or threatened flora species listed as extinct in the pwild. If listing of a species as extinct in the wild occurs, then a schedule will be added to the applicable notice.

Specially Protected Species

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.

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.

MI Migratory birds protected under an international agreement

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).

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 *Convention on the Conservation of Migratory Species of Wild Animals* (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.

Published as migratory birds protected under an international agreement under schedule 5 of the *Wildlife Conservation (Specially Protected Fauna) Notice 2018*.

CD Species of special conservation interest (conservation dependant fauna)

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).

Published as conservation dependent fauna under schedule 6 of the *Wildlife Conservation (Specially Protected Fauna) Notice 2018*.

OS Other specially protected species

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).

Published as other specially protected fauna under schedule 7 of the *Wildlife Conservation (Specially Protected Fauna) Notice 2018*.

P Priority species

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.

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.

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

P1 Priority 1: Poorly-known species

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.

P2 Priority 2: Poorly-known species

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.

P3 Priority 3: Poorly-known species

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.

P4 Priority 4: Rare, Near Threatened and other species in need of monitoring

(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.

(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.

(c) Species that have been removed from the list of threatened species during the past five years for reasons other than taxonomy.

Appendix D.
Rapid habitat assessment results

Basic Vertebrate Fauna Survey and Risk Assessment
Hilldditch and 8500 Project Areas

