Reconnaissance Flora and Vegetation Survey of the GSM Solar Farm Expansion Area- May 2022

Prepared for

GSM Mining Company Pty Ltd

FINAL V2.0
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1 INTRODUCTION

Gold Fields Limited, via its subsidiary GSM Mining Company Pty Ltd (GSM), are proposing to Expand the Solar Farm at the Granny Smith Mine, just south of the Wallaby Haul Road. The Solar Farm produces electricity to supplement existing power supplies to the mine site.

Native Vegetation Solutions (NVS) was supplied with a survey area located approximately 24 km South of Laverton, in the Murchison Region (MUR) of Western Australia (Figure 1). The total survey area received from GSM covers approximately 241.4 ha.

The survey area lies within Mining Tenements M 38/0849, M 38/1289, M 38/0397, M 38/0691 and M 38/1280, Miscellaneous tenements L 38/0326, L 39/0227, L 38/0144, L 38/0088 and L 38/0077, and Prospecting tenement P 38/4407.

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 GSM Solar Farm Expansion survey area.

Figure 1: Regional map of survey location

1.1 Objectives

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

- *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 Geology and Vegetation

The survey area lies in the Murchison (MUR) bioregion, more specifically the Eastern Murchison (MUR01) subregion. The Eastern Murchison subregion covers over 7 million hectares and contains the northern parts of the 'Southern Cross' and 'Eastern Goldfields' Terrains of the Yilgarn Craton. The landscape is characterised by extensive areas of elevated red desert sandplains with minimal dune development and internal drainage. The occluded Paleodrainage system generates Salt Lake systems. Other features include broad plains of red-brown soils, breakaway complexes, and red sandplains. Mulga woodlands often rich in ephemerals; hummock grasslands, saltbush shrublands and *Tecticornia* shrublands dominate the vegetation (CALM, 2002)

1.3 Climate

The climate is classified as 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 Laverton Aero (station number 012305), which is located approximately 26 km north-northeast of the survey area.

1.3.1 Temperature

Mean annual minimum temperature at Laverton Aero is 14.1°C and mean annual maximum temperature is 27.2°C (BOM, 2022). The coldest temperatures are attained in July (mean minimum temperature 5.9°C), the hottest is January (mean maximum temperature 35.6°C) and diurnal temperature variations are relatively consistent throughout the year (Figure 2).

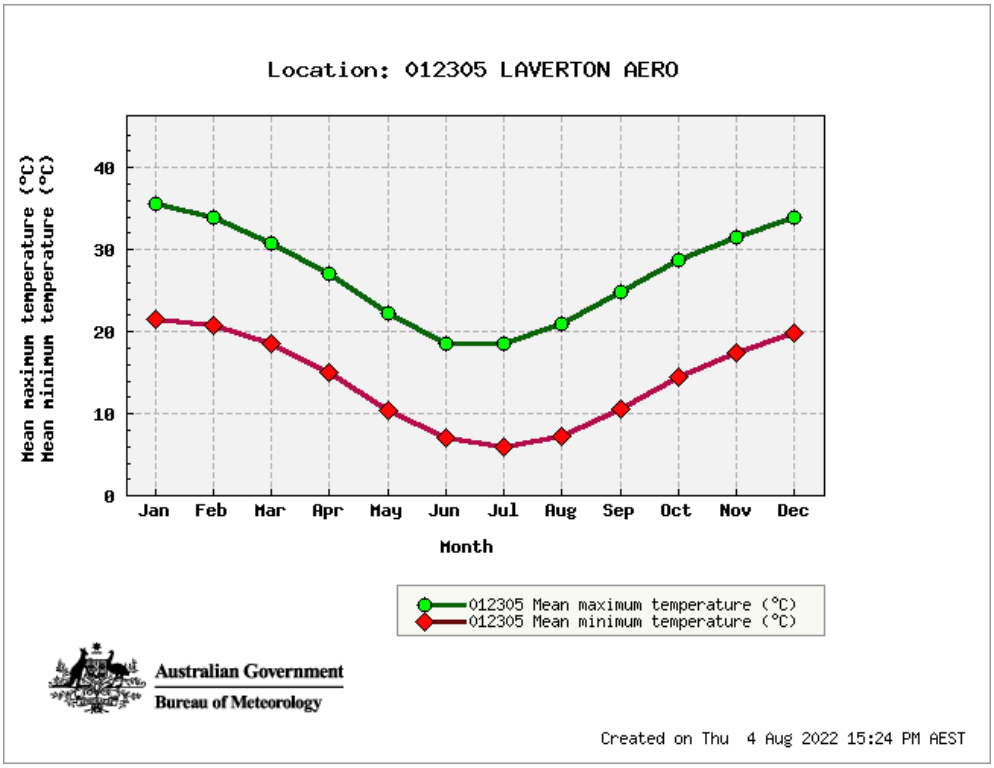

Figure 2: Mean temperature ranges for Laverton Aero weather station

1.3.2 Rainfall

The annual average rainfall at Laverton Aero is 275.5 mm, which falls (>1 mm) on an average of 34 rain-days (BOM, 2022). Larger rainfall events occur from December to March (Figure 3). Prior to the survey in 2022, rainfall in March exceeded monthly averages while rainfall for all other months remained below monthly averages (BOM, 2022).

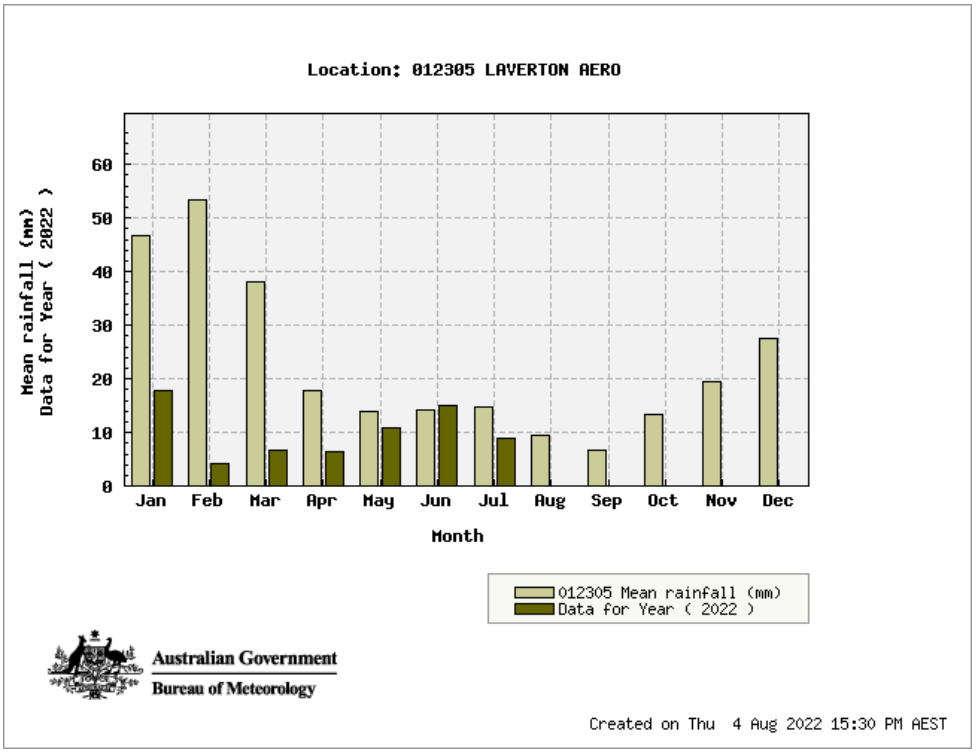

Figure 3: Monthly and mean rainfall for Laverton Aero weather station

2. ASSESSMENT METHODOLOGY

2.1 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 one year specifically working on botanical survey reporting; and
- Mr Frank Obbens (*BSc*), Consultant Botanist, Bushtech Consultancy, undertook identification of unknown samples collected in the field. Mr Frank Obbens has over 22 years' experience offering botanical identification and conducting taxonomic investigations to consultancies and industry.

2.2 Preliminary Desktop Study

A preliminary assessment of the survey area and its potential constraints was undertaken by reviewing relevant government agency managed databases (Sections 2.2.1 to 2.2.6, and Appendices 1 & 2) and consulting with government agencies where necessary. The following sections provide a summary of desktop searches undertaken for the project.

2.2.1 Known Previous Flora and Vegetation Surveys

A Reconnaissance flora and vegetation survey was completed by NVS in the GSM Solar Farm project area in 2018 (NVS, 2018). The current survey area surrounds the previous survey area. Vegetation mapping from the 2018 report was used as a reference for vegetation mapping descriptions, and locations of known Priority and Threatened Flora within the current survey area.

