

22 January 2024

[REDACTED]
Resource and Environmental Compliance Division
Department of Energy, Mines, Industry Regulation and Safety
100 Plain Street
East Perth WA 6004

Application to amend clearing permit CPS 5947/2

1 Introduction

1.1 Background

GMA Garnet Pty Ltd (GMA) is a wholly owned subsidiary of Garnet International Resources Pty Ltd. GMA owns and operates the garnet mineral sand mining and processing operations in the Mid-West Region, Port Gregory, Western Australia.

GMA previously submitted a native vegetation clearing permit (NVCP) application to clear native vegetation for mining within M70/968 (Figure 1). A NVCP CPS 5947/2 was granted on 23 April 2015.

2 Document purpose

The purpose of this document is to provide supporting information to amend the CPS 9707/2 clearing permit under Section 51k of Part V of the *Environmental Protection Act 1986* to amend the permit duration from 3 May 2024 to 3 May 2030.

This document is to be read in conjunction with the supporting documentation provided to DMIRS as part of the CPS 5947/2 clearing application – GHD (2013) GMA Port Gregory *Mining Tenement M70/968 Supporting Documentation for Native Vegetation Clearing Permit Application*, and GHD (2014) Report for Port Gregory Mine Targeted Flora Survey. The documents are provided in Attachment 1.

3 Environmental Risk Management

3.1 Identifying the Environmental Threats

Threats related to clearing native vegetation for activities under this clearing permit are summarised below.

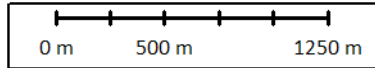
Table 1 Threats from Native Vegetation Clearing

Environmental Threats	Potential Risk
Clearing of native vegetation	Clearing beyond the approved boundary or exceeding the approved disturbance area
Dust	Impacts on native flora caused by dust emanating from the site.
Native fauna and habitat	Clearing of vegetation and activity associated with the project has the potential to directly (vehicle strikes, habitat removal) and indirectly impact native fauna (changes to foraging or dispersion dynamics)
Introduced flora	Weeds compete with native species and impact the success of rehabilitation.



Legend

- CPS 5947-1
- DMIRS Mining Tenements



Map Projection: Transverse Mercator
 Horizontal Datum: GDA 1994
 Grid: GDA 1994 MGA Zone 50



Figure 1
GMA Garnet
Port Gregory Garnet
CPS 5497/2
Permit Area

6885000

6885000

230000

230000

3.2 Risk Assessment

An Environmental Risk Assessment was undertaken for the abovementioned threats using the criteria adopted from the DEMIRS Statutory Guidelines for Mining Proposals (2020). The environmental risk assessment criteria are provided in Attachment 2. The risk assessment was developed based on the information provided in supporting documentation provided to DEMIRS as part of the CPS 5947/2 clearing application – GHD (2013) *GMA Port Gregory Mining Tenement M70/968 Supporting Documentation for Native Vegetation Clearing Permit Application*, and GHD (2014) Report for Port Gregory Mine Targeted Flora Survey.



Table 2 Risk assessment and management

Environmental Threat	Cause	Potential Impact	C	L	Inherent Risk Level	Management	C	L	Treated risk
Clearing of native vegetation	Clearing works undertaken for pit expansion	Clearing of vegetation in unapproved areas and/or outside the tenement boundary	Moderate	Possible	Medium	<p>Clearing and Ground Disturbance Procedure implemented.</p> <p>Induction and training.</p> <p>Survey control of areas to be cleared.</p> <p>Post clearing checks to ensure clearing has been undertaken in accordance with approval</p>	Moderate	Unlikely	Medium
Native fauna and habitat	Clearing of Native Vegetation	Loss of wildlife corridor	Minor	Possible	Medium	Clearing activities is required to facilitate mine expansion.	Minor	Rare	Low
		Permanent loss of vegetation, fauna habitat and biodiversity	Minor	Possible	Medium	<p>Mining of the Lynton North pit will progressively expand northwards. The method of mining permits the mining voids to be progressively backfilled and rehabilitated at the trailing edge of the pit, while mining activities continue at the leading edge, progressing northwards (Plate 1).</p> <p>GMA mine closure requirements for M70/968 are outlined in the Port Gregory Project – Revised Mine Closure Plan and Lynton Mine Extension M70/968 Mining Proposal. GMA has an obligation to rehabilitate the mined area to pre-mining native vegetation</p>	Minor	Rare	Low

Environmental Threat	Cause	Potential Impact	C	L	Inherent Risk Level	Management	C	L	Treated risk
						<p>communities. Therefore, there is no permanent loss of vegetation, biodiversity, fauna habitat or any wildlife corridors.</p> <p>A rehabilitation management plan has been prepared to guide rehabilitation and revegetation post-mining (refer to section 3.3).</p> <p>GMA has successfully rehabilitated and returned areas to native vegetation (refer to section 3.3.4).</p>			
Dust	Vehicle and machinery movement	Fugitive dust emissions associated with mining fleet movements and exposed area, causing impacts to health and condition of the surrounding vegetation and adjoining Hutt Lagoon.	Moderate	Likely	High	<p>Dust management will be undertaken in accordance with the GMA's Dust Management Procedure. The following management measures are proposed:</p> <ul style="list-style-type: none"> • Both visual and monitoring of the wind station located at Hose. 	Minor	Unlikely	Low
	Wind	Dust generated by wind blowing across cleared areas and stockpiles settles on adjacent vegetation causing plant death.	Moderate	Likely	High	<ul style="list-style-type: none"> • Clearing is limited to the extent required as per mining planning. • Pre-stripping will be kept to the minimum practicable work area. • Progressively rehabilitate all mined-out areas. • Water carts will undertake dust suppression on haul roads and areas exposed by southerly winds during the summer. 	Minor	Unlikely	Low

Environmental Threat	Cause	Potential Impact	C	L	Inherent Risk Level	Management	C	L	Treated risk
						<ul style="list-style-type: none"> Dust suppressant additives (mulches or polymer additives) will be used if water applicates is insufficient to ameliorate dust generation. To manage potential dust from stockpiles. Any mining activities will cease in the event that dust suppression controls fail to mitigate dust emissions. 			
Surface water	Clearing of native vegetation	Clearing of vegetation leading to erosion and sedimentation from surface water runoff leading to Hutt Lagoon	Minor	Rare	Low	<p>No drainage lines were recorded within the clearing permit area.</p> <p>Due to the porous nature of the soils, any rainfall rapidly infiltrates directly through limestone. It is expected that most of the surface water will rapidly infiltrate.</p> <p>The progressive and final rehabilitation of the mining pit area will incorporate re-contouring to blend in with the surrounding landscape and ensure any pre-mining landforms reinstated. As a result, this management approach, there will be no effect on surface water flow.</p>	Minor	Rare	Low
Introduced Flora	New weeds species introduced to site	Successful restoration of native vegetation is inhibited by weed infestation.	Minor	Possible	Medium	<ul style="list-style-type: none"> Weed management procedure If Machinery is brought to site it has to be clean and hygiene certificate provide. Inspection of machinery on arrival. Weed surveys undertaken 	Minor	Unlikely	Low

3.3 Rehabilitation

The progress of revegetation establishment will be monitored through a combination of visual inspection and botanical survey.

3.3.1 General Approach

The table below presents the current rehabilitation approach adopted by GMA. The table also includes recommendations regarding stockpile storage.

Table 3 Rehabilitation Approach

#	Task	Action	Objective
1	Contour Survey	Topographical survey of location before vegetation clearing.	Completed pits are backfilled with mine waste and shaped to blend in with adjacent natural contours.
2	Seed Collection	Collection of seed of native species within Mine Site before vegetation clearing.	Retain genetic suite of remnant vegetation in Mine Site.
3	Vegetation Removal	100 m corridor removed per year within the mining lease.	Sequential clearing methodology minimising disturbances to fauna movement. Biological matter retained.
4	Topsoil removal	Standing remnant vegetation to be pushed into windrows for stockpiling for later respreading on areas rehabilitated.	Maximum retention of soil fertility and existing seed bank. Retention of biological material in topsoil. Reduction in a change in the physical structure of the topsoil because of compaction and change in moisture content. Retention of preferred growth media to support plant growth in rehabilitated areas.
5	Overburden removal	Overburden (where present) to be progressively removed and stockpiled or placed directly over tailings during pit excavations.	Minimisation of the open area of pit.
6	Tailings storage	Tailings to be progressively returned to the trailing edge of the excavated mine pit (Plate 1).	Storage of tailings within landform profile.
7	Overburden return	Stockpiled overburden to be returned to the trailing edge of the excavated mine pit and over tailings as soon as practicable (Plate 1).	Construction of post-mining landform. Minimise storage time of overburden.
8	Landform construction	Contouring of completed mining area to natural contours to be achieved by earth-moving machinery.	Construction of post-mining landforms to blend in with surrounding landforms. Height and footprint ensure that the rehabilitated area blends with the surrounding landscape. The new landform does not restrict the existing hydrological regime in the area.
9	Topsoil return	Topsoil is placed over subsoil (overburden, tails) to a minimum depth of 150 mm.	Construction of post-mining landform to match pre-mining landform.

#	Task	Action	Objective
10	Soil treatment (as required)	Addition of fertilisers suitable for native plant growth (as required).	Create conditions suitable for native plant growth, but minimising weed growth (stage may not be required).
11	Integration of topsoil and landform	Deep ripping of constructed landform to ensure integration of topsoil and subsoil.	Minimise the risk of erosion by wind and water.
12	Return of larger vegetative material	Spreading across landscape of stockpiled logs, branches, and other vegetative material pushed up into windrows.	Increase rainfall penetration of soil profile.
13	Seeding	Direct seeding of reconstructed landform with seeds collected from the Site.	Minimise the risk of erosion by wind and water.
14	Monitoring	Establishment of long-term monitoring sites.	Increase microhabitat.
15	Weed management	Ongoing weed management via a regular treatment program.	Increase seed retention areas for growth.

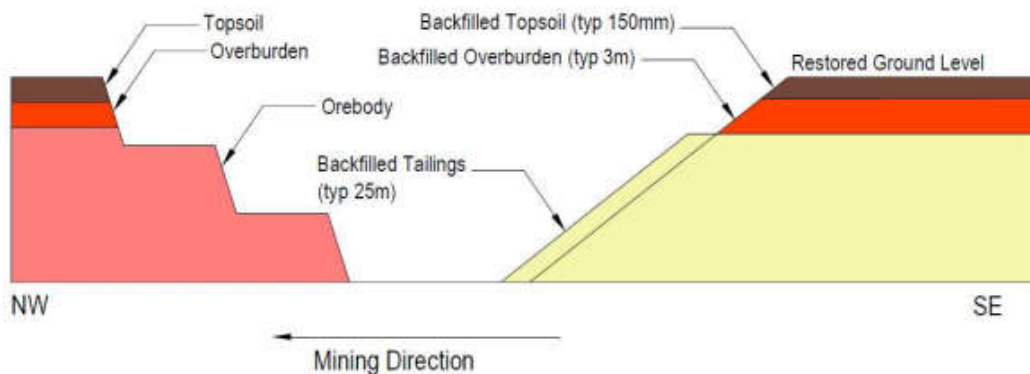


Plate 1 Pit Backfilling/Landform Construction

3.3.2 Vegetation Establishment

3.3.2.1 Erosion Control – Early Revegetation

Progressive rehabilitation will occur as soon as possible after being backfilled. The vegetative matter shall be returned to the Site and strategically placed in windrows to help mitigate wind erosion and enhance the establishment of new native vegetation. If required, the application of gluon on topsoil areas is completed to mitigate wind erosion, and earthen bunds are used to protect topsoil areas.