Date: 3/04/2024 Habitat Assessment #: 1 Observer: Thomas Raymond

GDA94 51; 357116 mE 6528399 mN Fire History: > 5yrs Landform: Flat plain

Soil Type: Sandy clay Habitat Quality: Good Surface: Sand

Habitat Type: Eucalypts with mixed shrubs

Date: 3/04/2024 Habitat Assessment #: 2 Observer: Thomas Raymond

GDA94 51; 357036 mE 6528722 mN Fire History: > 5yrs Landform: Flat plain plain

Soil Type: Sandy clay Habitat Quality: Good Surface: Sand

Habitat Type: Eucalyptus with tall melaleuca

Date: 3/04/2024 Habitat Assessment #: 3 Observer: Thomas Raymond

GDA94 51; 356993 mE 6528787 mN Fire History: > 5yrs Landform: Flat plain plain

Soil Type: Sandy clay Habitat Quality: Good Surface: Sand

Habitat Type: Eucalyptus with tall melaleuca

Date: 3/04/2024 Habitat Assessment #: 4 Observer: Thomas Raymond

GDA94 51; 356966 mE 6528565 mN Fire History: > 5yrs Landform: Flat plain plain

Soil Type: Sandy clay Habitat Quality: Good Surface: Sand

Habitat Type: Eucalypts with mixed shrubs

TERRESTRIAL ECOSYSTEMS

Date: 3/04/2024 Habitat Assessment #: 5 Observer: Thomas Raymond

GDA94 51; 356996 mE 6528414 mN Fire History: > 5yrs Landform: Flat plain plain

Soil Type: Sandy clay Habitat Quality: Good Surface: Sand

Habitat Type: Eucalypts with mixed shrubs

Date: 3/04/2024 Habitat Assessment #: 6 Observer: Thomas Raymond

GDA94 51; 356831 mE 6528179 mN Fire History: > 5yrs Landform: Drainage

Soil Type: Sandy clay Habitat Quality: Good Surface: Sand

Habitat Type: Closed Eucalyptus and Acacia shrubland

TERRESTRIAL ECOSYSTEMS

Date: 3/04/2024 Habitat Assessment #: 7 Observer: Thomas Raymond

GDA94 51; 356875 mE 6528303 mN Fire History: > 5yrs Landform: Drainage

Soil Type: Sandy clay Habitat Quality: Good Surface: Sand

Habitat Type: Eucalypts with mixed shrubs

Date: 3/04/2024 Habitat Assessment #: 8 Observer: Thomas Raymond

GDA94 51; 356868 mE 6528731 mN Fire History: > 5yrs Landform: Drainage

Soil Type: Sandy clay Habitat Quality: Good Surface: Sand

Habitat Type: Eucalypts with mixed shrubs

Date: 3/04/2024 Habitat Assessment #: 9 Observer: Thomas Raymond

GDA94 51; 356869 mE 6529004 mN Fire History: > 5yrs Landform: Flat plain plain

Soil Type: Sandy clay Habitat Quality: Good Surface: Sand

Habitat Type: Eucalypts with mixed shrubs

Date: 3/04/2024 Habitat Assessment #: 10 Observer: Thomas Raymond

GDA94 51; 356881 mE 6529121 mN Fire History: > 5yrs Landform: Flat plain

Soil Type: Sandy clay Habitat Quality: Good Surface: Sand

Habitat Type: Eucalypts with mixed shrubs

TERRESTRIAL ECOSYSTEMS

Date: 3/04/2024 Habitat Assessment #: 11 Observer: Thomas Raymond

GDA94 51; 356852 mE 6529225 mN Fire History: > 5yrs Landform: Flat plain

Soil Type: Sandy clay Habitat Quality: Good Surface: Pebbles, Sand

Habitat Type: Eucalypts with mixed shrubs

Date: 3/04/2024 Habitat Assessment #: 12 Observer: Thomas Raymond

GDA94 51; 356800 mE 6529279 mN Fire History: > 5yrs Landform: Drainage

Soil Type: Sandy clay Habitat Quality: Good Surface: Pebbles, Sand

Habitat Type: Eucalypts with mixed shrubs

Date: 3/04/2024 Habitat Assessment #: 13 Observer: Thomas Raymond

GDA94 51; 356698 mE 6529156 mN Fire History: > 5yrs Landform: Drainage

Soil Type: Sandy clay Habitat Quality: Good Surface: Pebbles, Sand

Habitat Type: Eucalypts with mixed shrubs

Date: 3/04/2024 Habitat Assessment #: 14 Observer: Thomas Raymond

GDA94 51; 356681 mE 6529073 mN Fire History: > 5yrs Landform: Flat plain

Soil Type: Sandy clay Habitat Quality: Good Surface: Pebbles, Sand

Habitat Type: Eucalypts with mixed shrubs

Date: 3/04/2024 Habitat Assessment #: 15 Observer: Thomas Raymond

GDA94 51; 356701 mE 6528965 mN Fire History: > 5yrs Landform: Flat plain

Soil Type: Sandy clay Habitat Quality: Good Surface: Pebbles, Sand

Habitat Type: Eucalypts with mixed shrubs

Date: 3/04/2024 Habitat Assessment #: 16 Observer: Thomas Raymond

GDA94 51; 356696 mE 6528846 mN Fire History: > 5yrs Landform: Drainage

Soil Type: Sandy clay Habitat Quality: Good Surface: Pebbles, Sand

Habitat Type: Eucalypts with mixed shrubs

TERRESTRIAL ECOSYSTEMS

Date: 3/04/2024 Habitat Assessment #: 17 Observer: Thomas Raymond

GDA94 51; 356722 mE 6528709 mN Fire History: > 5yrs Landform: Drainage

Soil Type: Sandy clay Habitat Quality: Good Surface: Pebbles, Sand

Habitat Type: Closed Eucalyptus and Acacia shrubland

Date: 3/04/2024 Habitat Assessment #: 18 Observer: Thomas Raymond

GDA94 51; 356677 mE 6528431 mN Fire History: > 5yrs Landform: Drainage

Soil Type: Sandy clay Habitat Quality: Good Surface: Pebbles, Sand

Habitat Type: Eucalypts with mixed shrubs

Date: 3/04/2024 Habitat Assessment #: 19 Observer: Thomas Raymond

GDA94 51; 356545 mE 6528291 mN Fire History: > 5yrs Landform: Drainage

Soil Type: Sandy clay Habitat Quality: Good Surface: Pebbles, Sand

Habitat Type: Eucalyptus with tall melaleuca

Date: 3/04/2024 Habitat Assessment #: 20 Observer: Thomas Raymond

GDA94 51; 356507 mE 6528578 mN Fire History: > 5yrs Landform: Drainage

Soil Type: Sandy clay Habitat Quality: Good Surface: Sand

Habitat Type: Closed Eucalyptus and Acacia shrubland

Date: 3/04/2024 Habitat Assessment #: 21 Observer: Thomas Raymond

GDA94 51; 356565 mE 6528728 mN Fire History: > 5yrs Landform: Drainage

Soil Type: Sandy clay Habitat Quality: Good Surface: Sand

Habitat Type: Eucalypts with mixed shrubs

Date: 3/04/2024 Habitat Assessment #: 22 Observer: Thomas Raymond

GDA94 51; 356568 mE 6528868 mN Fire History: > 5yrs Landform: Flat plain

Soil Type: Sandy clay Habitat Quality: Good Surface: Sand