2.2.2 *Environment Protection and Biodiversity Conservation Act* Protected Matters

The *Environment Protection and Biodiversity Conservation Act 1999 (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 3 km buffer (DAWE, 2022).

2.2.3 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, 2016a).

The Threatened and Priority Ecological Communities (TECs and PECs) database was searched to determine the presence of PECs or TECs (DBCA, 2016), with Geographic Information System (GIS) data supplied for assessment, within a 20 km radial area of the survey area.

2.2.4 Environmentally Sensitive Areas (ESAs) and Conservation Reserves

The Department of Water and Environmental Regulation (DWER, 2022) Clearing Permit System Map Viewer was used to determine the location of any ESAs and Conservation Reserves.

2.2.5 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.

2.2.6 Wetlands

The potential of wetlands within the project area was determined by examining DWER's Clearing Permit System Map Viewer (DWER, 2022).

2.2.7 Dieback

Dieback is only considered a potential issue for any project if both of the below factors are relevant for the project (CALM, 2003):

- the project area lies within the Southwest Land Division; and
- the mean annual rainfall of the area is greater than 400 mm.

2.3 Site Investigation

A site visit of the GSM Solar Farm Expansion area was carried out by Botanist Eren Reid from Native Vegetation Solutions on the 16th and 17th of May 2022 to examine the flora and vegetation groups contained within the survey area. A total of 9 hours was spent on site traversing the survey area, by Yamaha Viking 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 Murchison (MUR) IBRA region, a reconnaissance flora and vegetation survey was deemed adequate.

2.3.1 Licenses

Field work was conducted under Scientific License FB62000171, held by Mr Eren Reid with expiry 08/10/2022.

2.3.2 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 viable 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

Specimens of taxa not recognised by the Botanists were collected and pressed along with specimens of taxa recognised as, or thought to be, conservation-significant species.

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 2.3.4. below.

Opportunistic sampling 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 collect flora specimens and assist in mapping vegetation groups.

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

2.3.3 Post-Field Methods

Unknown specimens collected in the field were identified post field work by Frank Obbens (Bushtech Consultancy) and Eren Reid (NVS) with reference to published keys, WAHERB reference herbarium and information published on Florabase (WAHERB, 2022). 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.

2.3.4 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.

2.3.5 IBSA Data Package

The Environmental Protection Authority (EPA), Department of Water and Environmental Regulation (DWER) and Department of Mines, Industry Regulation and Safety (DMIRS) 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 Metadata and Licensing Statement in .pdf format
- 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 has been submitted via the DWER IBSA Submission Portal.

2.4 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. Definitions of Threatened Flora are also included in Section 6 below.

2.5 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 has over 18 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 Autumn 2022. Flowering annual species were present within the survey area, suggesting recent rainfall was sufficient for the period of survey.
Disturbance in survey area	N	Minimal disturbance (Roads and historical 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 Murchison bioregion is readily available. Adequate information was able to be accessed from available databases.

3. RESULTS

3.1 Preliminary Desktop Assessment

3.1.1 EPBC Act Protected Matters

Results of the EPBC Protected Matters search tool are included in Appendix 1. The results revealed that the survey area could possibly contain suitable habitat for the weed species *Carrichtera annua* (Ward's Weed) and *Cenchrus ciliaris* (Buffel grass) (DAWE, 2022a).

Carrichtera annua was introduced into Australia from the eastern Mediterranean, and is now widespread throughout South Australia, the Interior, and Western Australia (Lamp & Collet, 1989). This species is not listed as a declared plant by DPIRD (2022), however according to the EPBC search tool this invasive weed species is considered a threat to the rangeland biodiversity within the Southern Australian Sheep and Cattle Grazing Land Management Zone (DAWE, 2022a).

Cenchrus ciliaris is native to Africa and India, was widely planted in Western Australian pastoral regions as a pasture grass, and has become a widespread weed of roadsides, creeklines, river edges and most vegetation types from Geraldton to the Pilbara, Kimberley and adjacent desert (Hussey, 2007). In the Murchison region it often colonises roadside table drains, excluding native everlastings. It seriously alters the fire characteristics of invaded plant cover by generating highly flammable fuel that is prone to more frequent fires.

The EPBC Protected Matters report indicated no TECs or Commonwealth Reserves within the requested survey area.

3.1.2 Threatened Flora and Communities

The DBCA database searches revealed a potential for no Threatened and 7 Priority Flora species to occur within a 20 km radius of the survey area (DBCA, 2016a). None of these known locations occur within the survey area, while the closest location occurs approximately 8.96 km northeast of the survey area (DBCA, 2016a).

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, 2016) revealed that no PECs or TECs fall within the survey area. Two PECs are found within 20 km of the survey area, with the closest occurring approximately 0.8 km to the northwest (DBCA, 2016).

3.1.3 Environmentally Sensitive Areas and Conservation Reserves

No ESA's or Conservation reserves are located within the survey area (DWER, 2022).

3.1.4 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 Survey Area (ha)	% Of Survey Area (%)
Carnegie System	Salt lakes with fringing saline alluvial plains, kopi dunes and sandy banks, supporting halophytic shrublands and acacia tall shrublands.	54.91	22.74
Sunrise System	Stony plains supporting mulga shrublands.	17.50	7.25
Monitor System	Distributary alluvial fans and wash plains supporting mulga - chenopod shrublands.	111.75	46.29
Bevon System	Irregular low ironstone hills with stony lower slopes supporting mulga shrublands.	24.06	9.97
Brooking System	Prominent ridges of banded iron formation supporting mulga shrublands and occasional minor halophytic communities.	33.21	13.76

3.1.5 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 three Beard vegetation units within the survey area at all scales is less than 1% of the total area at each scale (Table 3). All scales are above the 30% threshold at a State, bioregional and subregional level (Table 4 and Table 5).

Table 3: Extent of Beard Associations within the survey area

Beard Vegetation Association	Extent within survey area (ha)	% of survey area (%)	By Association WA	By Association WA	By IBRA Region (MUR)	By IBRA Sub-region (MUR01)	By Shire (Shire of Laverton)
18	241.371	99.97	<1%	<1%	<1%	<1%	<1%
389	0.067	0.03	<1%	<1%	<1%	<1%	<1%

Table 4: Summary of information regarding Pre-European and current vegetation extent of Vegetation Association 18 within the survey area

Factor	Value				
Beard Vegetation Association*	18				
Vegetation Association Description*	Low woodland; mulga (*Acacia aneura*)				
Pre-European Extent (ha)	Scale				
	***By Association** (WA)*	***By Association** (WA)*	***By IBRA Region** (MUR)*	***By IBRA Sub-region** (MUR01)*	***By Shire** (Shire of Laverton)*
	22,029,557*	19,892,306.46**	12,403,172.30**	10,269,896.44**	2,878,673.28**
% Pre-European Extent Remaining	*100.00%**	*99.75%***	*99.68%***	*99.66%***	*99.61%***
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 389 within the survey area

Factor	Value				
Beard Vegetation Association*	389				
Vegetation Association Description*	Succulent steppe with open low woodland; mulga over saltbush				
Pre-European Extent (ha)	Scale				
	***By Association** (WA)*	***By Association** (WA)*	***By IBRA Region** (MUR)*	***By IBRA Sub-region** (MUR01)*	***By Shire** (Shire of Laverton)*
	646,554*	442,356.85**	493,977.54**	493,977.54**	48,520.52**
% Pre-European Extent Remaining	*100.00%**	*99.71%***	*99.62%***	*99.62%***	*97.61%***
Surrounding Land Use***	Mining, Exploration, Pastoral Lease				
Weed prevalence***	Low				

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

3.1.6 Wetlands

The DWER Clearing Permit System Map Viewer revealed no waterbodies occur within the survey area (DWER, 2022). The closest waterbody lies 0.2 km to the south of the survey area.

3.1.7 Dieback

The survey area lies south of the 26th parallel, however receives average annual rainfall of 275.5 mm. There is no record of *Phytophthora cinnamomi* establishing in natural ecosystems in regions receiving less than 400mm rainfall per annum (CALM, 2003). Therefore, Dieback is not

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

3.2 Field Assessment

3.2.1 Threatened Flora

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

3.2.2 Vegetation Type, Extent and Status

A total of 19 Families, 34 Genera and 89 Species were recorded within the survey area. Eight major vegetation groups were recorded in the survey area and range from Good to Very Good (using the scale of Keighery 1994, see Appendix 3). Existing disturbance occurring in the survey area ranged from Completely degraded to degraded and included historic access tracks, haul roads and powerline corridors.