3.3.2.2 Return of Local Native Species

The use of seed for rehabilitation must be obtained from the local area and appropriate for the targeted vegetation type. Seeds should be collected from vegetation within the Site, so that genetic diversity of the Site is retained and returned.

Weeds are problematic for the Site and it is recommended that revegetation efforts focus on fast-growing plants (i.e. *Acacia*, *Eucalypts* and *Melaleuca*) rather than herbs in the initial years. It should be noted that the species list is not exhaustive.

3.3.2.3 Weed Management

Where there is a low likelihood of weeds being eradicated from areas such as existing paddocks. The weed management actions will focus on protecting areas of remnant native vegetation and native vegetation rehabilitation areas by preventing the spread of weeds into these areas. This form of management will be achieved through containment and land protection measures.

Longer-term objectives for dealing with well-established weed species will be to undertake measures to reduce the extent of the infestation of weed species (i.e aiming for a slow reduction in the extent of these infestations over time through a staged treatment of these areas). Strategically treating large areas starting from the outside and working inwards is the recommended approach for achieving this objective.

Weed species can potentially spread between sites by several different vectors including, but not limited to, contaminated machinery, vehicles, equipment, clothing and footwear. The implementation of weed hygiene procedures are critical to minimising the spread and/or introduction of weeds.

Appropriate weed hygiene measures will be implemented to minimise further weed species spread and introduction. All site personnel, vehicles and equipment entering the site area must follow weed hygiene measures.

Weed monitoring is an essential component of any weed management program as it identifies how well control measures are working, the rate of spread of weeds and/or the detection of new weeds established in disturbed areas. The Pest and Weed Management Guideline/Procedure can be adapted as needed to improve results and accommodate changing circumstances or changes in the local environment.

Ongoing weed monitoring and management of weeds, particularly in disturbed areas, is a high priority. Follow-up control is vital as many weed species have long-lived seeds that have the potential to remain viable in the soil for many years. Ongoing surveillance monitoring of sites shall be undertaken throughout the year, especially after rain periods.

3.3.2.4 Revegetation Treatments

The topsoil shall be spread across the area at an optimal depth of 150 mm or greater (or topsoil pre-clearing survey results), and vegetative matter will be strategically placed in windrows to establish fauna habitat and windbreaks.

Direct seeding of the reconstructed post-mining landform is the most suitable method of developing the vegetation community. Seeds will be sourced locally from the Site and collected before vegetation is cleared, to preserve the genetic diversity.

Direct seeding and if required supplemented with additional planting of locally sourced native flora species. This will be undertaken to enhance biodiversity on-site where quick-growing colonisers may outcompete slower-growing or recalcitrant species or where monitoring demonstrates a lack of species diversity compared to the biodiversity target criteria.

Direct planting will also be used in conjunction with the direct seed of the reconstructed post-mining landform to enhance soil stabilisation.

3.3.2.5 Monitoring

Visual monitoring of rehabilitated areas will be conducted to assess:

- Any signs of poor rehabilitation development that may require treatment, supplementary seeding or earthworks.
- Species recruitment.
- Stability of rehabilitation sites.

Areas will be photographed from fixed positions so that changes with time can be clearly observed.

3.3.2.6 Objective and Completion Criteria

A baseline for the re-establishment of vegetation was developed to guide revegetation and monitor the success of the works initially. Indicative values for foliage cover and flora species diversity at set intervals were provided to guide the progress of native flora taxa within each stratum and weed species until practical completion (Table below).

The success of revegetation can be affected by a range of issues, which may be out of the control of GMA, such as lack of rainfall, storm events, insect attack and vandalism, but other success factors, such as weeds, grazing, and care of planting can be managed. The overarching outcome for revegetation is:

- To achieve similar species composition, structure and diversity to what was present before vegetation clearing. Small-scale vegetation structure and species combinations may vary.

Practical completion is achieved when:

- An average of 75% species diversity of adjacent reference sites, +/- 5%, for a five-year period.
- An average of 50% plant cover in the ground and mid layers of the adjacent reference sites, +/- 5%, for a five-year period.
- The key upper storey species recorded in the vegetation type/adjacent reference site are present and likely to form an upper storey over time.

Four vegetation types (excluding cleared and degraded) were mapped within this mining tenement. The vegetation types included:

- Mixed Open Heath on Sandy Limestone Ridge (VT01)
- *Acacia rostellifera* Scrub (VT02)
- Low Heath (VT03)
- *Melaleuca* Thickets (VT04).

Background for vegetation re-establishment was developed for the identified vegetation types, as shown in the tables below. It is understood that the *Acacia rostellifera* Scrub (VT02) was excluded from the mining footprint, and therefore, completion criteria were not required for this vegetation type.

Table 4 Practical Completion Criteria Targets Guideline

M70/968					
Vegetation Type 1					
Stratum	Background	6 months	1 years	5 years	10+ years
Upper Stratum	84%	-	>2%	>50%	>84%
Middle Stratum	10%	-	>2%	>5%	>10%
Groundcover	<21%	<50%	<21%	<21%	<21%
Mean Weed Foliage Cover (%)	0	0	0	0	0
Declared Pest	≤3	≤3	≤3	≤3	≤3
Weed Species Count	≥20	≥4	≥6	≥10	≥20
Flora Diversity Species Count (native flora)	84%	-	>2%	>50%	>84%
Vegetation Type 3					
Stratum					
Upper Stratum	79%	-	>2%	>50%	>79%
Middle Stratum	26%	-	>2%	>10%	>26%
Groundcover	<5%	<50%	<25%	<5%	<5%
Mean Weed Foliage Cover (%)	0	0	0	0	0
Declared Pest	≤3	≤3	≤3	≤3	≤3
Weed Species Count	≥16	≥4	≥4	≥8	≥16
Flora Diversity Species Count (native flora)	79%	-	>2%	>50%	>79%
Vegetation Type 4					
Stratum	Background	6 months	1 year	5 years	10 years
Upper stratum	18%	-	-	>5%	>18%
Middle stratum	67%	-	>2%	>30%	>67%
Groundcover	22%	-	>2%	>15%	>22%
Mean weed foliage cover (%)	<8%	<50%	<25%	<8%	<8%
Declare Pests	0	0	0	0	0
Weed species count	≤1	≤1	≤1	≤1	≤1
Flora diversity species count (native flora)	≥12	≥3	≥6	≥12	≥12

3.3.3 Site Establishment and Data Collection

3.3.3.1 Site Establishment

At each mining tenement where revegetation is undertaken, a minimum of one permanent quadrats (10 x 10 m) will be established within both remnant vegetation and rehabilitation areas for each revegetation year with the aim of providing sufficient monitoring data.

The analogue quadrats (reference sites) established within the remnant vegetation will assist with measuring the progress of revegetation and be used to determine whether practical completion has been met.

Galvanised steel post will be installed in each corner of the quadrat and each corner will be geo-referenced.

3.3.3.2 Data collection, analysis and reporting

Site data collected from each quadrat will be recorded on pro-forma data sheets and will include the parameters described in the table below.

Table 5 Example of Data Collection at Monitoring Quadrats

Parameters	Measurements
Collection attributes	Personnel/recorder, date, quadrat dimensions, GPS coordinates of all corners and photographs from each corner of the quadrat.
Rehabilitation details	Rehabilitation year and works
Physical attributes	Landform, drainage, soil, litter type and cover
Disturbances	Nature of disturbances, fire age
Vegetation	Structure: overall projected foliar cover of upper, mid- and ground stratum (based on cover classes of: 1-100%)
Flora	Composition (species diversity): list of all flora species and stratum abundance
Weeds and Declared Pests	Overall foliar cover of all weed species combined based on the cover class of: 1 to 100%

3.3.3.3 Monitoring Frequency and Duration

Monitoring will be conducted every second year for a minimum of five years from the completion of rehabilitation activities or until the closure objectives associated with each domain have been met. As monitoring for progressive rehabilitation is completed, this monitoring timeframe will be reviewed.

3.3.4 Rehabilitation Performance

Past rehabilitation of mined zones on southern M70/204 has successfully restored the pre-mining vegetation.

The GMA Rehabilitation Management Plan outlines the rehabilitation monitoring methodologies for areas to be returned to remnant vegetation.




The monitoring results are summarised in the section below, and a copy of the reports is attached in Attachment 3.

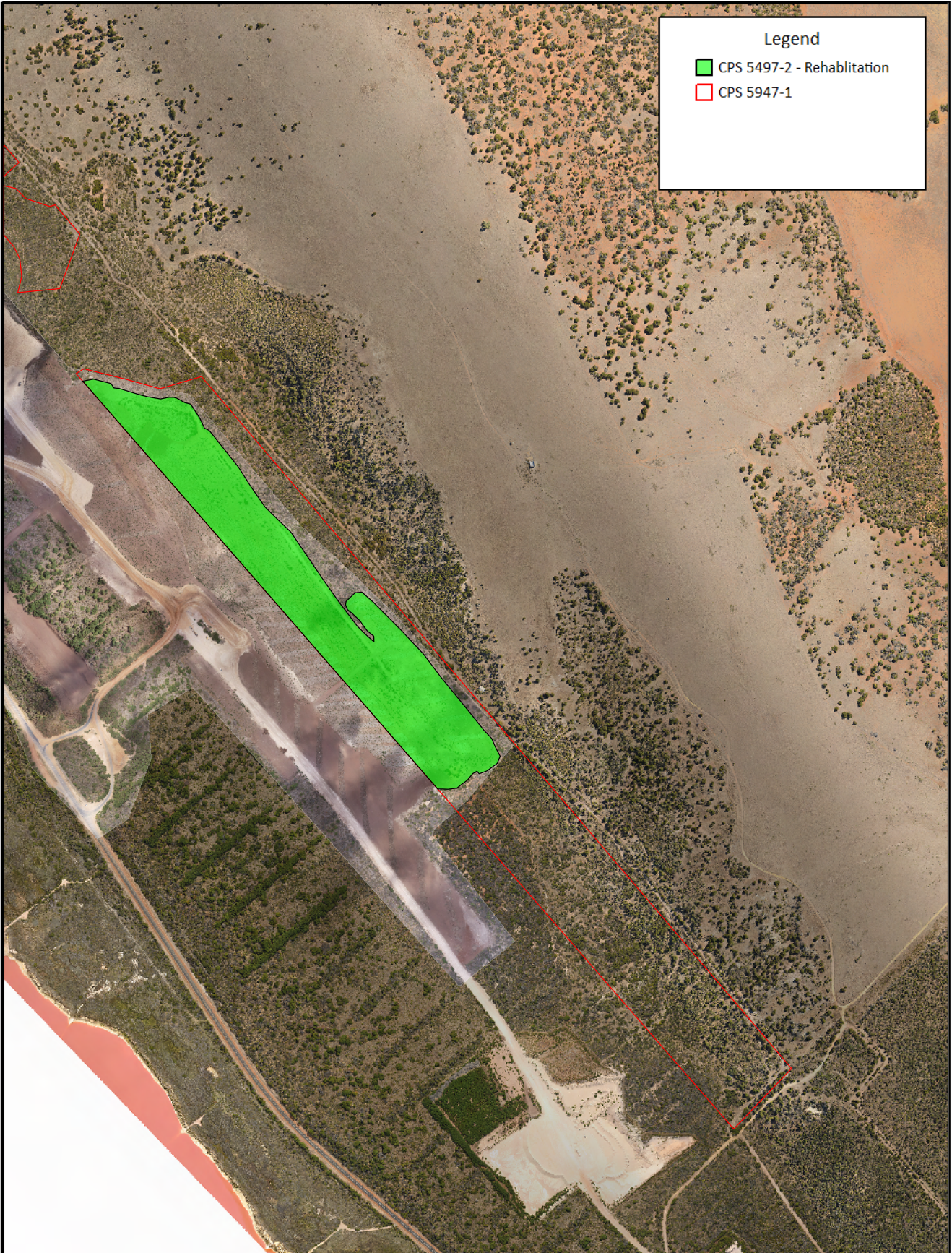
3.4 Summary of Rehabilitation Works for CPS 5947