Habitat Type: Eucalypts with mixed shrubs

TERRESTRIAL ECOSYSTEMS

Date: 3/04/2024 Habitat Assessment #: 23 Observer: Thomas Raymond

GDA94 51; 356588 mE 6529080 mN Fire History: > 5yrs Landform: Flat plain

Soil Type: Sandy clay Habitat Quality: Good Surface: Sand

Habitat Type: Closed Eucalyptus and Acacia shrubland

Date: 3/04/2024 Habitat Assessment #: 24 Observer: Thomas Raymond

GDA94 51; 356479 mE 6529215 mN Fire History: > 5yrs Landform: Flat plain

Soil Type: Sandy clay Habitat Quality: Good Surface: Sand

Habitat Type: Chenopod Shrubland

TERRESTRIAL ECOSYSTEMS

Date: 3/04/2024 Habitat Assessment #: 25 Observer: Thomas Raymond

GDA94 51; 356387 mE 6529262 mN Fire History: > 5yrs Landform: Flat plain

Soil Type: Sandy clay Habitat Quality: Good Surface: Sand

Habitat Type: Chenopod Shrubland

Date: 3/04/2024 Habitat Assessment #: 26 Observer: Thomas Raymond

GDA94 51; 356249 mE 6529275 mN Fire History: > 5yrs Landform: Drainage

Soil Type: Sandy clay Habitat Quality: Good Surface: Pebbles, Sand

Habitat Type: Chenopod Shrubland

Date: 3/04/2024 Habitat Assessment #: 27 Observer: Thomas Raymond

GDA94 51; 356394 mE 6529118 mN Fire History: > 5yrs Landform: Drainage

Soil Type: Sandy clay Habitat Quality: Good Surface: Pebbles, Sand

Habitat Type: Chenopod Shrubland

Date: 3/04/2024 Habitat Assessment #: 28 Observer: Thomas Raymond

GDA94 51; 356396 mE 6528973 mN Fire History: > 5yrs Landform: Flat plain

Soil Type: Sandy clay Habitat Quality: Good Surface: Pebbles, Sand

Habitat Type: Closed Eucalyptus and Acacia shrubland

Date: 3/04/2024 Habitat Assessment #: 29 Observer: Thomas Raymond

GDA94 51; 356387 mE 6528797 mN Fire History: > 5yrs Landform: Flat plain

Soil Type: Sandy clay Habitat Quality: Good Surface: Pebbles, Sand

Habitat Type: Closed Eucalyptus and Acacia shrubland

Date: 3/04/2024 Habitat Assessment #: 30 Observer: Thomas Raymond

GDA94 51; 356380 mE 6528319 mN Fire History: > 5yrs Landform: Flat plain

Soil Type: Sandy clay Habitat Quality: Disturbed Surface: Pebbles, Sand

Habitat Type: Eucalyptus with tall melaleuca

TERRESTRIAL ECOSYSTEMS

Date: 3/04/2024 Habitat Assessment #: 31 Observer: Thomas Raymond

GDA94 51; 356397 mE 6528230 mN Fire History: > 5yrs Landform: Flat plain

Soil Type: Sandy clay Habitat Quality: Disturbed Surface: Pebbles, Sand

Habitat Type: Eucalyptus with tall melaleuca

Date: 3/04/2024 Habitat Assessment #: 32 Observer: Thomas Raymond

GDA94 51; 356461 mE 6528163 mN Fire History: > 5yrs Landform: Flat plain

Soil Type: Sandy clay Habitat Quality: Good Surface: Cobbles, Pebbles, Sand

Habitat Type: Eucalyptus with tall melaleuca

Date: 3/04/2024 Habitat Assessment #: 33 Observer: Thomas Raymond

GDA94 51; 356254 mE 6528495 mN Fire History: > 5yrs Landform: Flat plain

Soil Type: Sandy clay Habitat Quality: Good Surface: Pebbles, Sand

Habitat Type: Eucalyptus with tall melaleuca

Date: 3/04/2024 Habitat Assessment #: 34 Observer: Thomas Raymond

GDA94 51; 356248 mE 6528744 mN Fire History: > 5yrs Landform: Flat plain

Soil Type: Sandy clay Habitat Quality: Good Surface: Pebbles, Sand

Habitat Type: Eucalyptus with tall melaleuca

TERRESTRIAL ECOSYSTEMS

Date: 3/04/2024 Habitat Assessment #: 35 Observer: Thomas Raymond

GDA94 51; 356104 mE 6529179 mN Fire History: > 5yrs Landform: Flat plain

Soil Type: Sandy clay Habitat Quality: Good Surface: Pebbles, Sand

Habitat Type: Eucalypts with mixed shrubs

Date: 3/04/2024 Habitat Assessment #: 36 Observer: Thomas Raymond

GDA94 51; 356094 mE 6528995 mN Fire History: > 5yrs Landform: Flat plain

Soil Type: Sandy clay Habitat Quality: Good Surface: Pebbles, Sand

Habitat Type: Eucalyptus with tall melaleuca

TERRESTRIAL ECOSYSTEMS

Date: 3/04/2024 Habitat Assessment #: 37 Observer: Thomas Raymond

GDA94 51; 356104 mE 6528781 mN Fire History: > 5yrs Landform: Flat plain

Soil Type: Sandy clay Habitat Quality: Good Surface: Pebbles, Sand

Habitat Type: Eucalyptus with tall melaleuca

Date: 3/04/2024 Habitat Assessment #: 38 Observer: Thomas Raymond

GDA94 51; 356101 mE 6528288 mN Fire History: > 5yrs Landform: Flat plain

Soil Type: Sandy clay Habitat Quality: Good Surface: Pebbles, Sand

Habitat Type: Eucalyptus with tall melaleuca

TERRESTRIAL ECOSYSTEMS

Date: 3/04/2024 Habitat Assessment #: 39 Observer: Thomas Raymond

GDA94 51; 356215 mE 6527928 mN Fire History: > 5yrs Landform: Flat plain

Soil Type: Sandy clay Habitat Quality: Disturbed Surface: Cobbles, Pebbles, Sand

Habitat Type: Pit

Date: 3/04/2024 Habitat Assessment #: 40 Observer: Thomas Raymond

GDA94 51; 355910 mE 6528193 mN Fire History: > 5yrs Landform: Flat plain

Soil Type: Sandy clay Habitat Quality: Disturbed Surface: Pebbles, Sand

Habitat Type: Eucalyptus with tall melaleuca

Date: 3/04/2024 Habitat Assessment #: 41 Observer: Thomas Raymond

GDA94 51; 355929 mE 6528322 mN Fire History: > 5yrs Landform: Flat plain

Soil Type: Sandy clay Habitat Quality: Good Surface: Pebbles, Sand

Habitat Type: Eucalyptus with tall melaleuca

Date: 3/04/2024 Habitat Assessment #: 42 Observer: Thomas Raymond

GDA94 51; 355974 mE 6528527 mN Fire History: > 5yrs Landform: Flat plain

Soil Type: Sandy clay Habitat Quality: Good Surface: Pebbles, Sand

Habitat Type: Eucalyptus with tall melaleuca

Date: 3/04/2024 Habitat Assessment #: 43 Observer: Thomas Raymond

GDA94 51; 355940 mE 6528989 mN Fire History: > 5yrs Landform: Flat plain

Soil Type: Sandy clay Habitat Quality: Good Surface: Pebbles, Sand

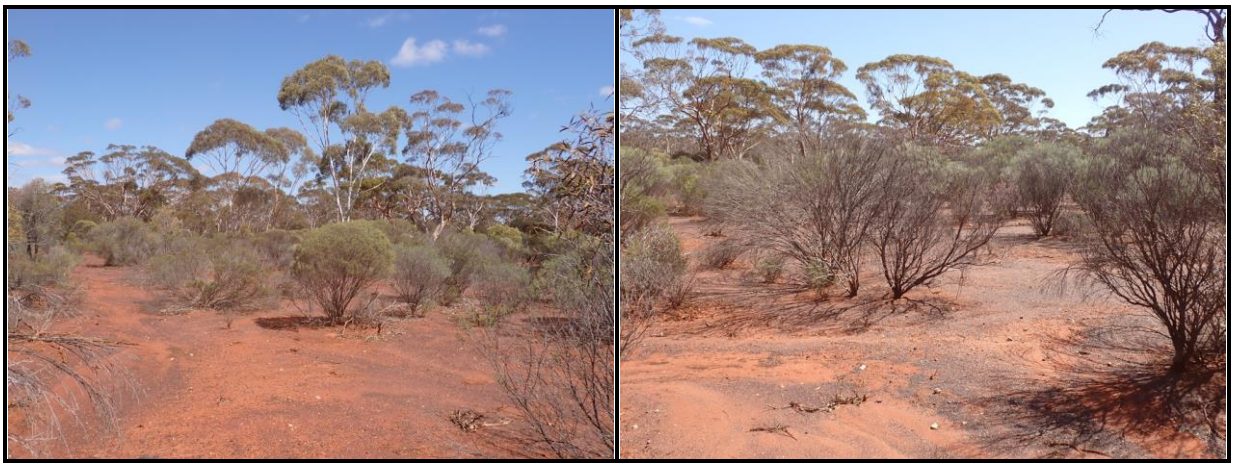
Habitat Type: Eucalypts with mixed shrubs