No unique or restricted vegetation communities were identified, and all vegetation types/communities are common, widespread and well represented in the Eastern Murchison 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 (%)
Open Mulga woodland over *Acacia kalgoorliensis* and Chenopod shrublands	A	10	15	32	34.40	14.25
Mulga Creekline Vegetation	B	12	21	41	62.98	26.09
Mulga woodland over *Eremophila forrestii* over tussock grassland on sandy plains	C	8	14	23	39.78	16.48
Open Chenopodiaceae Shrubland	D	10	13	23	38.76	16.05
Mulga shrubland over BIF rocky outcrops	E	9	11	21	8.92	3.69
Tecticornia shrubland	F	3	5	7	1.03	0.43
Open Mulga Woodland	G	9	13	27	41.71	17.28
Mulga over *Maireana sedifolia* and sclerophyll shrubland	H	10	11	22	6.60	2.73
Existing Disturbance	N/A	N/A	N/A	N/A	7.25	3.00
	Total	**19***	**34***	**89***	**241.4#**	**100%#**

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

The GSM Solar Farm Expansion vegetation groups are described in more detail below

3.2.2.1 Open Mulga woodland over *Acacia kalgoorliensis* and Chenopod shrublands (A)

This Scrub (Muir, 1977) consisted of 10 Families, 15 Genera and 32 Species. The vegetation group was approximately 34.40 ha which makes up 14.25% of the survey area.

Figure 4: Vegetation Group A within the survey area

3.2.2.2 Mulga Creekline Vegetation (B)

This Thicket (Muir, 1977) consisted of 12 Families, 21 Genera and 41 Species. The vegetation group was approximately 62.98 ha which makes up 26.09% of the survey area.

Figure 5: Vegetation Group B within the survey area

3.2.2.3 Mulga woodland over *Eremophila forrestii* over tussock grassland on sandy plains (C)

This Scrub (Muir, 1977) consisted of 8 Families, 14 Genera and 23 Species. The vegetation group was approximately 39.78 ha which makes up 16.48% of the survey area.

Figure 6: Vegetation Group C within the survey area

3.2.2.4 Open Chenopodiaceae Shrubland (D)

This Low Scrub B (Muir, 1977) consisted of 10 Families, 13 Genera and 23 Species. The vegetation group was approximately 38.76 ha which makes up 16.05% of the survey area.

Figure 7: Vegetation Group D within the survey area

3.2.2.5 Mulga shrubland over BIF rocky outcrops *(E)*

This Scrub (Muir, 1977) consisted of 9 Families, 11 Genera and 21 Species. The vegetation group was approximately 8.92 ha which makes up 3.69% of the survey area.

Figure 8: Vegetation Group E within the survey area

3.2.2.6 Tecticornia shrubland *(F)*

This Low Heath D (Muir, 1977) consisted of 3 Families, 5 Genera and 7 Species. The vegetation group was approximately 1.03 ha which makes up 0.43% of the survey area.

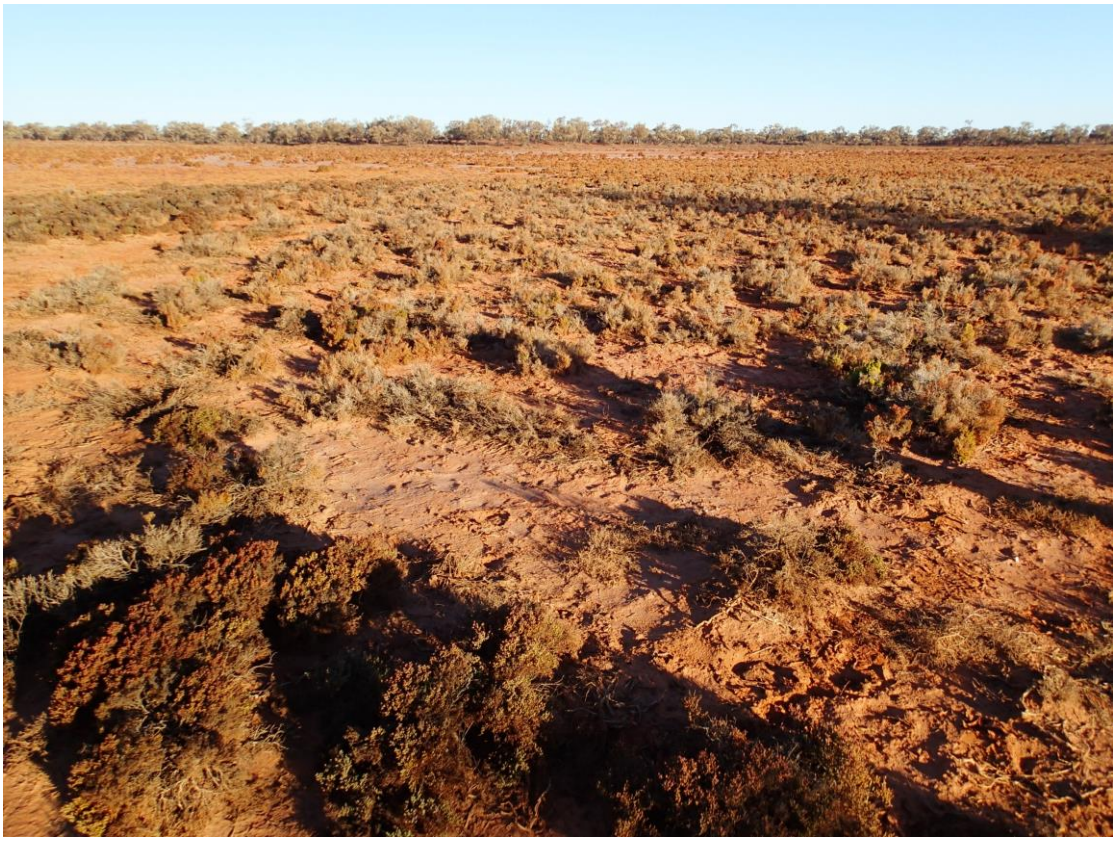

Figure 9: Vegetation Group F within the survey area

3.2.2.7 Open Mulga shrubland *(G)*

This Open Scrub (Muir, 1977) consisted of 9 Families, 13 Genera and 27 Species. The vegetation group was approximately 41.71 ha which makes up 17.28% of the survey area.

Figure 10: Vegetation Group G within the survey area

3.2.2.8 Mulga over *Maireana sedifolia* and sclerophyll shrubland *(H)*

This Scrub (Muir, 1977) consisted of 10 Families, 11 Genera and 22 Species. The vegetation group was approximately 6.60 ha which makes up 2.73% of the survey area.

Figure 11: Vegetation Group H within the survey area

3.2.2.9 Existing Disturbance

Existing disturbance within the survey area consisted of historic access tracks, haul roads and powerline corridors and was approximately 7.25 ha which makes up 3.00% of the survey area.

No picture available for the existing disturbance.

3.2.3 Weeds

No weed species were recorded within the survey area.

3.2.4 Vegetation Condition

Evidence of historic exploration was observed during the field assessment. A number of access roads, gazetted roads and powerline corridors also run through the survey area.

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

4. DISCUSSION

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

No weed species were recorded within the survey area.

No Priority or Threatened Flora were recorded in the survey area, (DBCA, 2016a).

No TECs or PECs 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 Murchison subregion.

Any proposed disturbance/clearing of vegetation will result in a loss of species. 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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6. 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)
DBCA	Department of Biodiversity, Conservation and Attractions, Western Australia
DMIRS	Department of Mines, Industry Regulation and Safety, Western Australia
DOTEE	Department of the Environment and Energy, Australian Government
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, DOTEE
IUCN	International Union for the Conservation of Nature and Natural Resources – commonly known as the World Conservation Union
km	Kilometres
m	Metres
MUR	Murchison Bioregion (IBRA)
MUR01	Eastern Murchison Subregion (IBRA)
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 (2019) 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 Agriculture, Water and the Environment

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.

Information on the coverage of this report and qualifications on data supporting this report are contained in the caveat at the end of the report.

Information is available about Environment Assessments and the EPBC Act including significance guidelines, forms and application process details.