Rehabilitation works undertaken are summarised below and the rehabilitated area shown in Figure 2:



- Approximately 13.1 hectares between 2019 – 2022 have been rehabilitated.
- Between 2020 and 2023 both seed application and tubestock planting have been conducted, including:
 - Eucalyptus and Melaleuca seed application over approximately 3 ha area.
 - 3500 (Melaleuca and Eucalyptus) tubestocks were planted in 2022, and 500 g Eucalyptus seed was applied in 2022 over a 6.7-hectare rehabilitated area.
 - 10,760 (Melaleuca, Eucalyptus and Pittosporum) tubestock were planted in 2023.
 - The application of 72 kg of pelletised seed over 6.6 hectares of rehabilitated area.

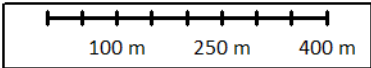
Table 6 Representative Photographs of Rehabilitation on M70/968 (1/12/2023

Photograph	Description
	<p>Representative photograph of successful establishment Melaleuca tube stock planted in 2022.</p>
	<p>Representative photograph of the successful establishment Eucalyptus seed spread in 2020.</p>
	<p>Representative photograph of successful establishment Melaleuca tube stock planted in 2022.</p>



Legend

-  CPS 5497-2 - Rehabilitation
-  CPS 5947-1



Map Projection: Transverse Mercator
Horizontal Datum: GDA 1994
Grid: GDA 1994 MGA Zone 50



Figure 2
GMA Garnet
Port Gregory Garnet
CPS 5497/2
Rehabilitation Effort

4 Clearing Status

The table below summarises the area cleared within CPS 5947/2 permit area since 2012. Attachment 4 provides an overview of the clearing efforts plans undertaken between 2014 and July 2023.

Table 7 Clearing Activities CPS 5947/2

Reporting Periods	Clearing extent (ha)	Date Cleared	Clearing Purpose
1 July to 30 June			
2014 – 2015	1.11	30/09/2014	Pit progression
	3.02	20/01/2015	Pit progression and access tracks
2015 – 2016	0.98	15/09/2015	Pit progression
	0.33	30/10/2015	Pit progression
	0.29	9/02/2016	Drill line clearing
	0.25	24/05/2016	Pit Progression
2016-2017	1.35	8/08/2016	Pit progression and topsoil stockpiling - South
	0.46	21/10/2016	Pit progression and topsoil stockpiling - South
	0.85	12/12/2016	Pit progression and topsoil stockpiling - South
	0.25	19/03/2017	Pit progression - South
	0.24	19/03/2017	Pit progression - North
	1.49	15/05/2017	Pit progression and topsoil stockpiling - South
2019-2020	1.27	29/05- 20/6/2020	Clearing of regrowth to access topsoil stockpiles and prepare the area for topsoiling.
2020-2021	NIL	NIL	No clearing was undertaken.
2021-2022	0.084	1/07-1/08/2021	Clearing of regrowth to progress rehabilitation.
	0.789	9/5 – 23/5/2022	
2022-2023	1.2	4/08-7/09/2022	Clearing of regrowth to progress rehabilitation and access topsoil stockpiles.
	0.8	20/02/2023	Clearing of native vegetation for pit expansion.

5 References

GHD (2013) GMA Port Gregory Mining Tenement M70/968 Supporting Documentation for Native Vegetation Clearing Permit Application. Unpublished. Prepared for GMA Garnet.

GHD (2014) Report for Port Gregory Mine Targeted Flora Survey. Unpublished. Prepared for GMA Garnet.

Should you require any further information, please do not hesitate to contact me.

A handwritten signature in black ink, appearing to read 'SPetts'.

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**Attachment 1 –GHD (2013) GMA Port Gregory Mining Tenement M70/968
Supporting Documentation for Native Vegetation Clearing Permit Application, and
GHD (2014) Report for Port Gregory Mine Targeted Flora Survey.**



GMA Garnet Pty Ltd
GMA Port Gregory Mine Tenement M70/968
Supporting Document for Clearing Permit Application

October 2013

This Supporting Document for Clearing Permit Application (Purpose Permit) has been prepared by GHD for GMA Garnet Pty Ltd and may only be used and relied on by GMA Garnet Pty Ltd for the purpose agreed between GHD and the GMA Garnet Pty Ltd as set out 1.1 of this report.

GHD otherwise disclaims responsibility to any person other than GMA Garnet Pty Ltd arising in connection with this report. GHD also excludes implied warranties and conditions, to the extent legally permissible.

The services undertaken by GHD in connection with preparing this report were limited to those specifically detailed in the report and are subject to the scope limitations set out in the report.

The opinions, conclusions and any recommendations in this report are based on conditions encountered and information reviewed at the date of preparation of the report. GHD has no responsibility or obligation to update this report to account for events or changes occurring subsequent to the date that the report was prepared.

The opinions, conclusions and any recommendations in this report are based on assumptions made by GHD described in this report Section 1.4. GHD disclaims liability arising from any of the assumptions being incorrect.

GHD has prepared this report on the basis of information provided by GMA Garnet Pty Ltd and others who provided information to GHD (including Government authorities)], which GHD has not independently verified or checked beyond the agreed scope of work. GHD does not accept liability in connection with such unverified information, including errors and omissions in the report which were caused by errors or omissions in that information.

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Appendices

Appendix A – Vegetation, Flora and Fauna Assessment

1. Introduction

1.1 Project Description

GMA Garnet Pty Ltd (GMA Garnet) currently own and operate the Port Gregory Mine, located 12 km north of Port Gregory in Western Australia.

GMA Garnet Pty Ltd (GMA Garnet) commissioned GHD Pty Ltd to prepare a clearing permit application (Purpose Permit) for proposed mining activities at the Port Gregory Mine Site. GMA Garnet propose to clear up to 50 ha (over a ten year period- i.e. 5 ha/year) of native vegetation for ore extraction within the lease M70/968. The area to be cleared will hereon be referred to as the application area (Figure 1).

A clearing permit for the proposed development is required under the *Environmental Protection (Clearing of Native Vegetation) Regulations 2004* and the *Environmental Protection Act 1986* (EP Act), which contains provisions that protect native vegetation while allowing for approved clearing activities. The requirements for a clearing permit to clear native vegetation in Western Australia came into effect on 8 July 2004.

The following details are provided in this report:

- A description of the proposed works;
- Locality of the Application Area;
- Information about the vegetation and flora in the application area and the existing environment;
- Information about the fauna in the application area and the existing environment; and
- An assessment of the proposal against the Department of Environment Regulation's Ten Clearing Principles.

1.2 Application Area

The application area is located within the Shire of Northampton in the locality of Port Gregory, Western Australia. The area to be assessed is tenement M70/968, which is 64.69 ha in size. GMA Garnet proposes to clear up to 50 ha over a ten year period (i.e. 5 ha/year) of native vegetation in the application area.

The clearing of vegetation will be associated with mining of ore, additional exploration drill pads and access tracks. GMA Garnet has not yet defined the ore body and hence the area that will be cleared is not yet finalised.

1.3 Proponent Details

GMA Garnet Pty Ltd (GMA Garnet) is the Project Manager and agent for the site.

1.4 Assumptions

The opinions, conclusions and any recommendations in this application are based on the assumptions made by GHD when undertaking services and preparing the report ('Assumptions') including:

- Information provided by Government Agencies is correct;
- Information provided by the GMA Garnet Pty Ltd (GMA Garnet) is correct; and

- One field assessment was completed by GHD as specified by the GMA Garnet Pty Ltd (GMA Garnet).

GHD expressly disclaims responsibility for any error in, or omission from, this Report arising from or in connection with any of the Assumptions being incorrect. Where reports, searches any third party information and similar work have been performed and recorded by others the data is included and used in the form provided by others. The responsibility for the accuracy of such data remains with the issuing authority and not with GHD.

Subject to the paragraphs in this section of the Report, the opinions, conclusions and any recommendations in this Report are based on conditions encountered and information reviewed at the time of preparation and may be relied on until six months, after which time GHD expressly disclaims responsibility for any error in or omission from, this Report arising from or in connection with those opinions, conclusions and any recommendations.

2. Existing Environment

A Vegetation, Flora and Fauna Assessment was conducted for the site by GHD Pty Ltd in August 2013. The Vegetation, Flora and Fauna Assessment Report (GHD, 2013) is included in Appendix A.

Relevant biological information is extracted from the Assessment Report is included below.

2.1 Environmentally Sensitive Areas

A search on the Native Vegetation Viewer database indicated that there are no Environmentally Sensitive Areas within or adjacent to the application area.

2.2 Native Vegetation

A search on the Australian Government *Environmental Biodiversity Act 1999* (EPBC Act) Protected Matters Search Tool indicated that no Wetlands of International or National Significance (i.e. listed under the Ramsar Convention) or Wetlands of National Importance occur within the area of proposed works.

The nearest waterbody to the site is the Hutt Lagoon located approximately one kilometre west of the Project. It is listed as a Wetland of National Importance, but will not be impacted by the proposed works.

2.3 Reserves and Conservation Areas

A search using the EPBC Protected Matters Search Tool and *NatureMap* indicated the nearest reserve is located approximately 15 kilometres north of the application area:

- Reserve 640- Utcha Well Nature Reserve.

This reserve will not be impacted by the proposed works.