Date: 3/04/2024 Habitat Assessment #: 44 Observer: Thomas Raymond

GDA94 51; 355820 mE 6529261 mN Fire History: > 5yrs Landform: Flat plain

Soil Type: Sandy clay Habitat Quality: Good Surface: Pebbles, Sand

Habitat Type: Eucalypts with mixed shrubs



TERRESTRIAL ECOSYSTEMS

Date: 3/04/2024 Habitat Assessment #: 45 Observer: Thomas Raymond

GDA94 51; 355773 mE 6528999 mN Fire History: > 5yrs Landform: Flat plain

Soil Type: Sandy clay Habitat Quality: Good Surface: Pebbles, Sand

Habitat Type: Eucalypts with mixed shrubs

Date: 3/04/2024 Habitat Assessment #: 46 Observer: Thomas Raymond

GDA94 51; 355789 mE 6528832 mN Fire History: > 5yrs Landform: Flat plain

Soil Type: Sandy clay Habitat Quality: Good Surface: Pebbles, Sand

Habitat Type: Eucalyptus with tall melaleuca

Date: 3/04/2024 Habitat Assessment #: 47 Observer: Thomas Raymond

GDA94 51; 355783 mE 6528698 mN Fire History: > 5yrs Landform: Flat plain

Soil Type: Sandy clay Habitat Quality: Good Surface: Pebbles, Sand

Habitat Type: Eucalyptus with tall melaleuca

Date: 3/04/2024 Habitat Assessment #: 48 Observer: Thomas Raymond

GDA94 51; 355815 mE 6528608 mN Fire History: > 5yrs Landform: Flat plain

Soil Type: Sandy clay Habitat Quality: Disturbed Surface: Pebbles, Sand

Habitat Type: Eucalyptus with tall melaleuca

TERRESTRIAL ECOSYSTEMS

Date: 3/04/2024 Habitat Assessment #: 49 Observer: Thomas Raymond

GDA94 51; 355794 mE 6528300 mN Fire History: > 5yrs Landform: Flat plain

Soil Type: Sandy clay Habitat Quality: Good Surface: Pebbles, Sand

Habitat Type: Eucalyptus with tall melaleuca

Date: 3/04/2024 Habitat Assessment #: 50 Observer: Thomas Raymond

GDA94 51; 355796 mE 6528148 mN Fire History: > 5yrs Landform: Flat plain

Soil Type: Sandy clay Habitat Quality: Good Surface: Pebbles, Sand

Habitat Type: Eucalyptus with tall melaleuca

Date: 3/04/2024 Habitat Assessment #: 51 Observer: Thomas Raymond

GDA94 51; 355677 mE 6528060 mN Fire History: > 5yrs Landform: Flat plain

Soil Type: Sandy clay Habitat Quality: Good Surface: Pebbles, Sand

Habitat Type: Eucalyptus with tall melaleuca

Date: 3/04/2024 Habitat Assessment #: 52 Observer: Thomas Raymond

GDA94 51; 355646 mE 6528113 mN Fire History: > 5yrs Landform: Flat plain

Soil Type: Sandy clay Habitat Quality: Good Surface: Pebbles, Sand

Habitat Type: Eucalyptus with tall melaleuca

TERRESTRIAL ECOSYSTEMS

Date: 3/04/2024 Habitat Assessment #: 53 Observer: Thomas Raymond

GDA94 51; 355676 mE 6528205 mN Fire History: > 5yrs Landform: Flat plain

Soil Type: Sandy clay Habitat Quality: Good Surface: Pebbles, Sand

Habitat Type: Eucalyptus with tall melaleuca

Date: 3/04/2024 Habitat Assessment #: 54 Observer: Thomas Raymond

GDA94 51; 355656 mE 6528338 mN Fire History: > 5yrs Landform: Flat plain

Soil Type: Sandy clay Habitat Quality: Good Surface: Pebbles, Sand

Habitat Type: Eucalyptus with tall melaleuca

Date: 3/04/2024 Habitat Assessment #: 55 Observer: Thomas Raymond

GDA94 51; 355582 mE 6528698 mN Fire History: > 5yrs Landform: Flat plain

Soil Type: Sandy clay Habitat Quality: Good Surface: Pebbles, Sand

Habitat Type: Eucalyptus with tall melaleuca

Date: 3/04/2024 Habitat Assessment #: 56 Observer: Thomas Raymond

GDA94 51; 355492 mE 6528511 mN Fire History: > 5yrs Landform: Flat plain

Soil Type: Sandy clay Habitat Quality: Good Surface: Pebbles, Sand

Habitat Type: Eucalyptus with tall melaleuca

TERRESTRIAL ECOSYSTEMS

Date: 3/04/2024 Habitat Assessment #: 57 Observer: Thomas Raymond

GDA94 51; 355519 mE 6527668 mN Fire History: > 5yrs Landform: Flat plain

Soil Type: Sandy clay Habitat Quality: Good Surface: Pebbles, Sand

Habitat Type: Eucalyptus with tall melaleuca

Date: 3/04/2024 Habitat Assessment #: 58 Observer: Thomas Raymond

GDA94 51; 355993 mE 6527655 mN Fire History: > 5yrs Landform: Flat plain

Soil Type: Sandy clay Habitat Quality: Good Surface: Pebbles, Sand

Habitat Type: Eucalyptus with tall melaleuca

TERRESTRIAL ECOSYSTEMS

Date: 3/04/2024 Habitat Assessment #: 59 Observer: Thomas Raymond

GDA94 51; 356064 mE 6527627 mN Fire History: > 5yrs Landform: Flat plain

Soil Type: Sandy clay Habitat Quality: Good Surface: Pebbles, Sand

Habitat Type: Eucalyptus with tall melaleuca

Date: 3/04/2024 Habitat Assessment #: 60 Observer: Thomas Raymond

GDA94 51; 357019 mE 6536415 mN Fire History: > 5yrs Landform: Flat plain

Soil Type: Sandy clay Habitat Quality: Good Surface: Pebbles, Sand

Habitat Type: Eucalypts with mixed shrubs

TERRESTRIAL ECOSYSTEMS

Date: 3/04/2024 Habitat Assessment #: 61 Observer: Thomas Raymond

GDA94 51; 356813 mE 6536336 mN Fire History: > 5yrs Landform: Flat plain

Soil Type: Sandy clay Habitat Quality: Good Surface: Pebbles, Sand

Habitat Type: Eucalypts with mixed shrubs

Date: 3/04/2024 Habitat Assessment #: 62 Observer: Thomas Raymond

GDA94 51; 356491 mE 6536248 mN Fire History: > 5yrs Landform: Flat plain

Soil Type: Sandy clay Habitat Quality: Good Surface: Pebbles, Sand

Habitat Type: Eucalypts with mixed shrubs

Date: 3/04/2024 Habitat Assessment #: 63 Observer: Thomas Raymond

GDA94 51; 356251 mE 6536120 mN Fire History: > 5yrs Landform: Flat plain

Soil Type: Sandy clay Habitat Quality: Good Surface: Pebbles, Sand

Habitat Type: Eucalypts with mixed shrubs

Date: 3/04/2024 Habitat Assessment #: 64 Observer: Thomas Raymond

GDA94 51; 355830 mE 6535883 mN Fire History: > 5yrs Landform: Flat plain

Soil Type: Sandy clay Habitat Quality: Good Surface: Pebbles, Sand

Habitat Type: Eucalypts with mixed shrubs

Date: 3/04/2024 Habitat Assessment #: 65 Observer: Thomas Raymond

GDA94 51; 355450 mE 6535825 mN Fire History: > 5yrs Landform: Flat plain

Soil Type: Sandy clay Habitat Quality: Good Surface: Pebbles, Sand

Habitat Type: Eucalypts with mixed shrubs

Date: 3/04/2024 Habitat Assessment #: 66 Observer: Thomas Raymond

GDA94 51; 355326 mE 6535840 mN Fire History: > 5yrs Landform: Drainage

Soil Type: Sandy clay Habitat Quality: Good Surface: Pebbles, Sand

Habitat Type: Eucalypts with mixed shrubs

TERRESTRIAL ECOSYSTEMS

Date: 3/04/2024 Habitat Assessment #: 67 Observer: Thomas Raymond

GDA94 51; 355194 mE 6535962 mN Fire History: > 5yrs Landform: Flat plain

Soil Type: Sandy clay Habitat Quality: Good Surface: Pebbles, Sand

Habitat Type: Eucalypts with mixed shrubs

Date: 3/04/2024 Habitat Assessment #: 68 Observer: Thomas Raymond

GDA94 51; 355195 mE 6536135 mN Fire History: > 5yrs Landform: Flat plain

Soil Type: Sandy clay Habitat Quality: Good Surface: Pebbles, Sand

Habitat Type: Eucalypts with mixed shrubs

Date: 3/04/2024 Habitat Assessment #: 69 Observer: Thomas Raymond

GDA94 51; 355178 mE 6536400 mN Fire History: > 5yrs Landform: Flat plain

Soil Type: Sandy clay Habitat Quality: Good Surface: Pebbles, Sand

Habitat Type: Eucalypts with mixed shrubs

Date: 3/04/2024 Habitat Assessment #: 70 Observer: Thomas Raymond

GDA94 51; 355198 mE 6536754 mN Fire History: > 5yrs Landform: Flat plain

Soil Type: Sandy clay Habitat Quality: Good Surface: Pebbles, Sand

Habitat Type: Eucalypts with mixed shrubs

TERRESTRIAL ECOSYSTEMS

Date: 3/04/2024 Habitat Assessment #: 71 Observer: Thomas Raymond

GDA94 51; 355056 mE 6536734 mN Fire History: > 5yrs Landform: Flat plain

Soil Type: Sandy clay Habitat Quality: Good Surface: Pebbles, Sand

Habitat Type: Eucalypts with mixed shrubs

Date: 3/04/2024 Habitat Assessment #: 72 Observer: Thomas Raymond

GDA94 51; 355042 mE 6536609 mN Fire History: > 5yrs Landform: Flat plain

Soil Type: Sandy clay Habitat Quality: Good Surface: Pebbles, Sand

Habitat Type: Eucalypts with mixed shrubs

Date: 3/04/2024 Habitat Assessment #: 73 Observer: Thomas Raymond

GDA94 51; 355029 mE 6536473 mN Fire History: > 5yrs Landform: Flat plain

Soil Type: Sandy clay Habitat Quality: Good Surface: Pebbles, Sand

Habitat Type: Eucalypts with mixed shrubs

Date: 3/04/2024 Habitat Assessment #: 74 Observer: Thomas Raymond

GDA94 51; 355032 mE 6536235 mN Fire History: > 5yrs Landform: Flat plain

Soil Type: Sandy clay Habitat Quality: Good Surface: Pebbles, Sand

Habitat Type: Eucalypts with mixed shrubs

Date: 3/04/2024 Habitat Assessment #: 75 Observer: Thomas Raymond

GDA94 51; 355052 mE 6536021 mN Fire History: > 5yrs Landform: Flat plain

Soil Type: Sandy clay Habitat Quality: Good Surface: Pebbles, Sand

Habitat Type: Eucalyptus with tall melaleuca

Date: 3/04/2024 Habitat Assessment #: 76 Observer: Thomas Raymond

GDA94 51; 354973 mE 6535791 mN Fire History: > 5yrs Landform: Flat plain

Soil Type: Sandy clay Habitat Quality: Good Surface: Pebbles, Sand

Habitat Type: Eucalypts with mixed shrubs

TERRESTRIAL ECOSYSTEMS

Date: 3/04/2024 Habitat Assessment #: 77 Observer: Thomas Raymond

GDA94 51; 354933 mE 6535967 mN Fire History: > 5yrs Landform: Flat plain

Soil Type: Sandy clay Habitat Quality: Good Surface: Pebbles, Sand

Habitat Type: Eucalyptus with tall melaleuca

Date: 3/04/2024 Habitat Assessment #: 78 Observer: Thomas Raymond

GDA94 51; 354956 mE 6536335 mN Fire History: > 5yrs Landform: Flat plain

Soil Type: Sandy clay Habitat Quality: Good Surface: Pebbles, Sand

Habitat Type: Eucalypts with mixed shrubs

TERRESTRIAL ECOSYSTEMS

Date: 3/04/2024 Habitat Assessment #: 79 Observer: Thomas Raymond

GDA94 51; 354907 mE 6536518 mN Fire History: > 5yrs Landform: Flat plain

Soil Type: Sandy clay Habitat Quality: Good Surface: Pebbles, Sand

Habitat Type: Eucalypts with mixed shrubs

Date: 3/04/2024 Habitat Assessment #: 80 Observer: Thomas Raymond

GDA94 51; 354905 mE 6536694 mN Fire History: > 5yrs Landform: Flat plain

Soil Type: Sandy clay Habitat Quality: Good Surface: Pebbles, Sand