Report created: 04/08/22 16:39:44

No Image Available

This map may contain data which are ©Commonwealth of Australia (Geoscience Australia), ©PSMA 2015

Coordinates
Buffer: 3.0Km

No Image Available

Summary

Matters of National Environmental 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:	None
Great Barrier Reef Marine Park:	None
Commonwealth Marine Area:	None
Listed Threatened Ecological Communities:	None
Listed Threatened Species:	4
Listed Migratory Species:	8

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 http://www.environment.gov.au/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 Land:	None
Commonwealth Heritage Places:	None
Listed Marine Species:	10
Whales and Other Cetaceans:	None
Critical Habitats:	None
Commonwealth Reserves Terrestrial:	None
Australian Marine Parks:	None

Extra Information

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

State and Territory Reserves:	None
Regional Forest Agreements:	None
Invasive Species:	10
Nationally Important Wetlands:	None
Key Ecological Features (Marine)	None

Details

Matters of National Environmental Significance

Listed Threatened Species		[Resource Information]
Name	Status	Type of Presence
Birds		
Falco hypoleucos Grey Falcon [929]	Vulnerable	Species or species habitat may occur within area
Leipoa ocellata Malleefowl [934]	Vulnerable	Species or species habitat likely to occur within area
Polytelis alexandrae Princess Parrot, Alexandra's Parrot [758]	Vulnerable	Species or species habitat likely to occur within area
Mammals		
Sminthopsis psammophila Sandhill Dunnart [291]	Endangered	Species or species habitat may occur within area

Listed Migratory Species		[Resource Information]
* Species is listed under a different scientific name on the EPBC Act - Threatened Species list.		
Name	Threatened	Type of Presence
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
Motacilla flava Yellow Wagtail [644]		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]		Species or species habitat may occur within area
Calidris melanotos Pectoral Sandpiper [858]		Species or species habitat may occur within area

Name	Threatened	Type of Presence
Charadrius veredus		
Oriental Plover, Oriental Dotterel [882]		Species or species habitat may occur within area
Tringa nebularia		
Common Greenshank, Greenshank [832]		Species or species habitat may occur within area

Other Matters Protected by the EPBC Act

Listed Marine Species [Resource Information]

* Species is listed under a different scientific name on the EPBC Act - Threatened Species list.

Name	Threatened	Type of Presence
Birds		
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
Calidris acuminata		
Sharp-tailed Sandpiper [874]		Species or species habitat may occur within area
Calidris melanotos		
Pectoral Sandpiper [858]		Species or species habitat may occur within area
Charadrius veredus		
Oriental Plover, Oriental Dotterel [882]		Species or species habitat may occur within area
Chrysococcyx osculans		
Black-eared Cuckoo [705]		Species or species habitat likely to occur within area
Merops ornatus		
Rainbow Bee-eater [670]		Species or species habitat may occur within area
Motacilla cinerea		
Grey Wagtail [642]		Species or species habitat may occur within area
Motacilla flava		
Yellow Wagtail [644]		Species or species habitat may occur within area
Tringa nebularia		
Common Greenshank, Greenshank [832]		Species or species habitat may occur within area

Extra Information

Invasive Species [Resource Information]

Weeds reported here are the 20 species of national significance (WoNS), along with other introduced plants that are considered by the States and Territories to pose a particularly significant threat to biodiversity. The following feral animals are reported: Goat, Red Fox, Cat, Rabbit, Pig, Water Buffalo and Cane Toad. Maps from Landscape Health Project, National Land and Water Resouces Audit, 2001.

Name	Status	Type of Presence
Birds		
Columba livia Rock Pigeon, Rock Dove, Domestic Pigeon [803]		Species or species habitat likely to occur within area
Mammals		
Camelus dromedarius Dromedary, Camel [7]		Species or species habitat likely to occur within area
Canis lupus familiaris Domestic Dog [82654]		Species or species habitat likely to occur within area
Capra hircus Goat [2]		Species or species habitat likely to occur within area
Equus asinus Donkey, Ass [4]		Species or species habitat likely to occur within area
Felis catus Cat, House Cat, Domestic Cat [19]		Species or species habitat likely to occur within area
Oryctolagus cuniculus Rabbit, European Rabbit [128]		Species or species habitat likely to occur within area
Vulpes vulpes Red Fox, Fox [18]		Species or species habitat likely to occur within area
Plants		
Carrichtera annua Ward's Weed [9511]		Species or species habitat may occur within area
Cenchrus ciliaris Buffel-grass, Black Buffel-grass [20213]		Species or species habitat may occur within

Name	Status	Type of Presence
		area

Caveat

The information presented in this report has been provided by a range of data sources as acknowledged at the end of the report.

This report is designed to assist in identifying the locations of places which may be relevant in determining obligations under the Environment Protection and Biodiversity Conservation Act 1999. It holds mapped locations of World and National Heritage properties, Wetlands of International and National Importance, Commonwealth and State/Territory reserves, listed threatened, migratory and marine species and listed threatened ecological communities. Mapping of Commonwealth land is not complete at this stage. Maps have been collated from a range of sources at various resolutions.

Not all species listed under the EPBC Act have been mapped (see below) and therefore a report is a general guide only. Where available data supports mapping, the type of presence that can be determined from the data is indicated in general terms. People using this information in making a referral may need to consider the qualifications below and may need to seek and consider other information sources.

For threatened ecological communities where the distribution is well known, maps are derived from recovery plans, State vegetation maps, 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 distributions have been derived through a variety of methods. Where distributions are well known and if time permits, maps are derived using either thematic spatial data (i.e. vegetation, soils, geology, elevation, aspect, terrain, etc) together with point locations and described habitat; or environmental modelling (MAXENT or BIOCLIM habitat modelling) using point locations and environmental data layers.

Where very little information is available for 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 reliable distribution mapping methods are used to update these distributions as time permits.

Only selected species covered by the following provisions of the EPBC Act have been mapped:

- migratory and
- marine

The following species and ecological communities have not been mapped and do not appear in reports produced from this database:

- threatened species listed as extinct or considered as vagrants
- some species and ecological communities that have only recently been listed
- some terrestrial species that overfly the Commonwealth marine area
- migratory species that are very widespread, vagrant, or only occur in small numbers

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

- non-threatened seabirds which have only been mapped for recorded breeding sites
- seals which have only been mapped for breeding sites near the Australian continent

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

Coordinates

-28.83697 122.34092,-28.83705 122.36049,-28.84909 122.36049,-28.85475 122.34084,-28.83697 122.34092