2.4 Vegetation

2.4.1 Broad Vegetation Description

The application area is located within the Geraldton Hills (GS2) IBRA sub – region of the Geraldton Sandplains. The vegetation consists primarily of proteaceous heath with Banksia York gum woodlands on alluvial plains and Acacia scrub on limestone (Desmond and Chant 2002).

The following Beard Vegetation Associations exists within the application area.

Table 1 Beard's Vegetation Association within the Application Area.

Vegetation Association	Description	Location
371	Low Forest; Acacia rostellifera	Western fringe of Application Area, below limestone outcropping
17	Shrublands; Acacia rostellifera thicket	Eastern Application Area, typically on limestone outcropping

2.4.2 Vegetation Types M70/968

A vegetation survey was undertaken by GHD Pty Ltd (2013) of the application area. From the survey five vegetation types were identified:

- 1: Mixed Open Heath on Sandy Limestone Ridge - High Open Shrubland of *Acacia rostellifera*, *Melaleuca cardiophylla*, *Grevillea argyrophylla*, over Shrubland of *Olearia* sp. Kennedy Range, *Hibiscus huegelii*, over Low Shrubland of *Pimelea angustifolia*, *Diplopeltis petiolaris*, *Acanthocarpus preissii* over Scattered Grasses of **Avena barbata*, *Austrostipa* spp., over Mixed Herbs of **Lysimachia arvensis*, *Goodenia beardiana*, *Erodium* sp. with Scattered Climbers of **Cuscuta* sp., *Dioscorea hastifolia*, *Commicarpus australis*;
- 2: *Acacia rostellifera* Scrub - High Shrubland to Open Scrub of *Acacia rostellifera* over Shrubland of *Rhagodia latifolia*, *Stylobasium spathulatum*, *Olearia* sp. Kennedy Range over Low Shrubs of *Tetragonia implexicoma* over Grasses of **Ehrharta longiflora*, **Avena barbata*, *Austrostipa* spp., over Mixed Herbs of **Lysimachia arvensis*, *Erodium* sp. over with Scattered Climbers of **Cuscuta* sp., *Dioscorea hastifolia*, *Commicarpus australis*;
- 3: Low Heath- Low Open Heath to Low Heath of *Melaleuca cardiophylla*, *Diplopeltis petiolaris*, *Bossiaea spinescens*, *Pimelea angustifolia*, *Opercularia vaginata*, over Scattered Grasses of **Avena barbata*, *Austrostipa* spp., over Mixed Herbs of **Sisymbrium irio*, *Zygophyllum billardieri* with Scattered Climbers of *Dioscorea hastifolia*, with Open Rushes of *Desmocladius asper*;
- 4: *Melaleuca* Thickets - Closed Scrub of *Melaleuca cardiophylla* with Mallee of *Eucalyptus* spp. over Low Shrubs of *Rhagodia latifolia*, *Lasiopetalum angustifolium* with Scattered Climbers of *Aphanopetalum clematideum*, *Dioscorea hastifolia*; and
- 5: Cleared/Degraded - Cleared Tracks and firebreaks, old pits with regrowth of *Acacia rostellifera*, pasture grasses and weeds.

2.4.3 Vegetation Condition

The condition of the surveyed area using the vegetation condition rating scale developed by Keighery (1994) rated *Excellent* to *Good* in areas of native vegetation. There were areas of previous disturbance such as firebreaks and given a rating of *Degraded* to *Completely Degraded*.

2.5 Relevant Biological Surveys

A Vegetation, Flora and Fauna Assessment was conducted for the site by GHD Pty Ltd in August 2013. The Vegetation, Flora and Fauna Assessment Report (GHD, 2013) is included in Appendix A.

2.5.1 Flora

GHD Pty Ltd (2013) identified a total of 75 flora taxa from 39 vascular plant families within the application area.

2.5.2 Conservation Significant Flora

No flora taxa of conservation significance were recorded from the application area.

2.5.3 Fauna

GHD Pty Ltd (2013) identified a total of five birds and two mammal taxa within the application area.

2.5.4 Conservation Significant Fauna

No fauna taxa of conservation significance were recorded from the application area.

3. Assessment Against the Ten Clearing Principles

Under the *Environmental Protection Act 1986* (EP Act), clearing of native vegetation is an offence unless you have obtained a clearing permit or an exemption applies. Exemptions for low impact routine land management practices are contained in the *Environmental Protection (Clearing of Native Vegetation) Regulations 2004*. These exemptions do not apply within environmentally sensitive areas declared by the Minister for Environment under section 51B of the EP Act.

The application area includes native vegetation (a maximum of 50 ha over a ten year period) that will require and approved clearing permit for its removal. Clearing applications are assessed against the Ten Clearing Principles outlined under Part V of the EP Act. These Principles aim to ensure that all potential impacts resulting from the removal of native vegetation can be assessed in an integrated way.

Clearing associated with the application area has been assessed against the Ten Clearing Principles. The assessment of the proposed clearing of native vegetation within the Application Area is considered to be “at variance” with Clearing 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”.

A small portion of the Application Area is considered to be equivalent to Vegetation Association 371 which is classified as *Vulnerable to Depleted*.

GMA Garnet’s recent mining proposal for the Hose Mining Project on M70/927 (located 15 km north of the application area) was also at variance with this principle. Included in a land-swap deal that expanded the existing Utcha Well Nature Reserve was GMA Garnet existing mining method adapted to ensure that rehabilitation occurs following the mining front (c.100 m/year).

This mining/rehabilitation method minimises the area of vegetation required to be cleared at any one time, and allows the progressive re-establishment of vegetation behind the mining area.

Details of the Ten Clearing Principles and their application against the findings of this Assessment are included in Table 2.

Table 2 Assessment Against the Ten Clearing Principles

Principle Number	Principle	Assessment	Outcome
(a)	Native vegetation should not be cleared if it comprises a high level of biological diversity	<p>The Application Area is considered to be of moderate biodiversity, but is not considered to be of higher biodiversity than the surrounding areas. The proposed clearing is unlikely to have any significant impact on the biodiversity of the region.</p> <p>The Application Area is not within Threatened or Priority Ecological Communities.</p> <p>A total of 75 flora taxa from 39 families were recorded from the Application Area.</p> <p>A total of seven Priority Flora taxa are considered to potentially occur in the application area based on known range and habitat. No Threatened (Declared Rare) or Priority Flora are known from the application area, and none were recorded from the field survey.</p> <p>No flora taxa recorded at or beyond their known were recorded.</p>	The proposal is not at variance with the Principle.
(b)	Native vegetation should not be cleared if it comprises the whole or a part of, or is necessary for the maintenance of, a significant habitat for fauna indigenous to Western Australia.	<p>Few fauna taxa were recorded, predominantly due to the small Application Area. No Threatened or Priority Fauna taxa were recorded from the Application Area.</p> <p>No known significant habitat is present in the Application Area. Two broad habitat types were recorded in the Application Area: Mixed scrub on sandy soils with limestone; and Low heath on limestone hills.</p> <p>The proposal is unlikely to be at variance with the principle as clearing is minimal and occurs within habitat well represented both locally and regionally.</p> <p>The site is geographically isolated from the Utcha Well and Hutt Lagoon. The proposed project will not impact fauna utilising these areas.</p>	The proposal is not at variance with the Principle.

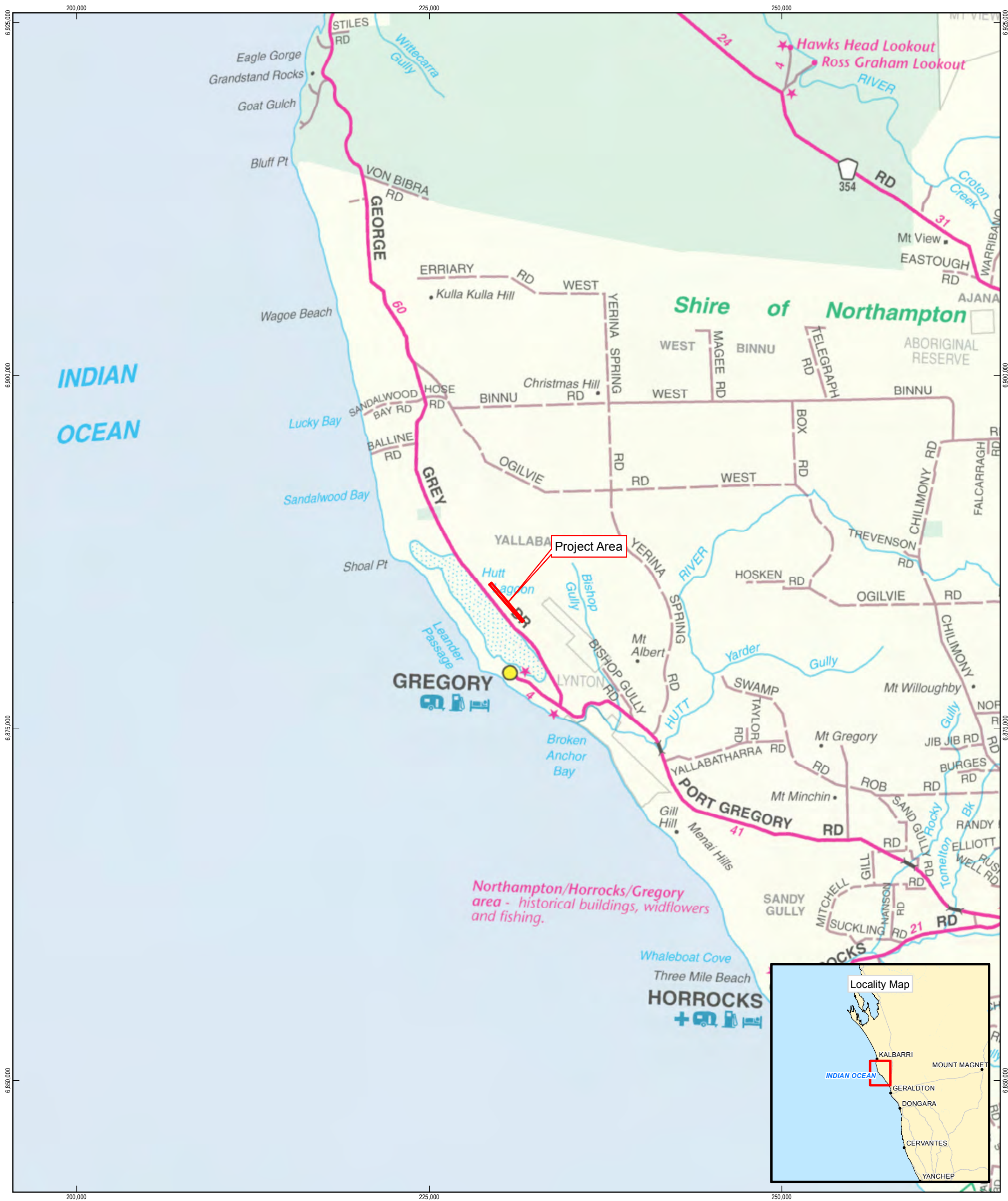
Principle Number	Principle	Assessment	Outcome
(c)	Native vegetation should not be cleared if it includes, or is necessary for the continued existence of, rare flora	<p>A total of four Threatened (Declared Rare) Flora taxa are considered to potentially occur in the application area based on known range and habitat: <i>Caladenia bryceana</i> subsp. <i>cracens</i>; <i>Caladenia hoffmanii</i>; <i>Drakaea concolor</i>; and <i>Pterostylis sinuata</i>.</p> <p>No Threatened (Declared Rare) Flora species are known from the application area, and none were recorded from the field survey.</p>	The proposal is unlikely to be at variance with this principle.
(d)	Native vegetation should not be cleared if it comprises the whole or a part of, or is necessary for the maintenance of a threatened ecological community	<p>A search on the EPBC Protected Matters and DPaW TEC/PEC databases, revealed no TECs occurring within 5 kilometres of the Application Area.</p> <p>PECs associated with Mound Springs occur between 5 and 9 km east of the Application Area. These will not be impacted by the proposed works.</p> <p>No TECs or PECs were recorded from the Application Area.</p>	The proposal is not at variance with the 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.	<p>Proposal is at variance with this principle.</p> <p>Vegetation types recorded on the western fringe of the Application Area are similar to Vegetation Association 371, and considered to be <i>Vulnerable to Depleted</i>.</p> <p>Clearing native vegetation within the application area will not significantly reduce the known extent from Pre-European extents. The GMA Garnet mining/rehabilitation method minimises the area of vegetation required to be cleared at any one time, and allows the progressive re-establishment of vegetation behind the mining area.</p> <p>Vegetation on the limestone uplands are considered to be of <i>Least Concern</i> and not under threat.</p>	At variance with principle.
(f)	Native vegetation should not be cleared if it is growing in, or in association with, an environment associated with a watercourse or wetland.	The Hutt Lagoon and Hutt River occur within 5 km of the application area. These will not be impacted by the proposed works. There are no other permanent watercourses or wetlands within the proposed work area that will be impacted.	The proposal will not be at variance with the principle.