Habitat Type: Eucalypts with mixed shrubs

TERRESTRIAL ECOSYSTEMS

Date: 3/04/2024 Habitat Assessment #: 81 Observer: Thomas Raymond

GDA94 51; 354722 mE 6536658 mN Fire History: > 5yrs Landform: Flat plain

Soil Type: Sandy clay Habitat Quality: Good Surface: Pebbles, Sand

Habitat Type: Eucalypts with mixed shrubs

Date: 3/04/2024 Habitat Assessment #: 82 Observer: Thomas Raymond

GDA94 51; 354726 mE 6536475 mN Fire History: > 5yrs Landform: Flat plain

Soil Type: Sandy clay Habitat Quality: Good Surface: Pebbles, Sand

Habitat Type: Eucalypts with mixed shrubs

Date: 3/04/2024 Habitat Assessment #: 83 Observer: Thomas Raymond

GDA94 51; 354724 mE 6536436 mN Fire History: > 5yrs Landform: Flat plain

Soil Type: Sandy clay Habitat Quality: Good Surface: Pebbles, Sand

Habitat Type: Disturbed area

Date: 3/04/2024 Habitat Assessment #: 84 Observer: Thomas Raymond

GDA94 51; 354739 mE 6536144 mN Fire History: > 5yrs Landform: Disterbed

Soil Type: Sandy clay Habitat Quality: Good Surface: Pebbles, Sand

Habitat Type: Eucalypts with mixed shrubs

TERRESTRIAL ECOSYSTEMS

Date: 3/04/2024 Habitat Assessment #: 85 Observer: Thomas Raymond

GDA94 51; 354743 mE 6536006 mN Fire History: > 5yrs Landform: Flat plain

Soil Type: Sandy clay Habitat Quality: Good Surface: Pebbles, Sand

Habitat Type: Eucalyptus with tall melaleuca

Date: 3/04/2024 Habitat Assessment #: 86 Observer: Thomas Raymond

GDA94 51; 354629 mE 6535812 mN Fire History: > 5yrs Landform: Flat plain

Soil Type: Sandy clay Habitat Quality: Good Surface: Pebbles, Sand

Habitat Type: Eucalypts with mixed shrubs

TERRESTRIAL ECOSYSTEMS

Date: 3/04/2024 Habitat Assessment #: 87 Observer: Thomas Raymond

GDA94 51; 354541 mE 6535810 mN Fire History: > 5yrs Landform: Flat plain

Soil Type: Sandy clay Habitat Quality: Disturbed Surface: Pebbles, Sand

Habitat Type: Eucalypts with mixed shrubs

Date: 3/04/2024 Habitat Assessment #: 88 Observer: Thomas Raymond

GDA94 51; 354600 mE 6535894 mN Fire History: > 5yrs Landform: Flat plain

Soil Type: Sandy clay Habitat Quality: Good Surface: Pebbles, Sand

Habitat Type: Eucalyptus with tall melaleuca

TERRESTRIAL ECOSYSTEMS

Date: 3/04/2024 Habitat Assessment #: 89 Observer: Thomas Raymond

GDA94 51; 354611 mE 6536097 mN Fire History: > 5yrs Landform: Flat plain

Soil Type: Sandy clay Habitat Quality: Good Surface: Pebbles, Sand

Habitat Type: Eucalyptus with tall melaleuca

Date: 3/04/2024 Habitat Assessment #: 90 Observer: Thomas Raymond

GDA94 51; 354604 mE 6536391 mN Fire History: > 5yrs Landform: Disterbed

Soil Type: Sandy clay Habitat Quality: Disturbed Surface: Pebbles, Sand

Habitat Type: Eucalyptus with tall melaleuca

TERRESTRIAL ECOSYSTEMS

Date: 3/04/2024 Habitat Assessment #: 91 Observer: Thomas Raymond

GDA94 51; 354625 mE 6536682 mN Fire History: > 5yrs Landform: Flat plain

Soil Type: Sandy clay Habitat Quality: Good Surface: Pebbles, Sand

Habitat Type: Eucalyptus with tall melaleuca

Date: 3/04/2024 Habitat Assessment #: 92 Observer: Thomas Raymond

GDA94 51; 354496 mE 6536506 mN Fire History: > 5yrs Landform: Flat plain

Soil Type: Sandy clay Habitat Quality: Good Surface: Pebbles, Sand

Habitat Type: Eucalyptus with tall melaleuca

Date: 3/04/2024 Habitat Assessment #: 93 Observer: Thomas Raymond

GDA94 51; 354356 mE 6535778 mN Fire History: > 5yrs Landform: Flat plain

Soil Type: Sandy clay Habitat Quality: Good Surface: Pebbles, Sand

Habitat Type: Eucalypts with mixed shrubs

Date: 3/04/2024 Habitat Assessment #: 94 Observer: Thomas Raymond

GDA94 51; 354329 mE 6536013 mN Fire History: > 5yrs Landform: Flat plain

Soil Type: Sandy clay Habitat Quality: Good Surface: Pebbles, Sand

Habitat Type: Eucalypts with mixed shrubs

Date: 3/04/2024 Habitat Assessment #: 95 Observer: Thomas Raymond

GDA94 51; 354301 mE 6536096 mN Fire History: > 5yrs Landform: Flat plain

Soil Type: Sandy clay Habitat Quality: Good Surface: Pebbles, Sand

Habitat Type: Eucalypts with mixed shrubs

Date: 3/04/2024 Habitat Assessment #: 96 Observer: Thomas Raymond

GDA94 51; 354308 mE 6536281 mN Fire History: > 5yrs Landform: Flat plain

Soil Type: Sandy clay Habitat Quality: Good Surface: Pebbles, Sand

Habitat Type: Eucalypts with mixed shrubs

Date: 3/04/2024 Habitat Assessment #: 97 Observer: Thomas Raymond

GDA94 51; 354339 mE 6536469 mN Fire History: > 5yrs Landform: Flat plain

Soil Type: Sandy clay Habitat Quality: Good Surface: Pebbles, Sand

Habitat Type: Eucalypts with mixed shrubs

Date: 3/04/2024 Habitat Assessment #: 98 Observer: Thomas Raymond

GDA94 51; 354320 mE 6536591 mN Fire History: > 5yrs Landform: Flat plain

Soil Type: Sandy clay Habitat Quality: Good Surface: Pebbles, Sand

Habitat Type: Eucalypts with mixed shrubs

Date: 3/04/2024 Habitat Assessment #: 99 Observer: Thomas Raymond

GDA94 51; 354260 mE 6536783 mN Fire History: > 5yrs Landform: Flat plain

Soil Type: Sandy clay Habitat Quality: Good Surface: Pebbles, Sand

Habitat Type: Eucalypts with mixed shrubs

Date: 3/04/2024 Habitat Assessment #: 100 Observer: Thomas Raymond

GDA94 51; 354205 mE 6536430 mN Fire History: > 5yrs Landform: Flat plain

Soil Type: Sandy clay Habitat Quality: Good Surface: Pebbles, Sand

Habitat Type: Eucalyptus with tall melaleuca

Date: 3/04/2024 Habitat Assessment #: 101 Observer: Thomas Raymond

GDA94 51; 354206 mE 6536213 mN Fire History: > 5yrs Landform: Flat plain

Soil Type: Sandy clay Habitat Quality: Good Surface: Pebbles, Sand

Habitat Type: Eucalyptus with tall melaleuca

Date: 3/04/2024 Habitat Assessment #: 102 Observer: Thomas Raymond

GDA94 51; 354225 mE 6536090 mN Fire History: > 5yrs Landform: Flat plain

Soil Type: Sandy clay Habitat Quality: Good Surface: Pebbles, Sand

Habitat Type: Eucalyptus with tall melaleuca

TERRESTRIAL ECOSYSTEMS

Date: 3/04/2024 Habitat Assessment #: 103 Observer: Thomas Raymond

GDA94 51; 354209 mE 6535927 mN Fire History: > 5yrs Landform: Flat plain

Soil Type: Sandy clay Habitat Quality: Good Surface: Pebbles, Sand

Habitat Type: Eucalyptus with tall melaleuca

Date: 3/04/2024 Habitat Assessment #: 104 Observer: Thomas Raymond

GDA94 51; 354213 mE 6535777 mN Fire History: > 5yrs Landform: Flat plain

Soil Type: Sandy clay Habitat Quality: Good Surface: Pebbles, Sand

Habitat Type: Eucalyptus with tall melaleuca


DETECTION DOG

Appendix 5: Targeted ABAB Survey Report (Terrestrial Ecosystems 2024b)

TERRESTRIAL ECOSYSTEMS

Ref: 2024-0088-005-st

14 October 2024

Tim Wither
Managing Director
Maximus Resources
GPO Box 1167,
Adelaide, SA, 5001

Re: Arid Bronze Azure Butterfly survey for the Hilditch project area

Dear Tim

Terrestrial Ecosystems is pleased to provide the outcomes of a targeted survey for the Arid Bronze Azure Butterfly for the Hilditch project area (i.e. project area: Figure 1).

Arid Bronze Azure Butterfly

The Arid Bronze Azure Butterfly (ABAB) is associated with colonies of the ant *Camponotus terebrans* in mallee vegetation on sandy soil, often near flood plains, and the ant typically digs its nest at the base of eucalypts (Threatened Species Scientific Committee 2014). Butterfly larvae hatching from eggs laid near an ant nest entrance (often near the bases of various mallee eucalypts) are carried, by the ants, into their nest. Details of *C. terebrans* biology and any form of herbivory by the larvae are unknown; however, the larvae are likely to be myrmecophagous. These butterflies fly close to the ground and have been observed flying over agricultural lands near presumed breeding colonies (Williams and Williams 2008). The goldfields population was originally known from Lake Douglas, about 12km south-west of Kalgoorlie (Field 1999), however, this population is reported to have become extinct (Williams et al. 2008, Williams and Williams 2008, Williams et al. 2018). There is an extant population in the Barbalin Nature Reserve (~11km west of Mukinbudin) in the Avon Wheatbelt (Threatened Species Scientific Committee 2014) and a more recently discovered population 40-60km north of Kalgoorlie (M. Byrne, DBCA pers comm.). There is also an additional extant population 100km from Barbalin Nature Reserve, but the DBCA has not provided its location nor direction from Barbalin Nature Reserve. There are some more recently discovered populations ~50km north of Kalgoorlie and ~20km north of Kalgoorlie near the Gidji Roaster.

Camponotus terebrans is typically only found in areas with smooth bark Eucalypts including Gimlet (*Eucalyptus salubris*) and Lake Grace Gum (*Eucalyptus loxophleba* ssp. *gratiae*), but also Wheatbelt Wandoo (*E. capillosa*) and Salmon Gum (*E. salmonophloia*). At Lake Douglas, the host tree was *Eucalyptus concinna* (Field 1999, Threatened Species Scientific Committee 2014). The ants typically form a crescent-shaped nest at the base of eucalypts. Some of these tree species are present in the project area.

Williams and Williams (2008; p.8) commented that 'Over 30 surveys have been conducted in the region by DEC staff and experienced volunteers between 1992 and 2008' and 'include extensive surveys between Payne's Find and Kalgoorlie, including most of the major conservation reserves. The surveys have covered extensive parts of the region in which *O. s. petrina* might occur, but have not detected any individuals or additional populations of the butterfly' (Williams and Williams 2008; p.8). The fact that further populations have not been located, despite the species being conspicuous, demonstrates the rarity of this butterfly and the significance of the Barbalin site.' (Williams and Williams 2008; p.9).