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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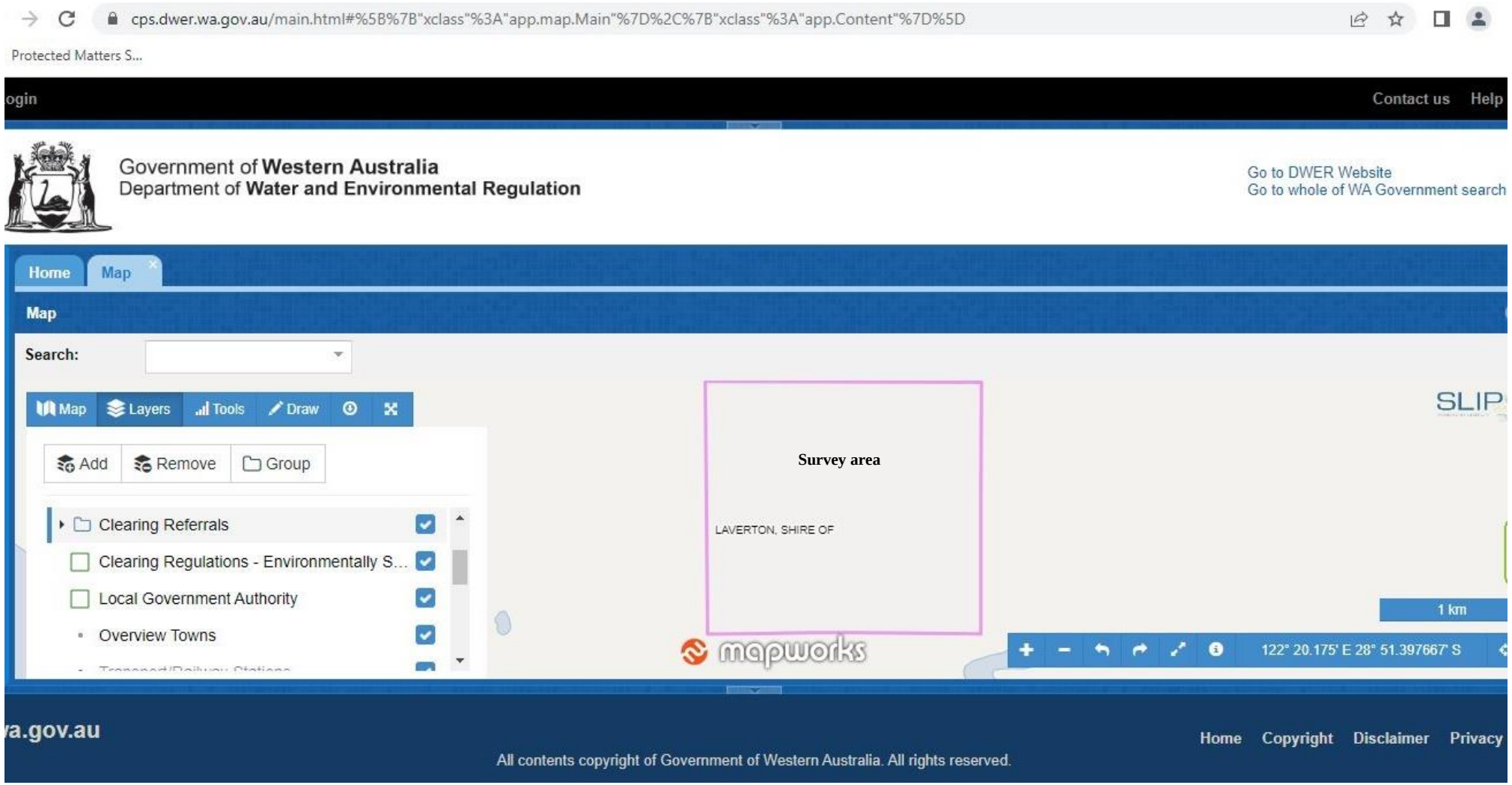
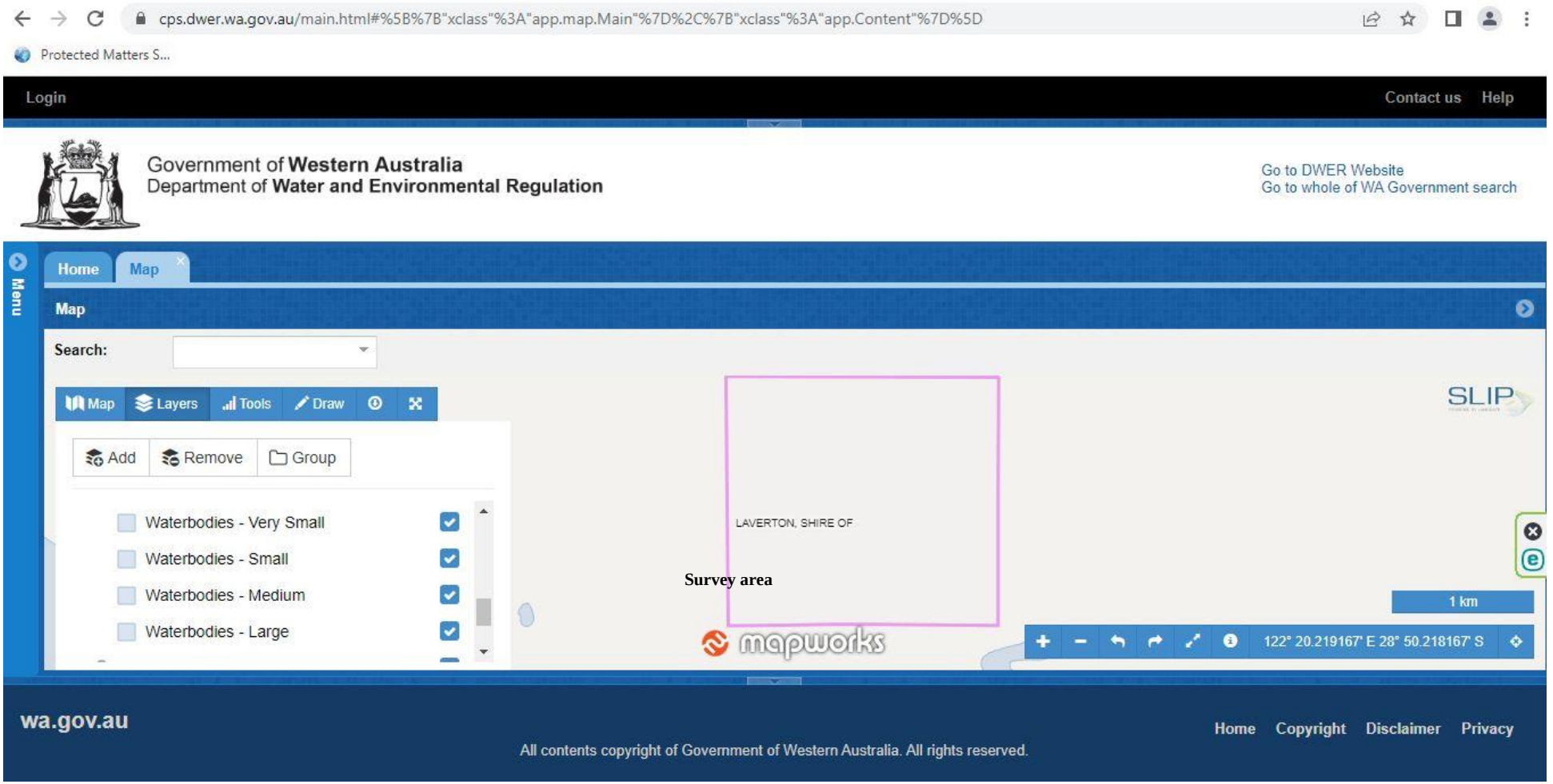


DWER's Clearing Permit System Map Viewer showing no ESA's (dark green shaded areas) within the survey area (DWER, 2022)



DWER Clearing Permit System Map Viewer showing waterbodies within the survey area (DWER, 2022)

Appendix 2

Threatened Flora Databases Search Results

GIS information provided in the Search results (Reference: 19_1316FL) listed the following species within a 20 km radius of the survey area (DBCA, 2016a):

Taxon	Conservation Code	Comment (Post field work)
Calytrix praecipua	P3	Not Likely- No suitable habitat
Goodenia lyrata	P3	Not Likely- Possible suitable habitat, extensively searched
Gunniopsis propinqua	P3	Not Likely- Possible suitable habitat, extensively searched
Olearia mucronata	P3	Not Likely- Possible suitable habitat, extensively searched
Tecticornia cymbiformis	P3	Not Likely- Possible limited suitable habitat, extensively searched
Tecticornia sp. *Lake Way* (P. Armstrong 05/961)	P1	Not Likely- Possible limited suitable habitat, extensively searched
Phyllanthus baeckeoides	P3	Not Likely- Possible suitable 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.

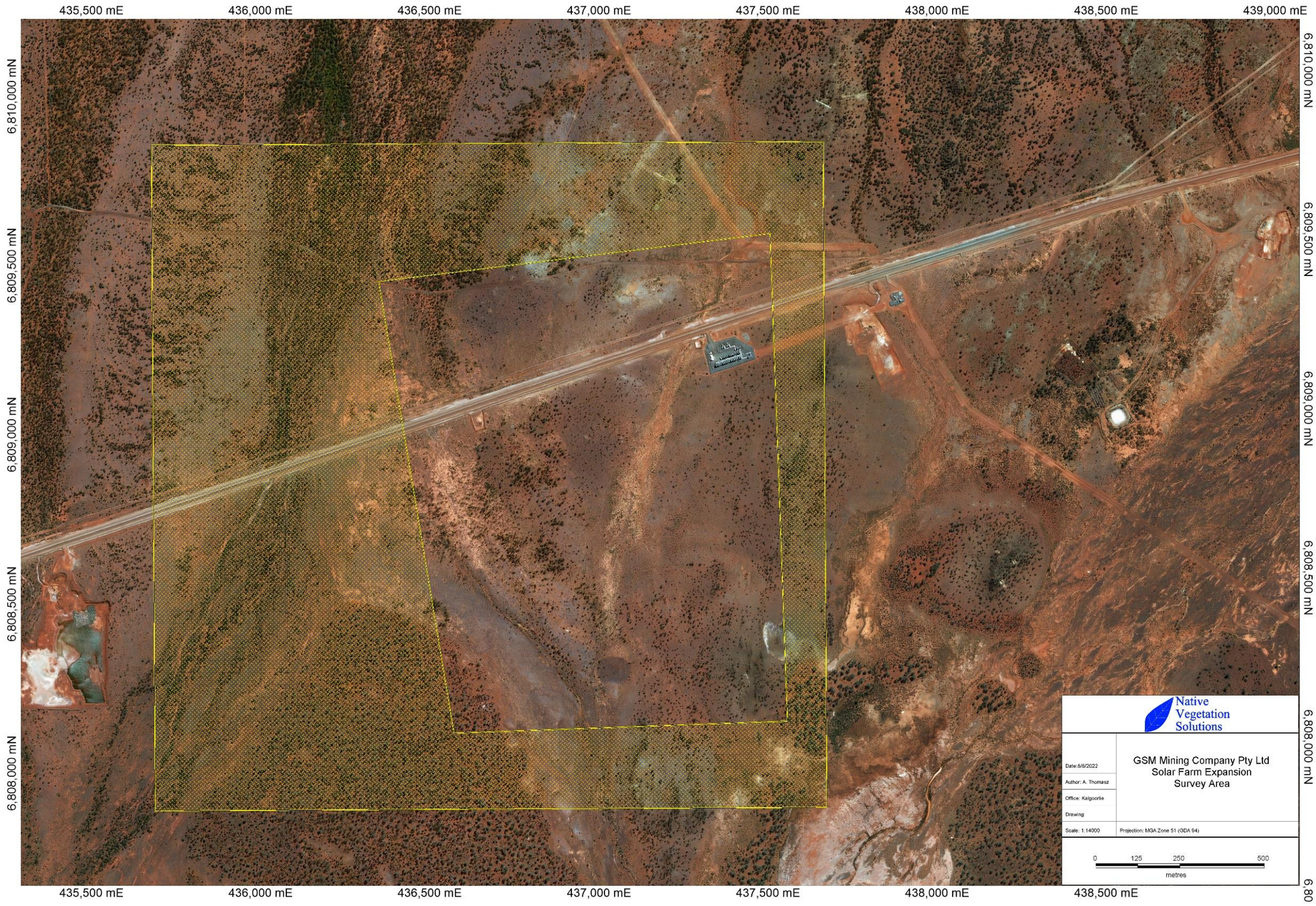
Completely Degraded (6). The structure of the vegetation is no longer intact and the area is completely or almost completely without native species.
These areas are often described as 'parkland cleared' with the flora compromising weed or crop species with isolated trees or shrubs.