Principle Number	Principle	Assessment	Outcome
(g)	Native vegetation should not be cleared if the clearing of the vegetation is likely to cause appreciable land degradation.	<p>Unlikely to be at variance with principle. The deep sands of the area have a high to very high wind erosion risk.</p> <p>However, GMA Garnet's current practise is to clear vegetation just prior to winter. Before clearing, vegetation is removed using a raised blade technique. Pre-winter clearing allows rain to wash into the soil, preserving root stock and encourages grass cover on the soil surface, which binds the soil. This controls erosion until mining commences.</p> <p>GMA Garnet does not clear vegetation in summer. A rehabilitation management plan prepared as part of a direct offset proposal at the northern end of current leases includes management measures for controlling wind erosion during rehabilitation.</p> <p>A similar rehabilitation plan will be employed for the clearing of native vegetation as part of these proposed works.</p> <p>The management measures proposed works mitigate the risk of any erosion by wind.</p>	The proposal is unlikely to be at variance with this Principle.
(h)	Native vegetation should not be cleared if the clearing of the vegetation is likely to have an impact on the environmental values of any adjacent or nearby conservation area.	There are no conservation areas that will be impacted by the proposed clearing works. The nearest known conservation area is 15 km to the north (Utcha Well Nature Reserve).	The proposal is not at variance with the 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.	The clearing of native vegetation is not considered likely to alter the quality of surface or ground waters within the application area. Works occur above the water table.	The proposal is unlikely to be at variance with this Principle.
(j)	Native vegetation should not be cleared if clearing the vegetation is likely to cause, or exacerbate, the incidence or intensity of flooding.	The clearing of native vegetation is not expected to cause, or exacerbate the incidence or intensity of flooding. The application area occurs on sandy soils which are not prevalent to flooding events.	The proposal is unlikely to be at variance with this principle.

4. References

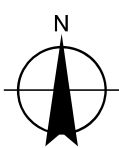
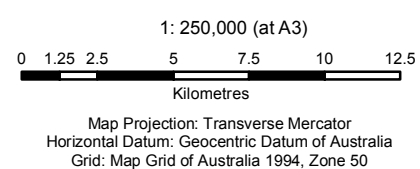
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LEGEND

Project Area



GMA Garnet Pty Ltd

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GMA Garnet Pty Ltd
 Clearing Permit Application
 Mining Tenement M70/968

Job Number	61-29817
Revision	0
Date	24 Oct 2013

Port Gregory Location

Figure 1

Appendices

Appendix A – Vegetation, Flora and Fauna Assessment



GMA Garnet Pty Ltd
GMA Port Gregory Mine Tenement M70/968
Vegetation, Flora and Fauna Assessment

October 2013

Executive Summary

The Vegetation, Flora and Fauna Assessment of the Project Area found that:

- No Environmentally Sensitive Areas occur within the Project Area;
- No watercourses or wetlands occur in the Project Area;
- Two Vegetation Associations are known to occur within the Project Area. Vegetation Association 371 occurs on the western fringe of the Project Area, and Association 17 on the limestone uplands;
- A total of six vegetation types were recorded from the Project Area;
- Vegetation types recorded on the western fringe of the Project Area are similar to Vegetation Association 371, and considered to be *Vulnerable to Depleted*;
- Vegetation on the limestone uplands are considered to be of Least Concern and not under threat;
- The Project Area is considered to be of moderate biodiversity, but is not considered to be of higher biodiversity than the surrounding areas;
- A search on the EPBC Protected Matters and DPaW TEC/PEC databases, revealed no TECs occurring within 5 kilometres of the Project Area. PECs associated with Mound Springs occur between 5 and 9 km east of the Project Area. These will not be impacted by the proposed works.
- No TECs or PECs were recorded from the Project Area.
- A total of 75 flora taxa from 39 families were recorded from the Project Area;
- No Threatened (Declared Rare) or Priority Flora were recorded. Very marginal habitat for the Threatened *Caladenia bryceana* subsp. *cracens* occurs at the north-eastern portion of the Project Area. This is disturbed from feral fauna activity (rabbits, pigs). No threatened plants or evidence of any orchid species were recorded from this area;
- No flora taxa recorded at or beyond their known were recorded;
- Few fauna taxa were recorded, predominantly due to the small Project Area. No Threatened or Priority Fauna taxa were recorded from the Project Area;
- No known significant habitat is present in the Project Area. The site is geographically isolated from the Utcha Well and Hutt Lagoon. The proposed project will not impact fauna utilising these areas.

This report is subject to, and must be read in conjunction with, the limitations set out in Section 1.4 and the assumptions and qualifications contained throughout the Report.

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Appendix C – Project Area Flora and Fauna Lists

1. Introduction

1.1 Background

GMA Garnet Pty Ltd (GMA Garnet) operates an open alluvial garnet mine within M70/856, with proposed expansion into adjacent tenements M70/926 and M70/927. GMA Garnet operates wet processing facilities (Hose Wet Plant) on G70/171. The tenements are registered under the parent company, Garnet International Resources Pty Ltd, and located between Northampton and Kalbarri.

GMA Garnet is currently undertaking mining operations on an ore body located within M70/204. For the continuation of the operation GMA Garnet is proposing to undertake exploration drilling in the adjacent M70/968.

1.2 Purpose of this Report

The purpose of this report is to identify flora, vegetation and fauna constraints within the Project Area to assist in the preparation of a Clearing Permit Application for the Port Gregory Mine Site M70/968.

The survey methodology and report was conducted congruent to a Level 1 fauna and flora assessment under the Environmental Protection Authority (EPA) Guidance Statement Number 51 and Number 56 (EPA, 2004a and EPA. 2004b).

1.3 Scope and Limitations

1.3.1 Project Area

The Project Area for the field flora, fauna and vegetation assessment is tenement M70/968.

1.3.2 Scope of Work

The flora, fauna and vegetation assessment involved both desktop and site assessment and provides the following:

- An inventory of the vascular plant species in each vegetation type within the Study Area;
- An inventory of the fauna species within the Study Area;
- A review of, and mapping of, native plant species considered to be rare or potentially endangered. Other species of interest, including those of limited distribution or outliers from their known range, are discussed;
- An inventory and location of dominant exotic plants, declared plants and environmental weed species;
- A description and location of, threatened and priority ecological communities;
- A description and location, including mapping, of vegetation types;
- A rating of condition of the vegetation types using the Keighery (1994) rating scale;
- A review of the local and regional significance of the plant communities in terms of their intrinsic value, extent, rarity and condition using the Statewide Vegetation Statistics (Government of Western Australia, 2012) data; and
- Determination and mapping of Environmentally Sensitive Areas.

1.3.3 Clearing of Native Vegetation

With regard to the clearing of Native Vegetation, GHD has:

- Examined whether the clearing of native vegetation will occur;
- Examined what permits or exemptions apply or are required;
- Investigated whether the project occurs within an Environmental Sensitive Area (ESA);
- Assessed Native Vegetation to be cleared against the Ten Clearing Principles; and
- Advised whether weeds are likely to spread to, and result in environmental harm to, adjacent areas of native vegetation which is in good or better condition.

1.4 Report Limitations and Assumptions

1.4.1 Limitations

This report: has been prepared by GHD for GMA Garnet Pty Ltd and may only be used and relied on by GMA Garnet Pty Ltd for the purpose agreed between GHD and the GMA Garnet Pty Ltd as set out in section 1.3.2... of this report.

GHD otherwise disclaims responsibility to any person other than GMA Garnet Pty Ltd arising in connection with this report. GHD also excludes implied warranties and conditions, to the extent legally permissible.

The services undertaken by GHD in connection with preparing this report were limited to those specifically detailed in the report and are subject to the scope limitations set out in the report.

The opinions, conclusions and any recommendations in this report are based on conditions encountered and information reviewed at the date of preparation of the report. GHD has no responsibility or obligation to update this report to account for events or changes occurring subsequent to the date that the report was prepared.

The opinions, conclusions and any recommendations in this report are based on assumptions made by GHD described in this report. GHD disclaims liability arising from any of the assumptions being incorrect.

GHD has prepared this report on the basis of information provided by GMA Garnet Pty Ltd and others who provided information to GHD (including Government authorities)], which GHD has not independently verified or checked beyond the agreed scope of work. GHD does not accept liability in connection with such unverified information, including errors and omissions in the report which were caused by errors or omissions in that information.

The opinions, conclusions and any recommendations in this report are based on information obtained from, and testing undertaken at or in connection with, specific sample points. Site conditions at other parts of the site may be different from the site conditions found at the specific sample points.

Investigations undertaken in respect of this report are constrained by the particular site conditions, such as the location of buildings, services and vegetation. As a result, not all relevant site features and conditions may have been identified in this report.

Site conditions (including the presence of hazardous substances and/or site contamination) may change after the date of this Report. GHD does not accept responsibility arising from, or in connection with, any change to the site conditions. GHD is also not responsible for updating this report if the site conditions change.