Due to the presence of smooth-barked Eucalypt trees and proximity to the extinct population at Lake Douglas and a recently discovered population north of Kalgoorlie, a targeted survey was undertaken. Due to the obligate association of the ABAB with the host ant, surveys to detect this species need to consider both species. The habitat critical for the ABAB is the optimal habitat for the host ant. If the ant does not occur in a survey area, then ABAB will be absent. However, ant presence does not guarantee the ABAB is present, given that only the larger colonies will support a butterfly population. A large ant colony is a strong indicator of potential presence of the Arid Bronze Azure Butterfly.

Terrestrial Ecosystems visited the Barbalin Nature Reserve in September 2024 to confirm that the host ants were active.

Targeted ant survey

Ant surveys can be conducted at any time of year, although lower ant activity in winter may result in lower activity levels and may reduce the chances of detection, which increases the risks of regulators not approving the methods. The optimal time to conduct ant surveys is when the ABAB is active from mid-September to late October, however, the ABAB is still active in lower numbers between late October and late April. The field survey was completed on 12-15 September 2024 by Tom Raymond and Isaac Cable. The field survey was therefore completed during an appropriate season.

Using Formulae 1 and 2, the number of mature trees required to adequately sample the area and their approximate spacing was calculated (Department of Biodiversity Conservation and Attractions 2020).

Formula 1. Number of sample trees = 10 x √ (site area in hectares)

Formula 2. Spacing of tree sampling = √ [(site area in hectares x 10,000) / No. sample trees]

The ant survey comprised the following technique:

- After selecting a sample tree, we used a pick to disturb the soil/bark/detritus at the base of the tree to a depth of ~10cm; and
- Observed for about 20-30 seconds to see if any host ants appear.
-

There is ~120ha of Eucalypt woodland in the project area. Terrestrial Ecosystems therefore calculated that 110 trees with an approximate spacing of 104m between trees needed to be sampled. Terrestrial Ecosystems sampled 117 trees at a spacing of 100m and included all habitat areas with smooth-barked eucalypt trees and mallee (Figure 2).

The following details were recorded for each tree:

- Tree type (smooth-bark or rough bark);
- GPS location;
- Tree diameter at ~1.5m height; and
- Ant and leafhopper presence/absence.

All of the tree data are shown in Appendix 1 and images in Appendix 3.

The targeted ant survey was undertaken in accordance with the DBCA guidelines (2020) for the survey of Arid Bronze Azure Butterfly in Western Australia.

Results

Although ants were present in the project area, no *Camponotus terebrans* were recorded.

Butterfly survey

Due to their dependence on the host ant, adult ABABs will always be found close to the breeding areas. As such, areas within and around places that have high densities of ants are a priority for surveys. Male ABABs are territorial, and they often establish small territories in open areas or along tracks so any tracks near the ant occurrences should be included in the survey area.

Surveys to detect the ABABs follow the standard butterfly walk transect method. Once the route of the transects is determined, it is investigated at a steady pace by one or more observers. Any ABABs seen to each side and ahead of the observers are recorded.

ABABs are only active in fine, warm weather and prefer sunny days with temperatures >23ºC and light winds. The optimal time of day to observe them is between 10am and 3pm. Before commencing each transect survey the following details were recorded:

- site name;
- date of survey;
- number and identity of observers;
- weather conditions – air temperature, wind speed and direction, estimate of cloudiness (% cloud cover); and
- the start and end time of transect which can be used to quantify survey effort.

At the completion of the survey the temperature, wind speed and direction, and cloud cover were recorded again. These data are provided in Appendix 2.

The length of the butterfly search transect is determined using Formula 3.

Formula 3. Transect length = 0.7 x √ (ant habitat area in hectares) km.

Terrestrial Ecosystems calculated that 7.7km of butterfly search transect was required to adequately survey the project area. Terrestrial Ecosystems completed 31.3km of transect searching in the project area, but it is acknowledged that some of this track survey was along the same transect multiple times. The entire project area was surveyed (Figure 2).

The butterfly survey was undertaken per the DBCA guidelines (2020) for the survey of Arid Bronze Azure Butterfly in Western Australia.

Results

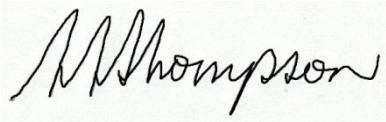
No Arid Bronze Azure Butterflies were recorded.

Conclusion

There was no evidence to indicate that the Arid Bronze Azure Butterfly or its host ant are present in the Hilditch project area.

Please do not hesitate to contact the undersigned (0407 385 239), if you require any further information regarding this report.

Yours sincerely



Dr Scott Thompson
Partner and Principal Zoologist

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Williams, M. R., and A. A. E. Williams. 2008. Threats to the critically endangered Arid Bronze Azure butterfly (*Ogyris subterrestris petrina*) by proposed vegetation clearing. Perth.

Disclaimer

This document is prepared in accordance with and subject to an agreement between Terrestrial Ecosystems and the client, Maximus Resources. It has been prepared and is restricted to those issues that have been raised by the client in its engagement of Terrestrial Ecosystems and prepared using the standard of skill and care ordinarily exercised by environmental scientists in the preparation of such reports.

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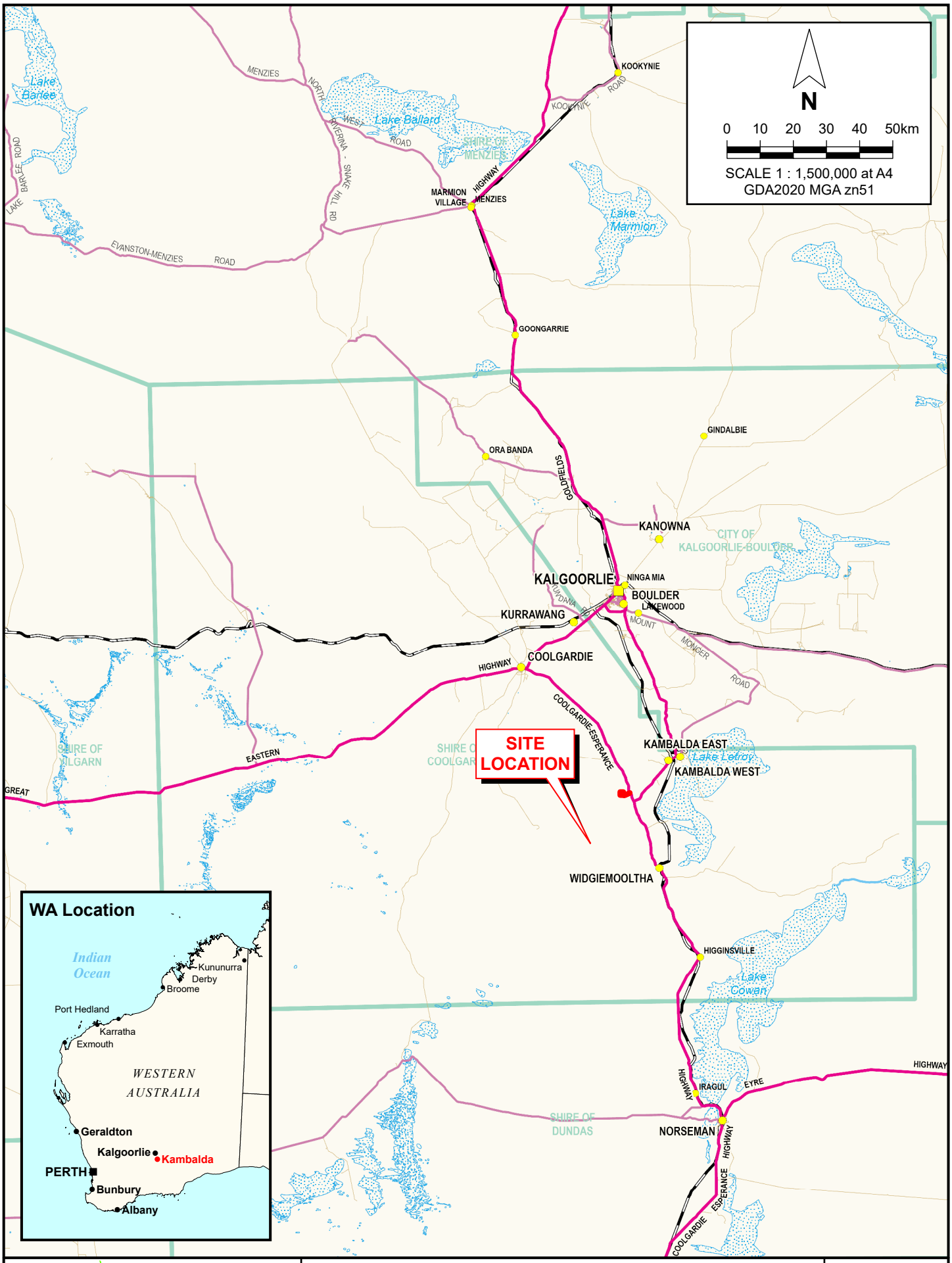