Vegetation Structure Definitions (Muir, 1977)

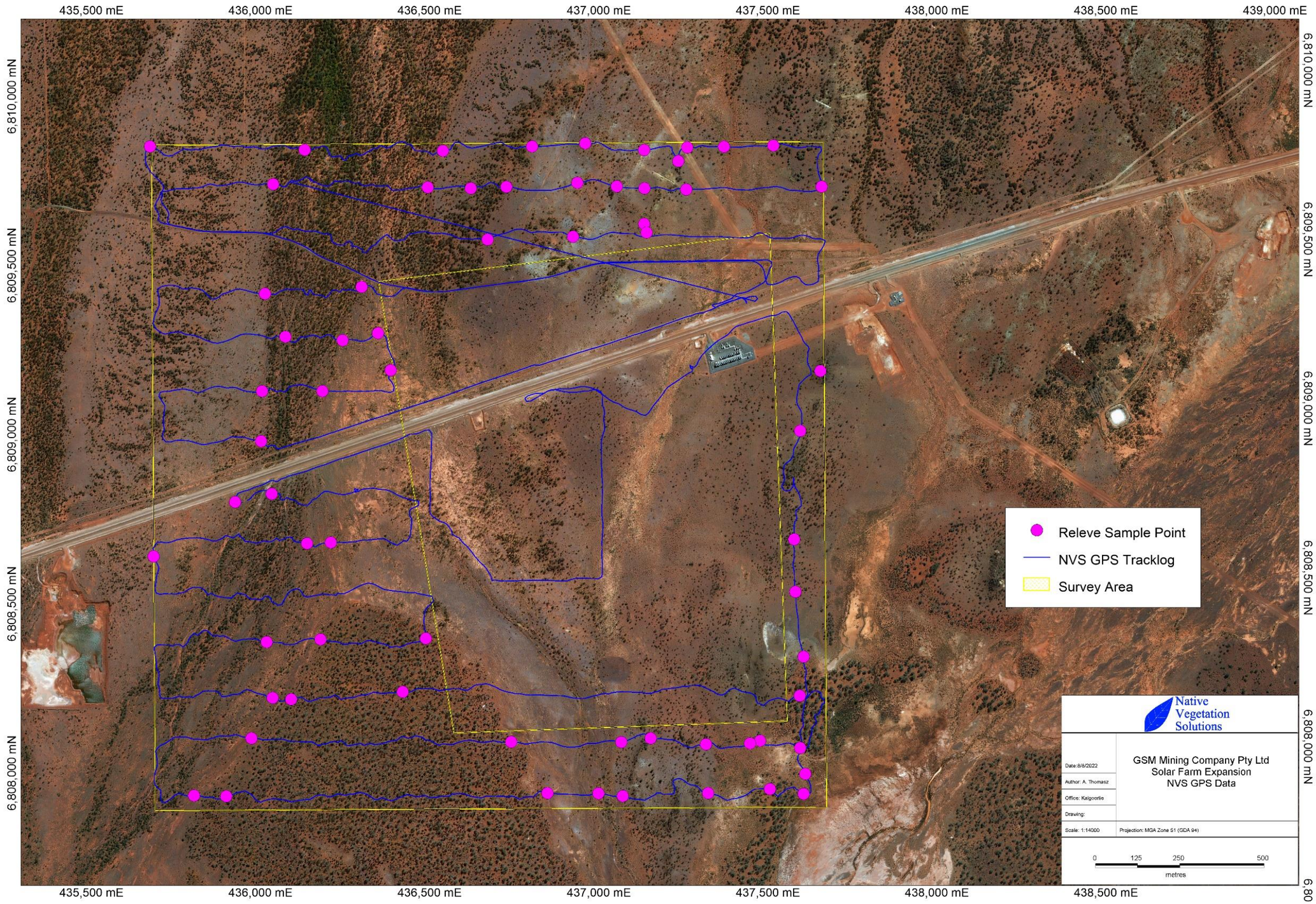
Life Form/Height Class	Canopy Cover			
	Dense 70-100% d	Mid-Dense 30-70% c	Sparse 10-30% i	Very Sparse 2-10% r
T Trees>30m	Dense Tall Forest	Tall Forest	Tall Woodland	Open Tall Woodland
M Trees 15-30m	Dense Forest	Forest	Woodland	Open Woodlnd
LA Trees 5-15m	Dense Low Forest A	Low Forest A	Low Woodland 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