1.4.2 Biological Assessment Limitations

The limitations and constraints associated with the field assessment of the Project Area are discussed in

Table 1 Field Survey Constraints

Variable	Impact on survey outcomes
Access Problems	The entire Study Area could be accessed for this survey.
Experience Levels	The Principal Ecologist and Environmental Scientist who executed this survey were practitioners suitably qualified in their field.
Timing, Weather, Season	<p>The survey was undertaken during late Winter on the 22 August 2013. In the three months directly prior to the survey (May to July) the Kalbarri Bureau of Meteorology station (station number 008251) recorded 97.4 mm of rainfall, which is well below the average rainfall for this location of 207.0 mm for the same three month period.</p> <p>Some flora species, such as annuals, are only available for collection at certain times of the year and others are only identifiable at certain times (such as when they are flowering). Additionally, climatic and stochastic events (such as fire) may affect the presence of plant species. Species that have a very low abundance in the area are more difficult to locate, due to the above factors.</p> <p>Flora composition changes over time, with flora species having specific growing periods, especially annuals and ephemerals (some plants lasting for a markedly brief time, some only a day or two). Therefore, the results of future botanical surveys in this location may differ from the results of this survey.</p> <p>Complete flora and fauna surveys can require multiple surveys, at different times of year, and over a period of a number of years, to enable observation of all species present.</p>
Completeness	Species that were insufficiently mature or dead were identified in the field to genus or family level only (where possible).
Determination	The taxonomy and conservation status of the Western Australian flora is dynamic. This report was prepared with reliance on taxonomy and conservation current at the time issuing, but it should be noted this may change.

1.4.3 Assumptions

This report uses the Project Area as provided by GMA Garnet. Any change to the extent of the study area may alter the results and recommendations presented in this assessment.

2. Relevant Legislation and Conservation Codes

2.1 Legislation

2.1.1 Australian Government *Environmental Protection and Biodiversity and Conservation Act 1999*

The *Environment Protection and Biodiversity and Conservation Act 1999* (EPBC Act) is the Australian Government's central piece of environmental legislation. It provides a legal framework to protect and manage nationally and internationally important flora, fauna, ecological communities and heritage places, which are defined in the EPBC Act as matters of national environmental significance (MNES).

The flora and vegetation aspects listed as MNES include:

- Nationally threatened flora species and ecological communities.

A person must not take an action that has, will have, or is likely to have a significant impact MNES, without approval from the Australian Government Minister for the Environment.

2.1.2 State *Environmental Protection Act 1986*

The *Environmental Protection Act 1986* (EP Act) is the primary legislative Act dealing with the protection of the environment in Western Australia. It provides for an Environmental Protection Authority (EPA), for the prevention, control and abatement of pollution and environmental harm, for the conservation, preservation, protection, enhancement and management of the environment and for matters incidental to or connected with the above.

Clearing of native vegetation in Western Australia requires a permit from the Department of Environment Regulation (DER), unless exemptions apply. Native vegetation includes aquatic and terrestrial vegetation indigenous to Western Australia, and intentionally planted vegetation declared by regulation to be native, but not vegetation planted in a plantation or planted with commercial intent.

In the EP Act Section 51A, clearing is defined as the killing or destruction of; the removal of; the severing or ringbarking of trunks or stems of; or the doing of substantial damage of some or all of the native vegetation in an area, including the flooding of land, the burning of vegetation, the grazing of stock or an act or activity that results in the above.

There are a number of Environmentally Sensitive Areas (ESAs) within Western Australia where exemptions in regulations do not apply. ESAs include locations of threatened communities and species.

2.1.3 State *Wildlife Conservation Act 1950*

The *Wildlife Conservation Act 1950* (WC Act) provides for the conservation and protection of wildlife. It is administered by the DER and applies to both flora and fauna. Any person wanting to capture, collect, disturb or study fauna requires a permit to do so.

A permit is required under the WC Act if removal of threatened species is required.

2.1.4 State *Biosecurity and Agriculture Management Act 2007*

Weeds that are, or may become, a problem to agriculture or the environment can be formally classified as Declared Pests. The Department of Agriculture and Food Western Australia have

registered 65 Declared Pests under the new *Biosecurity and Agriculture Management Act 2007* (BAM Act). The BAM Act replaces the repealed *Agriculture and Related Resources Protection Act 1976* (ARRP Act).

Categories of Declared Pests (as per regulation 7 of the *Biosecurity and Agriculture Management Regulations 2013*) are designated in accordance with section 22(3) of the BAM Act as the control categories to which a Declared Pest other than a prohibited organism may be assigned for the reasons stated in relation to that category —

- (a) Category 1 (C1) — Exclusion: if in the opinion of the Minister introduction of the declared pest into an area or part of an area for which it is declared should be prevented;
- (b) Category 2 (C2) — Eradication: if in the opinion of the Minister eradication of the declared pest from an area or part of an area for which it is declared is feasible;
- (c) Category 3 (C3) — Management: if in the opinion of the Minister eradication of the declared pest from an area or part of an area for which it is declared is not feasible but that it is necessary to —
 - (i) alleviate the harmful impact of the declared pest in the area; or
 - (ii) reduce the number or distribution of the declared pest in the area; or
 - (iii) prevent or contain the spread of the declared pest in the area.

With regards to the movement of Declared Pests a person other than an inspector must not —

- (a) move a Category 1 (C1) Declared Pest or a Category 2 (C2) Declared Pest for a Declared Pest area within that area; or
- (b) move an animal, plant or other thing that is infected or infested with a Category 1 (C1) Declared Pest or a Category 2 (C2) Declared Pest for a Declared Pest area within that area, unless —
- (c) the action is reasonably required for the purpose of controlling the Declared Pest; or
- (d) the action is taken as authorised by, and in accordance with the terms and conditions of, a permit held by that person.

With regards to the introduction into a nominated Declared Pest area a person other than an inspector must not —

- (a) bring a Declared Pest for a DP area into that area from another area of the State; or
- (b) bring an animal, plant or other thing that is infected or infested with a Declared Pest for a DP area into that area from another area of the State, unless the action is taken as authorised by, and in accordance with the terms and conditions of, a permit held by that person.

2.2 Conservation Codes

Conservation significant flora, fauna and ecological communities in Western Australia are assigned conservation codes under the EPBC Act, WC Act or DER's Priority Flora taxa listings. Information on the conservation codes is provided in Appendix B and summarised below.

2.2.1 Conservation Significant Communities

Ecological communities are defined as naturally occurring biological assemblages that occur in a particular type of habitat (English and Blythe, 1997).

Threatened Ecological Communities (TECs) are listed under both State and Australian Government legislation. Australian Government-listed TECs are protected under the EPBC Act administered by the Department of Sustainability, Environment, Water, Population and

Communities (DSEWPaC). The DER maintains a list of TECs for Western Australia; some of which are also protected under the EPBC Act. TECs are ecological communities that have been assessed and assigned to one of four categories related to the status of the threat to the community, i.e. *Presumed Totally Destroyed, Critically Endangered, Endangered and Vulnerable*.

Possible TECs that do not meet survey criteria are added to the DER Priority Ecological Community (PEC) Lists under Priorities 1, 2 and 3. These are ecological communities that are adequately known; are rare but not threatened, or meet criteria for Near Threatened. PECs that have been recently removed from the threatened list are placed in Priority 4. These ecological communities require regular monitoring. Conservation dependent ecological communities are placed in Priority 5.

2.2.2 Conservation Significant Flora

The Australian Government conservation level of flora species and their significance status is assessed under the EPBC Act.

Under the WC Act, the State Minister for the Environment may declare species of flora to be protected if they are considered to be in danger of extinction, rare or otherwise in need of special protection. Schedules 1 and 2 of the *Wildlife Conservation (Rare Flora) Notice* under the WC Act deal with those taxa that are Threatened and those that are Presumed Extinct, respectively.

Additionally, in Western Australia, the DER produces a supplementary list of Priority Flora and Priority Fauna, these being species that are not considered Threatened under the WC Act but for which the Department feels there is a cause for concern. These species have no special legislative protection, but their presence would normally be considered relevant to an assessment of the conservation status of an area. Such taxa need further survey and evaluation of conservation status before consideration can be given to declaration as threatened flora or fauna.

2.2.3 Conservation Significant Fauna

The conservation of fauna species and their significance status is currently assessed under both Commonwealth (EPBC Act) and State (WC Act) legislation.

Australian Government

The significance levels for fauna used in the EPBC Act are those recommended by the International Union for the Conservation of Nature and Natural Resources (IUCN). A description of Conservation Categories delineated under the EPBC Act and the circumstances under which a project will trigger referral to the DSEWPaC are described in Appendix A.

The EPBC Act protects migratory species that are listed under the following International Agreements:

- Appendices to the Bonn Convention (Convention on the Conservation of Migratory Species of Wild Animals) for which Australia is a range state under the Convention (BONN);
- The Agreement between the Government of Australia and the Government of the People's Republic of China for the Protection of Migratory Birds and their Environment (CAMBA);
- The Agreement between the Government of Japan and the Government of Australia for the Protection of Migratory Birds and Birds in Danger of Extinction and their Environment (JAMBA);

- The Agreement between the Republic of Korea and the Government of Australia for the Protection of Migratory Birds and Birds in Danger of Extinction and their Environment (ROKAMBA); and
- Listed migratory species also include species identified in other international agreements approved by the Australian Government Environment Minister.

The Act also protects Marine Listed species on Australian lands and waters.

The DSEWPaC maintains a database of matters of national environmental significance that are protected under the EPBC Act. An EPBC Act Protected Matters Report was generated for the matters of significance that may occur in, or relate to, the Project Area (DSEWPaC, 2011). These records are shown in Appendix C.

State – Western Australia

The WC Act uses a set of Schedules but also classifies species using some of the IUCN categories. These Schedules are described in

In Western Australia the DER also produces a supplementary list of Priority Fauna, these being species that are not considered Threatened under the Western Australian WC Act but for which the Government feels there is a cause for concern. These species have no special legislative protection, but their presence would normally be considered. Such taxa need further survey and evaluation of conservation status before consideration can be given to declaration as threatened fauna. Levels of Priority are described Appendix B.

2.3 Introduced Plants (weeds)

2.3.1 Weeds of National Significance

The spread of weeds across a range of land uses or ecosystems is important in the context of socio-economic and environmental values. The assessment of Weeds of National Significance (WONS) is based on four major criteria:

- Invasiveness;
- Impacts;
- Potential for spread; and
- Socio-economic and environmental values.

3. Methodology

3.1 Desktop Assessment

The desktop assessment of the Project Area included a review of background data, including flora and fauna previously recorded in the Project Area.

The desktop review included:

- A review of the *NatureMap* database, for flora and fauna species previously recorded within a 10 km buffer of the Study Area (currently indicated to remain as part of the DEC, 2013);
- A review of DER's TEC and PEC databases (DER, 2013a) to determine the potential for TECs or PECs to be present within the Study Area;
- A review of the DSEWPaCs Protected Matters Search Tool (PMST) (DSEWPaC, 2012) – to identify species listed under the EPBC Act potentially occurring within the Previous Area;
- Previous reports and vegetation mapping of the Project Area;
- Aerial photography, geology/soils and hydrology information: these datasets will be reviewed to provide background information on the variability of the environment and likely vegetation types; and
- A search of DEC's Native Vegetation Viewer to determine the presence of Environmentally Sensitive Areas (ESAs) in the area (DEC, 2012b).