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TERRESTRIAL ECOSYSTEMS

Maximus Resources Ltd
ARID BRONZE AZURE BUTTERFLY SURVEY
HILDITCH PROJECT AREA

REGIONAL LOCATION

Figure 1

Drawn: S. Thompson

Date: 11 Oct 2024

Job: 2024-0088

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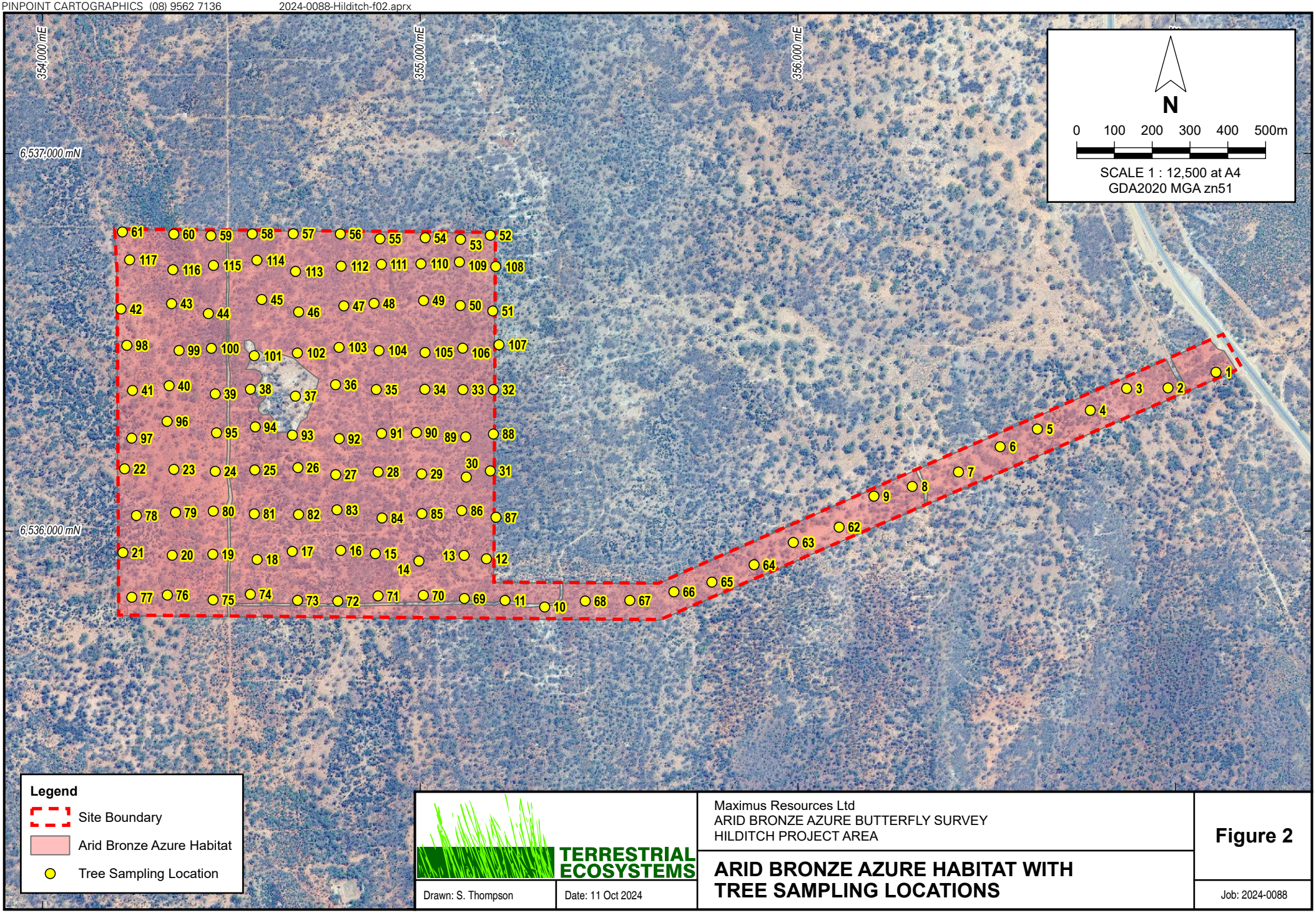

TERRESTRIAL ECOSYSTEMS

Drawn: S. Thompson

Date: 11 Oct 2024

Maximus Resources Ltd
ARID BRONZE AZURE BUTTERFLY SURVEY
HILDITCH PROJECT AREA

ARID BRONZE AZURE HABITAT WITH TREE SAMPLING LOCATIONS

Figure 2

Job: 2024-0088

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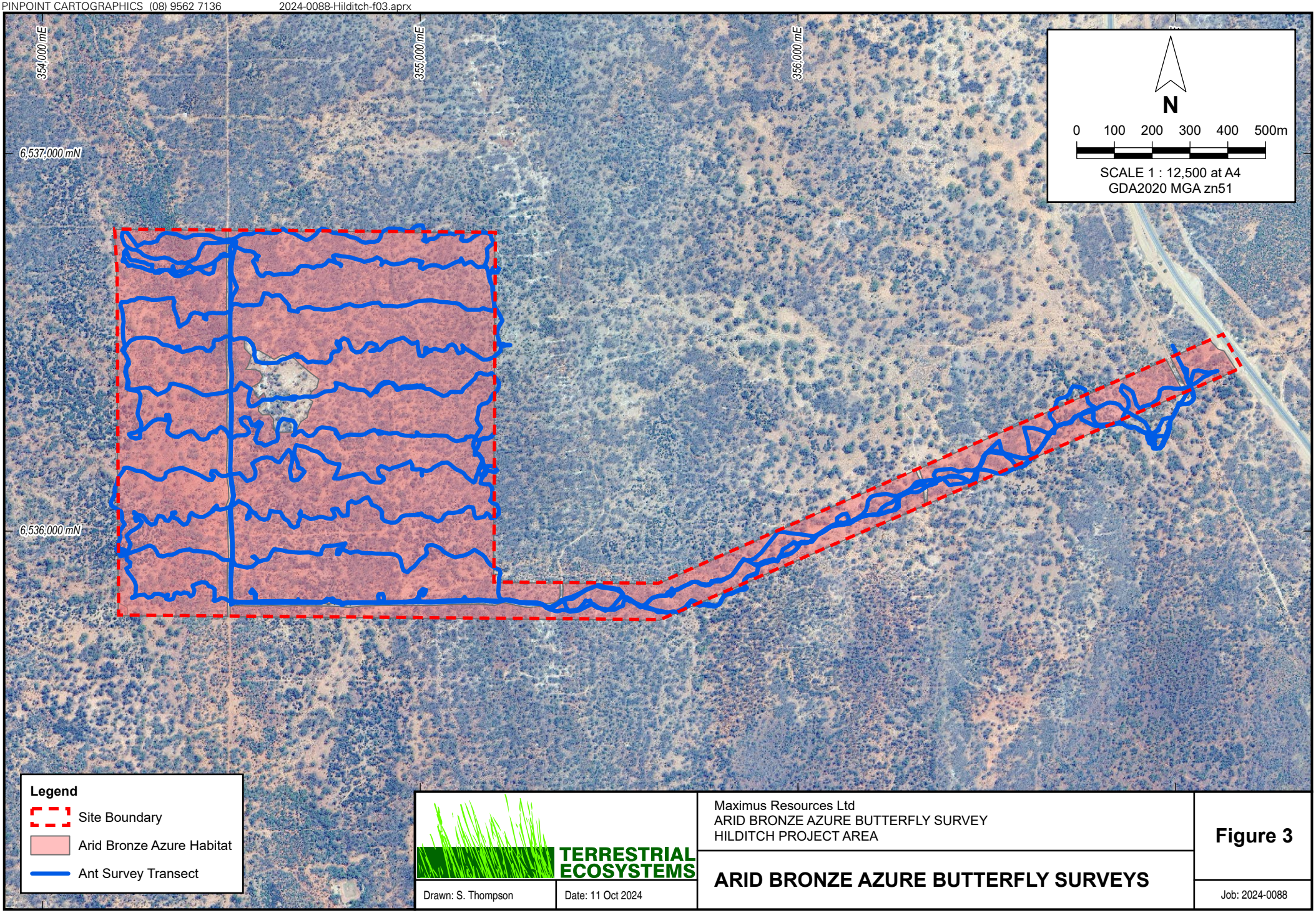