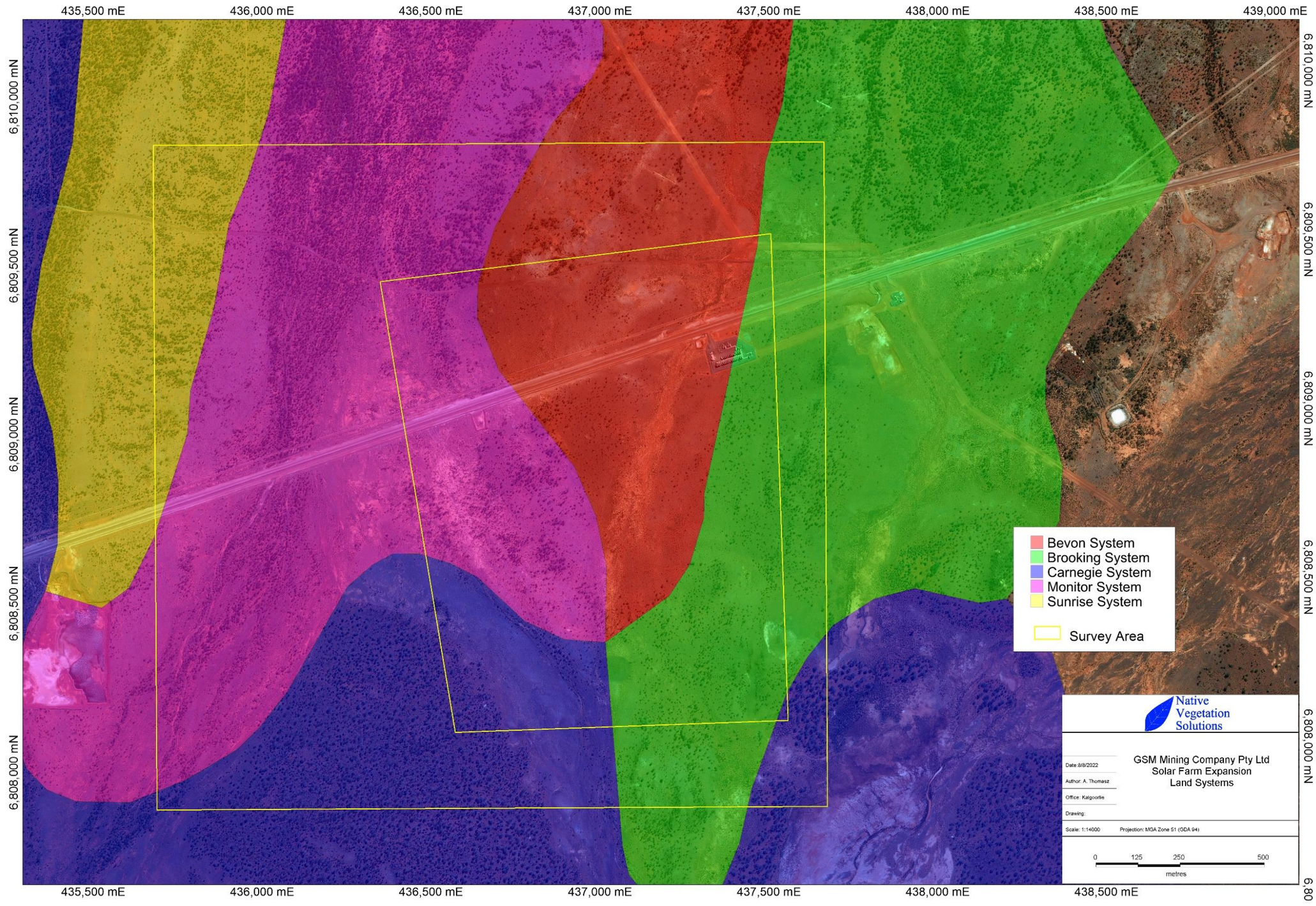
Vegetation Mapping



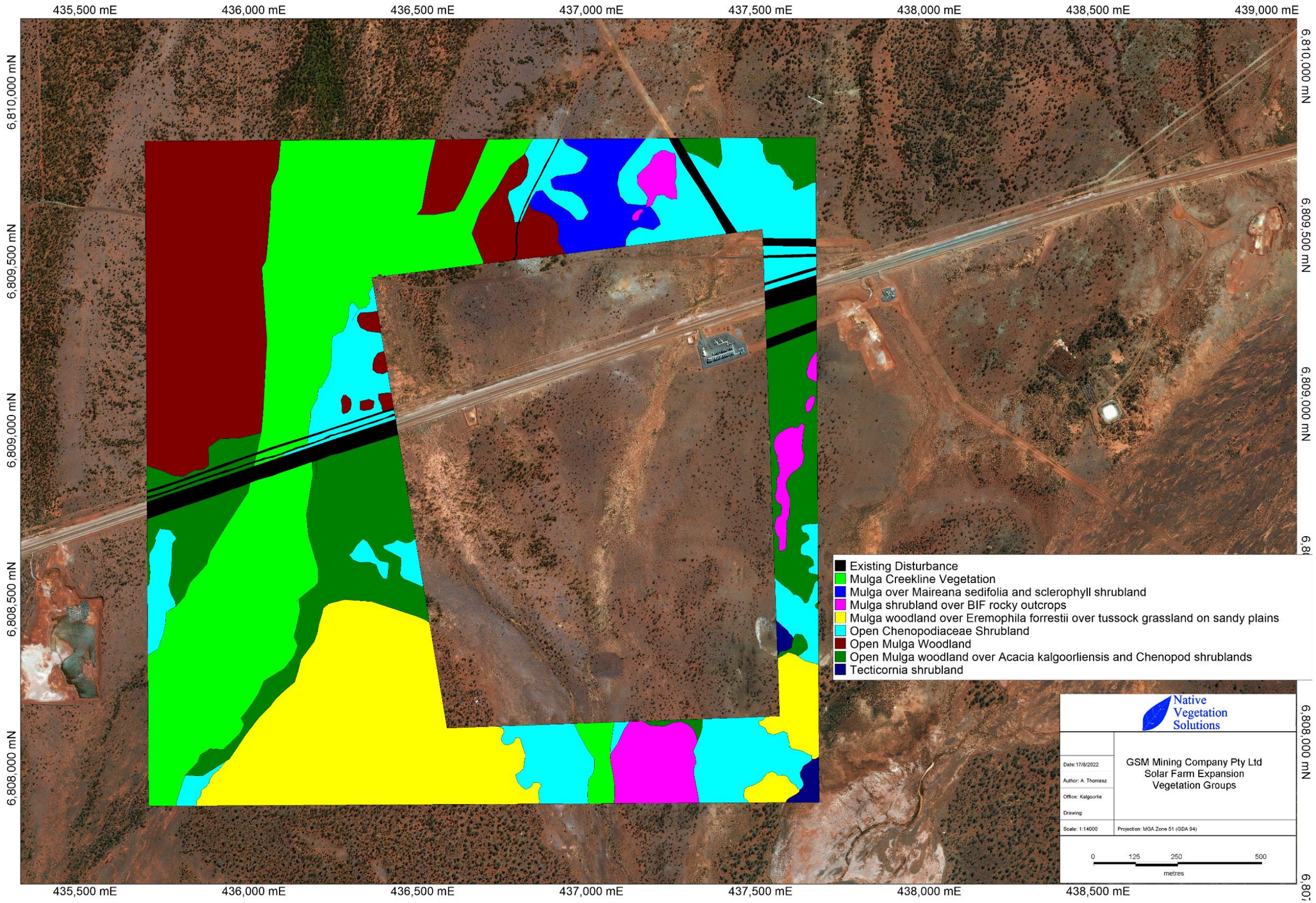
Map 1: GSM Solar Farm Expansion survey area



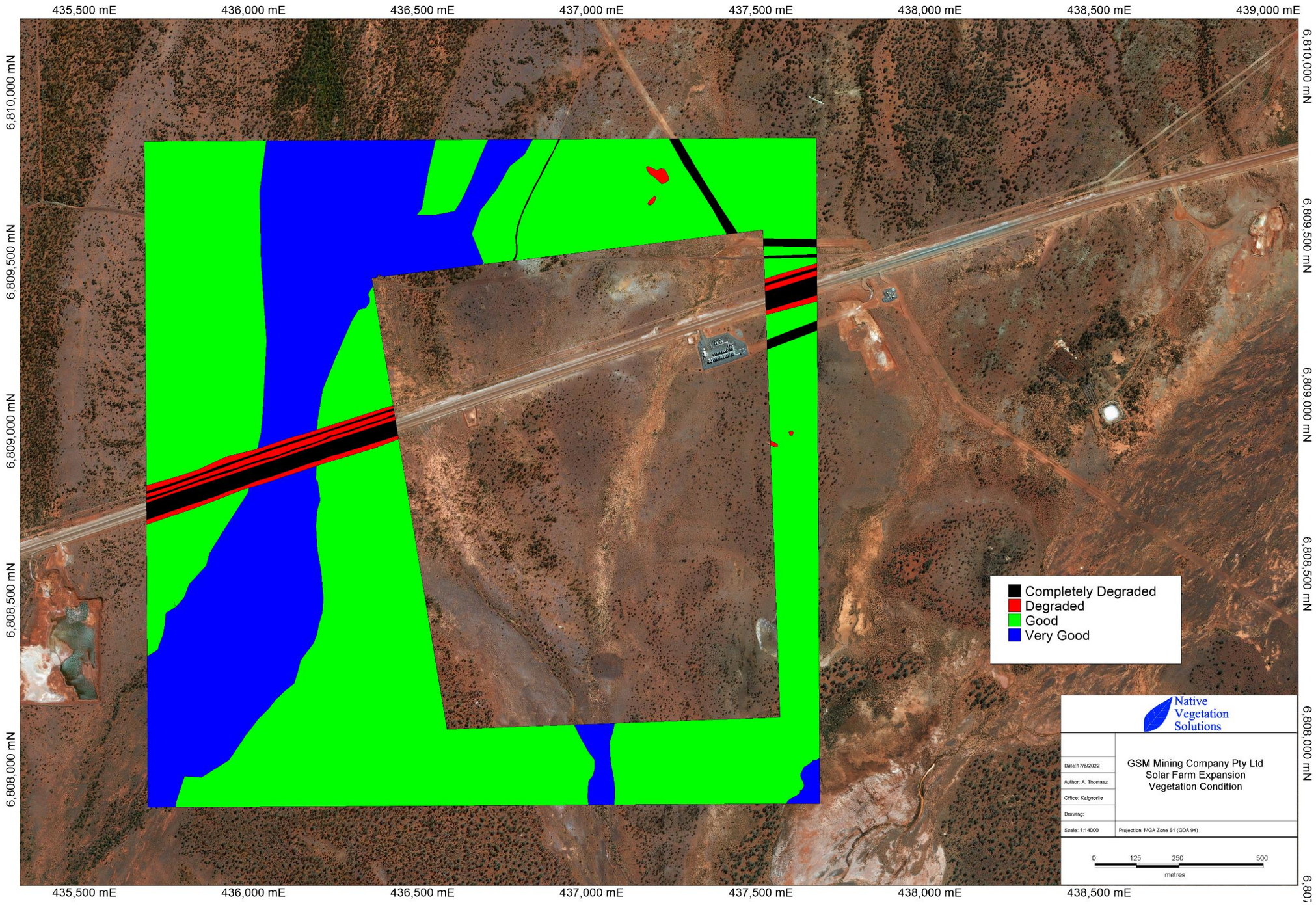
Map 2: NVS GPS Data for the GSM Solar Farm Expansion Area