Relevant environmental constraints identified in the desktop assessment are mapped (see Appendix A). Fauna and Flora desktop results are provided in Appendix C and D, respectively.

3.2 Previous Studies

GHD has previously surveyed M70/926 which occurs to the north of this study area.

No conservation significant flora or fauna taxa were recorded in that study.

GHD did note the presence of the under-represented Beard Vegetation Association 371, which is identified as a *Vulnerable* vegetation association with 10 – 30% of the pre-European extent remaining.

3.3 Flora Survey

A field survey to identify habitats, species and communities in the Project Area was undertaken by GHD's Principal Ecologist Joshua Foster and Environmental Scientist Amanda Melling on the 22 August 2013.

3.3.1 Terrestrial Flora

The flora assessment was as a Level 1 assessment with reference to the EPA Guidance Statement No. 51 Terrestrial Flora and Vegetation Surveys for Environmental Impact Assessment in Western Australia (EPA, 2004a).

Field assessment methods involved a combination of sampling quadrat sites and traversing the Project Area to record plant species present (visible) at the time of the survey. The dominant species were recorded in each stratum to assist in vegetation type mapping.

3.3.2 Flora Species Identification

Species that were well known to the survey botanists were identified in the field, while species that were unknown were collected and assigned a unique number to facilitate tracking. Plant species were identified by the use of local and regional flora keys and by comparison with the named species held at the Western Australian Herbarium.

3.3.3 Vegetation Condition

The vegetation condition of the site was assessed using the vegetation condition rating scale developed by Keighery (1994). This rating scale recognises the intactness of vegetation, which is defined by the following:

- Completeness of structural levels;
- Extent of weed invasion;
- Historical disturbance from tracks and other clearing or dumping; and
- The potential for natural or assisted regeneration.

The scale consists of six (6) rating levels as outlined below in

Table 2 Vegetation Condition Rating Scale

Vegetation Condition Rating	Vegetation Condition	Description
1	<i>Pristine or Nearly So</i>	No obvious signs of disturbance.
2	<i>Excellent</i>	Vegetation structure intact, disturbance affecting individual species, and weeds are non-aggressive species.
3	<i>Very Good</i>	Vegetation structure altered, obvious signs of disturbance.
4	<i>Good</i>	Vegetation structure significantly altered by very obvious signs of multiple disturbances retains basic vegetation structure or ability to regenerate it.
5	<i>Degraded</i>	Basic vegetation structure severely impacted by disturbance. Scope for regeneration but not in a state approaching good condition without intensive management.
6	<i>Completely Degraded</i>	The structure of the vegetation is no longer intact and the area is completely or almost without native species.

3.4 Fauna Survey

The fauna component of the field assessment was a Level 1 (opportunistic) assessment, undertaken with reference to the EPA Guidance Statement No. 56 Terrestrial Fauna Survey for Environmental Impact Assessment in Western Australia (EPA, 2004b).

The fauna field survey was undertaken in conjunction with the vegetation and flora survey. An assessment of the likelihood of significant fauna, opportunistic records of fauna species and fauna habitats were undertaken. The field survey was undertaken traversing the study area by a vehicle and on foot. Areas considered to contain unusual or potentially significant habitat were targeted.

3.4.1 Fauna species identification

Identification of fauna species was made in the field using available field guides. Where identification was not possible photographs of specimens were collected in a systematic manner to be later identified by in-house zoologists.

4. Existing Environment

4.1 Bioregion

The Interim Biogeographic Regionalisation of Australia (IBRA) divides the Australian continent into 85 biogeographic regions based on their climatic, faunal, vegetation, landform and geological features.

The coastal town site of Port Gregory is situated within the Geraldton Hills (GS2) IBRA sub – region of the Geraldton Sandplains. This region comprises of sandy earths of an extensive undulating and lateritic sandplain mantling Permian to Cretaceous strata. This region occurs within the southern end of the Carnarvon Basin and the northern end of the Perth Basin, with exposed areas of Permian/Silurian siltstone and Jurassic sandstones mostly overlain by sandplains, alluvial plains and coastal limestone. The vegetation consists primarily of proteaceous heath with Banksia York gum woodlands on alluvial plains and Acacia scrub on limestone (Desmond and Chant, 2002).

4.2 Climate

The region experiences a Mediterranean type climate, characterised by warm to hot dry summers and mild wet winters.

The closest Bureau of Meteorology (BoM) weather station that provides continuous reliable data to the Project Area is located at Kalbarri (Site Number 008251). A summary of maximum and minimum temperature statistics is provided below:

- Mean Daily Maximum Temperature 20.6° C in July to 34.2° C in February;
- Mean Daily Minimum Temperature 9.7° C in July to 21.7° C in February.

The average annual rainfall measured at Lynton (Site number 008075) is 399.1 mm with the average monthly rainfall ranging 3.4 mm in December to 95.4 mm in June. The majority of rainfall occurs in during the winter months and is generally associated with frontal systems from the south west. The summer rains are associated with isolated thunderstorms and tropical lows.

During summer average wind speeds of 21.9 km/h prevail from the northeast and southeast in the morning, before shifting to the south and southwest in the afternoon. During the winter months winds abate to an average of generally less than 14.4 km/h, with less distinctive wind patterns. The combination of high wind speeds and high temperatures during summer produces elevated evaporation rates, with high potential for dust lift off from non-vegetated areas during dry, windy conditions (Source: Bureau of Meteorology, 2013).

4.3 Surrounding Land Use

The Project Area is located in the Shire of Northampton. The surrounding landuse includes algae, wheat and sheep farming.

4.3.1 Conservation Reserves

There is one reserve located within five kilometres of the Project Area:

- Reserve 640 - Utcha Well Nature Reserve. This reserve will not be impacted by the proposed works.

The Hutt Lagoon is a wetland of national importance due to its migratory bird population (DEC, 2009) and is located immediately to the west of the project area. It is considered unlikely that the Lagoon will be impacted by the proposed Project.

4.4 Environmentally Sensitive Areas

Environmentally Sensitive Areas (ESAs) are subject to definition under Section 51B of the *Environmental Protection Act 1986* (EP Act) and may include areas such those requiring special management attention to protect important scenic values, fish and wildlife resources, historical and cultural values, and other natural systems or processes.

The Native Vegetation Map Viewer (idelve) indicated that no Environmentally Sensitive Areas occur in the Project Area.

4.5 Geology

4.5.1 Geology and Soils

The ore body for the Project is located approximately between four km east to 15 km north-east of Gregory in the Northampton Shire. The ore body is in the form of a continuous belt of sand that has been deposited along the base of a wave-cut escarpment of Tamala Limestone. The ore consists of quartz and shell sand containing garnet as the dominant heavy mineral. The sands are mostly in the form of aeolian dunes but there are some remnant strandline zones along the western margin of the ore body. Nodules of cemented sand are common due to in-situ precipitation of calcium carbonate derived from leached shell fragments. The sands are thought to have been deposited during the last interglacial period around 20,000 years ago (the Holocene Age) (DEC, 2009).

4.5.2 Acid Sulphate Soils

The DEC (2009) describes Acid Sulphate Soils (ASS) as naturally occurring soils and sediments containing sulphide minerals, predominantly pyrite (an iron sulphide). In an undisturbed state below the water table these soils are benign and not acidic. However, if the soils are drained, excavated or exposed by lowering of the water table the sulphides will react with oxygen to form sulphuric acid.

Inappropriate disturbance of these soils can generate large amounts of sulphuric acid and leaching of contaminants naturally occurring in soils. Flushing of acidic leachate to ground water and surface waters can cause off-site impacts including:

- Ecological damage to aquatic and riparian ecosystems;
- Effects on estuarine fisheries and aquaculture projects;
- Contamination of groundwater with arsenic, aluminium and other metals;
- Reduction in agricultural productivity through metal contamination of soils; (predominantly aluminium); and
- Drainage to infrastructure through the corrosion of concrete and steel pipes, bridges and other sub-surface assets.

The Australian Soil Resource Information System (ASRIS) indicated that there an Extremely Low probability of Acid Soils occurring in the Project Area.

GHD does not expect any impacts caused by ASS within the Project Area.

4.6 Watercourses and Wetlands

The Hutt Lagoon is located three kilometres south west of the Project and is approximately 15 kilometres and 2.5 kilometres wide. The lagoon is listed as a Wetland of National Importance on the Directory of Important Wetlands in Australia. The Hutt Lagoon comprises of most of the Hutt Lagoon System which includes Utcha Swamp located five km north of the Project location.

The Lagoon is usually partly filled with hypersaline water during winter. During the rest of the year the lagoon remains mainly empty except for the ponds where cultivation of algae takes place.

4.7 Vegetation Mapping

Vegetation mapping of the Project Area has previously been undertaken at varying scales. Broad scale vegetation mapping was undertaken by Beard (1979), which indicates that two vegetation associations are present within the Project Area. This is shown in Table 3.

Table 3 Beard's Vegetation Association

Vegetation Association	Description	Location
371	Low Forest; <i>Acacia rostellifera</i>	Western fringe of Project Area, below limestone outcropping
17	Shrublands; <i>Acacia rostellifera</i> thicket	Eastern Project Area, typically on limestone outcropping

Also present within one kilometre of the Project Area, occurring on limestone slopes is Vegetation Association 387 Shrublands: *Melaleuca cardiophylla* thicket.

4.7.1 Broad Vegetation Association Extent

The EPA recognises vegetation complexes that are not well represented in reserves as being 'significant'. Vegetation complexes which have 10%-30% of their pre-European extent remaining may be considered regionally significant. Projects that would impact on a vegetation complex with 10% or less remaining may be formally assessed by the EPA.

From a purely biodiversity perspective (not taking into account any other land degradation issues) the following listed key criteria are now being applied to vegetation complexes (EPA, 2000):

- The "threshold level" below which species loss appears to accelerate exponentially at an ecosystem level is regarded as being at a level of 30% of the pre-European/pre-1750 extent of the vegetation type;
- A level of 10% of the original extent is regarded as being a level representing *Endangered*; and
- Clearing which would put the threat level into the class below should be avoided.

The above criteria can be delineated into the following five classes:

- *Presumed Extinct*: Probably no longer present in the bioregion
- *Endangered**: < 10 % of pre-European extent remains
- *Vulnerable**: 10 – 30 % of pre-European extent exists
- *Depleted**: > 30 % and up to 50 % of pre-European extent exists

- *Least Concern:* > 50 % pre-European extent exists and subject to little or no degradation over a majority of this area.

** or a combination of depletion, loss of quality, current threats and rarity gives a comparable status (Department of Natural Resources and Environment, 2002)*

Beard mapping has been adapted by Shepherd (2002) and Government of Western Australian (2012) with each Vegetation Association is presented as a percentage of the pre-European extent that is estimated to be remaining.

The Vegetation Association's status at a State, IBRA, sub-IBRA and Local Government Area (LGA) level is shown in Table 4.