TERRESTRIAL ECOSYSTEMS

Drawn: S. Thompson

Date: 11 Oct 2024

Maximus Resources Ltd
ARID BRONZE AZURE BUTTERFLY SURVEY
HILDITCH PROJECT AREA

ARID BRONZE AZURE BUTTERFLY SURVEYS

Figure 3

Job: 2024-0088

Appendix 1. Host ant survey data (UTM Zone 51)

Site name: Hilditch	
Date: 11 September 2024	Observers: Tom Raymond and Isaac Cable

Tree	Species/type	Diameter (mm) at ~ 1.5m above the ground	Ants present? (Yes/No)	Leafhoppers present (Yes/No/NA)	Easting	Northing
1	mooth	230	No	No	357107	6536421
2	mooth	210	No	No	356980	6536379
3	oody	230	No	No	356871	6536378
4	oody	300	No	No	356774	6536320
5	mooth	230	No	No	356634	6536270
6	mooth	530	No	No	356536	6536224
7	mooth	210	No	No	356425	6536157
8	mooth	260	No	No	356303	6536118
9	mooth	210	No	No	356201	6536093
10	mooth	240	No	No	355330	6535799
11	mooth	140	No	No	355225	6535816
12	mooth	560	No	No	355176	6535926
13	mooth	210	No	No	355116	6535936
14	mooth	200	No	Y	354997	6535921
15	oody	340	No	No	354881	6535940
16	oody	590	No	No	354790	6535949
17	oody	230	No	No	354661	6535946
18	oody	120	No	No	354568	6535925
19	mooth	190	No	No	354451	6535939
20	mooth	280	No	No	354343	6535936
21	mooth	420	No	No	354213	6535943
22	mooth	330	No	No	354217	6536165
23	mooth	380	No	No	354348	6536163
24	mooth	340	No	No	354457	6536158
25	mooth	400	No	No	354562	6536162
26	mooth	300	No	No	354676	6536168
27	mooth	440	No	No	354776	6536149
28	mooth	270	No	No	354889	6536156
29	mooth	240	No	No	355004	6536151
30	mooth	160	No	No	355122	6536143
31	mooth	170	No	No	355186	6536159
32	mooth	210	No	No	355194	6536375
33	mooth	330	No	No	355113	6536375
34	mooth	300	No	No	355012	6536376
35	mooth	330	No	No	354884	6536375
36	mooth	170	No	No	354776	6536388
37	mooth	370	No	No	354670	6536357
38	mooth	240	No	No	354551	6536376

Tree	Species/type	Diameter (mm) at ~ 1.5m above the ground	Ants present? (Yes/No)	Leafhoppers present (Yes/No/NA)	Easting	Northing
39	mooth	580	No	No	354457	6536363
40	mooth	450	No	No	354335	6536385
41	mooth	430	No	No	354238	6536373
42	mooth	220	No	No	354208	6536588
43	mooth	160	No	No	354342	6536602
44	mooth	420	No	No	354439	6536576
45	mooth	340	No	No	354581	6536613
46	mooth	170	No	No	354678	6536580
47	mooth	180	No	No	354798	6536597
48	mooth	310	No	No	354878	6536603
49	mooth	220	No	No	355009	6536610
50	mooth	170	No	No	355106	6536597
51	mooth	210	No	No	355192	6536583
52	mooth	185	No	No	355186	6536784
53	mooth	150	No	No	355107	6536773
54	mooth	210	No	No	355013	6536777
55	mooth	160	No	No	354893	6536774
56	mooth	200	No	No	354789	6536787
57	mooth	180	No	No	354664	6536788
58	mooth	360	No	No	354555	6536787
59	mooth	300	No	No	354446	6536782
60	mooth	150	No	No	354348	6536786
61	mooth	230	No	No	354212	6536792
62	mooth	770	No	No	356109	6536010
63	mooth	310	No	No	355988	6535970
64	mooth	180	No	No	355884	6535911
65	mooth	540	No	No	355772	6535865
66	mooth	210	No	No	355672	6535839
67	mooth	240	No	Yes	355555	6535816
68	mooth	370	No	Yes	355437	6535815
69	mooth	200	No	No	355117	6535822
70	mooth	370	No	No	355008	6535830
71	mooth	900	No	No	354888	6535828
72	mooth	400	No	No	354782	6535815
73	mooth	170	No	No	354675	6535817
74	mooth	550	No	No	354550	6535832
75	mooth	160	No	No	354452	6535818
76	mooth	370	No	No	354331	6535831
77	mooth	150	No	No	354236	6535825
78	mooth	210	No	No	354249	6536041
79	ough	340	No	No	354352	6536049

Tree	Species/type	Diameter (mm) at ~ 1.5m above the ground	Ants present? (Yes/No)	Leafhoppers present (Yes/No/NA)	Easting	Northing
80	mooth	290	No	No	354452	6536053
81	mooth	240	No	Yes	354561	6536046
82	mooth	170	No	No	354678	6536044
83	mooth	320	No	No	354780	6536056
84	mooth	440	No	No	354899	6536035
85	mooth	210	No	No	355004	6536046
86	mooth	250	No	No	355110	6536054
87	mooth	230	No	No	355201	6536037
88	mooth	200	No	No	355194	6536257
89	mooth	200	No	No	355121	6536249
90	ough	390	No	No	354990	6536261
91	mooth	170	No	No	354898	6536259
92	mooth	230	No	No	354786	6536245
93	mooth	760	No	No	354662	6536254
94	mooth	130	No	No	354563	6536276
95	mooth	270	No	No	354461	6536260
96	mooth	420	No	No	354330	6536291
97	mooth	230	No	No	354236	6536246
98	mooth	610	No	No	354223	6536492
99	mooth	120	No	No	354362	6536479
100	mooth	290	No	No	354447	6536484
101	mooth	260	No	No	354561	6536465
102	mooth	180	No	No	354675	6536472
103	mooth	320	No	No	354785	6536486
104	mooth	230	No	No	354891	6536478
105	mooth	160	No	No	355013	6536473
106	mooth	380	No	No	355113	6536484
107	mooth	200	No	No	355209	6536493
108	mooth	170	No	No	355200	6536701
109	ough	400	No	No	355104	6536713
110	ough	250	No	No	355002	6536708
111	mooth	260	No	No	354897	6536706
112	mooth	220	No	No	354791	6536702
113	mooth	350	No	No	354670	6536688
114	mooth	230	No	No	354568	6536717
115	mooth	240	No	No	354453	6536704
116	mooth	280	No	No	354345	6536692
117	mooth	730	No	No	354231	6536718

Appendix 2. Arid Bronze Azure Butterfly survey data (weather)

Site name: Hildtich Observers: Tom Raymond and Isaac Cable		
Date: 11/9/2024	Cloud cover %: zero	
Start time: 0900hrs	Temperature C˚ - 18.1 ºC	Wind speed (km/hr) – 7.7kph,
Time: 1230hrs	Temperature C˚ - 30.1 ºC	Wind speed (km/hr) – 2.2kph,

Appendix 3. Sampled trees

Tree 1

Tree 2

Tree 3

Tree 4

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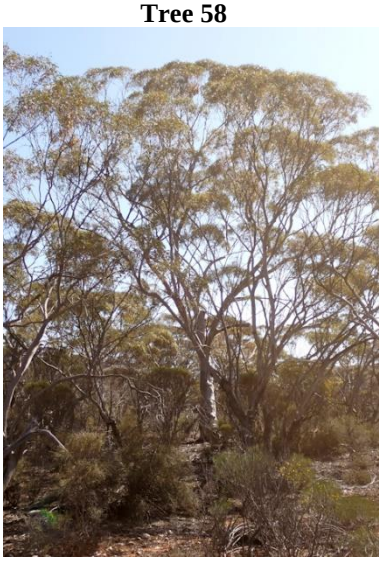

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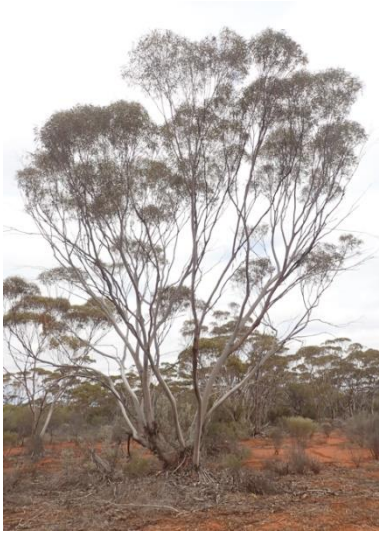

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