Map 3: Land Systems for the GSM Solar Farm Expansion Area



Map 4: Vegetation Groups for the GSM Solar Farm Expansion Area



Map 5: Vegetation Condition for the GSM Solar Farm Expansion Area

Appendix 5

Species List

Species List per Vegetation Group

Family	Genus	Species	A	B	C	D	E	F	G	H
Amaranthaceae	*Ptilotus*	*Ptilotus divaricatus*	*	*	*	*	*		*	*
Amaranthaceae	*Ptilotus*	*Ptilotus obovatus*		*	*					
Amaranthaceae	*Ptilotus*	*Ptilotus schwartzii*	*	*						
Apocynaceae	*Leichhardtia*	*Leichhardtia australis*		*	*				*	*
Asteraceae	*Cratystylis*	*Cratystylis subspinescens*					*			
Asteraceae	*Rhodanthe*	*Rhodanthe charsleyae*		*	*				*	
Asteraceae	*Rhodanthe*	*Rhodanthe floribunda*	*				*			
Chenopodiaceae	*Atriplex*	*Atriplex bunburyana*								*
Chenopodiaceae	*Atriplex*	*Atriplex codonocarpa*			*					
Chenopodiaceae	*Atriplex*	*Atriplex nummularia* subsp. *spathulata*	*	*	*		*		*	
Chenopodiaceae	*Atriplex*	*Atriplex stipitata*	*							
Chenopodiaceae	*Enchylaena*	*Enchylaena tomentosa* var. *tomentosa*		*						
Chenopodiaceae	*Maireana*	*Maireana brevifolia*	*						*	*
Chenopodiaceae	*Maireana*	*Maireana georgei*	*	*			*		*	*
Chenopodiaceae	*Maireana*	*Maireana glomerifolia*			*					
Chenopodiaceae	*Maireana*	*Maireana planifolia*		*						
Chenopodiaceae	*Maireana*	*Maireana pyramidata*	*	*	*					
Chenopodiaceae	*Maireana*	*Maireana sedifolia*	*	*	*	*	*	*	*	
Chenopodiaceae	*Maireana*	*Maireana trichoptera*	*	*						
Chenopodiaceae	*Maireana*	*Maireana triptera*	*							
Chenopodiaceae	*Rhagodia*	*Rhagodia drummondii*		*		*			*	
Chenopodiaceae	*Sclerolaena*	*Sclerolaena densiflora*	*			*				
Chenopodiaceae	*Sclerolaena*	*Sclerolaena diacantha*					*			
Chenopodiaceae	*Sclerolaena*	*Sclerolaena patenticuspis*					*			
Chenopodiaceae	*Tecticornia*	*Tecticornia ?undulata*		*		*				
Chenopodiaceae	*Tecticornia*	*Tecticornia indica*		*	*					
Chenopodiaceae	*Tecticornia*	*Tecticornia undulata*								*
Fabaceae	*Acacia*	*Acacia aneura*	*	*					*	
Fabaceae	*Acacia*	*Acacia ayersiana*		*	*					
Fabaceae	*Acacia*	*Acacia burkittii*		*						
Fabaceae	*Acacia*	*Acacia craspedocarpa*		*	*					
Fabaceae	*Acacia*	*Acacia grasbyi*	*	*	*				*	
Fabaceae	*Acacia*	*Acacia incurvaneura*			*					
Fabaceae	*Acacia*	*Acacia kalgoorliensis*		*	*					
Fabaceae	*Acacia*	*Acacia kempeana*	*							
Fabaceae	*Acacia*	*Acacia ligulata*	*							
Fabaceae	*Acacia*	*Acacia mulganeura*		*						
Fabaceae	*Acacia*	*Acacia oswaldii*	*							
Fabaceae	*Acacia*	*Acacia pteraneura*				*	*		*	
Fabaceae	*Acacia*	*Acacia ramulosa* var. *ramulosa*		*		*				
Fabaceae	*Acacia*	*Acacia tetragonophylla*	*	*			*		*	
Fabaceae	*Acacia*	*Acacia victoriae*				*				
Fabaceae	*Daviesia*	*Daviesia aphylla*		*						*
Fabaceae	*Senna*	*Senna artemisioides* subsp. ×*artemisioides*				*				*
Fabaceae	*Senna*	*Senna artemisioides* subsp. ×*sturtii*	*							
Fabaceae	*Senna*	*Senna artemisioides* subsp. *filifolia*							*	

Family	Genus	Species	A	B	C	D	E	F	G	H
Fabaceae	*Senna*	*Senna artemisioides* subsp. *helmsii*	*							
Fabaceae	*Senna*	*Senna glutinosa* subsp. *chatelainiana*						*		
Frankeniaceae	*Frankenia*	*Frankenia ?pauciflora*				*				
Frankeniaceae	*Frankenia*	*Frankenia interioris*			*					
Frankeniaceae	*Frankenia*	*Frankenia setosa*	*			*	*			*
Goodeniaceae	*Scaevola*	*Scaevola spinescens*				*	*	*		
Lamiaceae	*Teucrium*	*Teucrium teucriiflorum*								*
Loranthaceae	*Amyema*	*Amyema preissii*				*				
Malvaceae	*Lawrencia*	*Lawrencia squamata*	*			*	*		*	
Malvaceae	*Sida*	*Sida ectogama*	*			*	*			
Poaceae	*Aristida*	*Aristida contorta*							*	
Poaceae	*Austrostipa*	*Austrostipa elegantissima*		*		*				*
Poaceae	*Enneapogon*	*Enneapogon caerulescens*				*				*
Poaceae	*Enteropogon*	*Enteropogon ramosus*								*
Poaceae	*Eragrostis*	*Eragrostis eriopoda*	*	*		*	*		*	*
Poaceae	*Triodia*	*Triodia scariosa*					*			
Proteaceae	*Grevillea*	*Grevillea sarissa*			*					
Proteaceae	*Hakea*	*Hakea preissii*			*					
Pteridaceae	*Cheilanthes*	*Cheilanthes lasiophylla*		*						
Pteridaceae	*Cheilanthes*	*Cheilanthes sieberi* subsp. *sieberi*	*	*	*	*	*		*	*
Rubiaceae	*Psydrax*	*Psydrax rigidula*					*		*	*
Rubiaceae	*Psydrax*	*Psydrax suaveolens*			*					
Rutaceae	*Philotheca*	*Philotheca brucei* subsp. *brucei*		*						
Santalaceae	*Santalum*	*Santalum lanceolatum*		*						
Santalaceae	*Santalum*	*Santalum spicatum*	*							*
Sapindaceae	*Dodonaea*	*Dodonaea rigida*		*					*	
Scrophulariaceae	*Eremophila*	*Eremophila compacta*	*	*	*		*		*	*
Scrophulariaceae	*Eremophila*	*Eremophila falcata*							*	
Scrophulariaceae	*Eremophila*	*Eremophila forrestii* subsp. *forrestii*	*	*		*		*	*	
Scrophulariaceae	*Eremophila*	*Eremophila georgei*	*	*					*	
Scrophulariaceae	*Eremophila*	*Eremophila glabra* subsp. *glabra*		*					*	*
Scrophulariaceae	*Eremophila*	*Eremophila latrobei*	*	*		*	*			
Scrophulariaceae	*Eremophila*	*Eremophila latrobei* subsp. *filiformis*		*	*					*
Scrophulariaceae	*Eremophila*	*Eremophila latrobei* subsp. *latrobei*	*			*	*			
Scrophulariaceae	*Eremophila*	*Eremophila longifolia*								*
Scrophulariaceae	*Eremophila*	*Eremophila metallicorum*		*					*	
Scrophulariaceae	*Eremophila*	*Eremophila miniata*		*		*			*	*
Scrophulariaceae	*Eremophila*	*Eremophila oldfieldii* subsp. *angustifolia*	*							
Scrophulariaceae	*Eremophila*	*Eremophila pantonii*						*		
Scrophulariaceae	*Eremophila*	*Eremophila scoparia*						*		
Scrophulariaceae	*Eremophila*	*Eremophila youngii*						*		
Solanaceae	*Solanum*	*Solanum lasiophyllum*		*					*	
Solanaceae	*Solanum*	*Solanum nummularium*			*					