Table 4 Vegetation Type, Extent and Status

Vegetation Association	Scale	Pre-European Extent (ha)	Current Extent (ha)	% Current Extent in IUCN (1-4)	% Current Extent in All DER/DPaW Managed Lands	% Remaining	Status
371	State	32,816	3,499.42	6.92	6.92	10.60	<i>Vulnerable</i>
	IBRA Bioregion Geraldton Sandplains	32,807.53	3,499.40	6.92	6.92	10.67	<i>Vulnerable</i>
	IBRA subregion (Geraldton Hills)	32,807.53	3,499.40	6.92	6.92	10.67	<i>Vulnerable</i>
	LGA Shire of Northampton	5,749.92	2,124.08	10.69	10.69	36.94	<i>Depleted</i>
17	State	76,633.84	67,686.06	7.51	13.04	88.32	<i>Least Concern</i>
	IBRA Bioregion Geraldton Sandplains	54,078.08	45,240.43	10.64	13.41	83.66	<i>Least Concern</i>
	IBRA subregion (Geraldton Hills)	49,605.04	42,019.67	10.60	13.26	84.71	<i>Least Concern</i>
	LGA Shire of Northampton	49,549.89	41,939.33	10.61	13.29	84.64	<i>Least Concern</i>

Vegetation Associations in the Project Area are mapped in Figure 5.

4.8 Conservation Significant Ecological Communities

Ecological communities are defined as naturally occurring biological assemblages that occur in a particular type of habitat (English and Blythe, 1997).

Threatened Ecological Communities (TECs) are listed under both State and Australian Government legislation. Australian Government-listed TECs are protected under the EPBC Act administered by the Department of Sustainability, Environment, Water, Population and

Communities (DSEWPaC). The Department of Parks and Wildlife (DPaW) maintains a list of TECs for Western Australia; some of which are also protected under the EPBC Act. TECs are ecological communities that have been assessed and assigned to one of four categories related to the status of the threat to the community, i.e. *Presumed Totally Destroyed, Critically Endangered, Endangered and Vulnerable*.

Possible TECs that do not meet survey criteria are added to the DPaW Priority Ecological Community (PEC) Lists under Priorities 1, 2 and 3. These are ecological communities that are adequately known; are rare but not threatened, or meet criteria for Near Threatened. PECs that have been recently removed from the threatened list are placed in Priority 4. These ecological communities require regular monitoring. Conservation dependent ecological communities are placed in Priority 5.

No TECs or PECs occur within the project area. PECs associated with mound springs occur between five and nine km east of the project area. These will not be impacted by the proposed project.

4.9 Flora

4.9.1 Flora Diversity

The Project Area is located within an area of Mid-West Western Australia that is acknowledged for its moderate flora diversity. The *NatureMap* records are consistent with this moderate diversity and provide a list of 302 flora taxa (which includes ferns, fungi, and other non-vascular plants) previously recorded within 10 km of GMA Garnet tenement M70/968.

4.9.2 Conservation Significant Flora

Desktop searches identified a number of conservation significant flora (including EPBC Act, WC Act and DER Priority Flora) that have either been recorded or are predicted to occur within 10 km of the Project Area. A Likelihood of Occurrence Assessment that takes into account the habitats present, known species distribution and previous records was completed for all conservation significant flora identified in the desktop queries. This assessment is shown in Table 5.

Table 5 Assessment of Likelihood of Occurrence of Conservation Significant Flora known to occur within the vicinity of the Project Area

Taxon	EPBC Act Status	WC Act Status	DEC Status	Database Source	Project Area Within Known Range (10 km or less)	Project Area Within Known Habitat	*Likelihood of Occurrence in Project Area
<i>Acacia latipes</i> subsp. <i>licina</i>			P3	NM	Yes	Yes	Possible
<i>Acacia pelophila</i>			P1	NM	Yes	No	Unlikely
<i>Anthocercis intricata</i>			P3	NM	Yes	Yes	Possible
<i>Blackallia nudiflora</i>			P3	NM	Yes	Yes	Possible
<i>Caladenia barbarella</i>	En	T		EPBC	No	No	Unlikely
<i>Caladenia bryceana</i> subsp. <i>cracens</i>	Vu	T		EPBC	Yes	Yes	Possible
<i>Caladenia elegans</i>	En	T		EPBC	No	No	Unlikely
<i>Caladenia hoffmanii</i>	En	T		EPBC	Yes	Yes	Possible
<i>Calytrix harvestiana</i>			P2	NM	Yes	No	Unlikely
<i>Calytrix pimeleoides</i>			P3	NM	Yes	No	Unlikely
<i>Drakaea concolor</i>	Vu	T		EPBC, NM	Yes	Yes	Possible
<i>Drummondita ericoides</i>	En	T		EPBC	No	No	Unlikely
<i>Eremophila microtheca</i>			P4	NM	Yes	No	Unlikely
<i>Eucalyptus cuprea</i>	En	T		EPBC	No	No	Unlikely
<i>Frankenia confusa</i>			P2	NM	Yes	No	Unlikely
<i>Gastrolobium propinquum</i>			P3	NM	Yes	Yes	Possible
<i>Grevillea triloba</i>			P3	NM	Yes	Yes	Possible
<i>Guichenotia quasicalva</i>			P2	NM	Yes	No	Unlikely
<i>Hemigenia pimelifolia</i>			P2	NM	Yes	No	Unlikely
<i>Hypocalymma longifolium</i>	Vu	T		EPBC	Yes	No	Unlikely
<i>Isopogon uncinatus</i>	En	T		EPBC	No	No	Extremely Unlikely
<i>Lasiopetalum oldfieldii</i> subsp. <i>oldfieldii</i>			P3	NM	Yes	Yes	Possible
<i>Liparophyllum congestiflorum</i>			P4	NM	Yes	No	Unlikely

Taxon	EPBC Act Status	WC Act Status	DEC Status	Database Source	Project Area Within Known Range (10 km or less)	Project Area Within Known Habitat	*Likelihood of Occurrence in Project Area
<i>Prostanthera scutata</i>			P2	NM	Yes	No	Unlikely
<i>Pterostylis sinuata</i>	En	T		EPBC	Yes	Yes	Possible
<i>Ptilotus chortiphytus</i>			P1	NM	Yes	No	Unlikely
<i>Scaevola kallophylla</i>			P4	NM	Yes	Yes	Possible
<i>Scaevola oldfieldii</i>			P3	NM	Yes	No	Unlikely
<i>Teucrium</i> sp. Hutt River (W.H. Butler 54)			P1	NM	Yes	No	Unlikely
<i>Trithuria australis</i>			P4	NM	Yes	No	Unlikely
<i>Xanthoparmelia xanthomelanoides</i>			P2	NM	Yes	No	Unlikely

4.9.3 Invasive Flora

The EPBC Act Protection Matters (DSEWPaC, 2013) indicates that there are five invasive flora species that may occur within 10 km of the Project Area. *NatureMap* (DEC, 2013) indicates 27 invasive flora taxa that may occur within 10 km of the Project Area. The search results are shown in Table 6.

Table 6 Invasive Flora that may occur within 10 km of the Project Area

Species Name	Common Name	Source
* <i>Atriplex canescens</i>		NM
* <i>Burpleurum semicompositum</i>		NM
* <i>Cenchrus ciliaris</i>	Buffel Grass	EPBC, NM
* <i>Chenopodium murale</i>	Nettle-leaf Goosefoot	NM
* <i>Cyperus laevigatus</i>	a Sedge	NM
* <i>Dittrichia graveolens</i>	Stinkwort	NM
* <i>Erharta brevifolia</i>	Annual Veldt Grass	NM
* <i>Enteropogon ramosus</i>	Windmill Grass	NM
* <i>Euphorbia terracina</i>	Geraldton Carnation Weed	NM
* <i>Hordeum marinum</i>	Barley Grass	NM
* <i>Hypochaeris glabra</i>	Smooth Catsear	NM
* <i>Juncus bufonius</i>	Toad Rush	NM
* <i>Latana camara</i>	Latana	EPBC
* <i>Limonium hyblaeum</i>	Statice	NM
* <i>Lycium ferocissimum</i>	African Boxthorn	EPBC
* <i>Melilotus indicus</i>	Melilot	NM
* <i>Mesembryanthemum crystallinum</i>	Iceplant	NM
* <i>Moraea setifolia</i>	Cape Tulip	NM
* <i>Oenothera drummondii</i>	Beach Evening Primrose	NM
* <i>Parapholis incurva</i>	Coast Barbgrass	NM
* <i>Phalaris minor</i>	Lesser Canary Grass	NM
* <i>Polypogon monspeliensis</i>	Annual Beardgrass	NM
* <i>Prosopis</i> spp.	Mesquite	EPBC
* <i>Sagina apetala</i>	Annual Pearlwort	NM
* <i>Sonchus oleraceus</i>	Common Sowthistle	NM
* <i>Symphyotrichum squamatum</i>	Bushy Starwort	NM
* <i>Tamarix aphylla</i>	Athel Pine	EPBC
* <i>Tetragonia decumbens</i>	Sea Spinach	NM
* <i>Trifolium striatum</i>	Knotted Clover	NM
* <i>Verbesina encelioides</i>	Golden Crownbeard	NM

4.10 Diseases or Pathogens

Phytophthora cinnamomi (Dieback) disease is generally restricted to areas of the south west of the State, south of the 26th parallel of latitude, in areas receiving an average annual rainfall of greater than 400 mm.

Phytophthora cinnamomi is now widespread throughout the southwest of Western Australia, extending between Eneabba and Esperance. It has infested forest, heathland and woodland communities. *P. cinnamomi* is widespread in bushland in and around Perth.

P. cinnamomi is found throughout the landscape in areas that receive above 800 mm annual rainfall. Where annual rainfall is between 600 and 800 mm, *P. cinnamomi* tends to be confined to stream systems and road verges (especially table drains). In areas receiving less than 600 mm annual rainfall, *P. cinnamomi* is restricted to natural water gaining sites, or sites that have been altered and receive excessive drainage. There is no record of *P. cinnamomi* in regions receiving less than 400 mm annual rainfall (CALM, 1998).

The Project Area is not considered to be susceptible to the development of the *Phytophthora cinnamomi* pathogen as it is south of this latitude and the region only receives on average approximately 400 mm of rainfall per annum.

4.11 Fauna

4.11.1 Existing Fauna Records

A search on *NatureMap* was undertaken for the Project Area. The *NatureMap* and EPBC records indicate that 142 birds, 11 mammals and 13 reptiles and one arachnid have been officially recorded in the vicinity of the Project Area. A list of these species is provided in Appendix C.

4.11.2 Significant Fauna

A search of the DEC's Threatened Fauna database for any rare and priority species that may occur in the general area was undertaken.

From the DEC and the records of the Western Australian Museum (WAM) and the DSEWPac databases a number of protected fauna species were identified as potentially occurring 10 km of the Project Area. These are listed in Appendix C.

4.11.3 Introduced Fauna

The results of the *NatureMap* search indicate that two introduced fauna taxa have been reported within the 10 km of the Project Area. The search results identified the following:

**Mus musculus* House Mouse;

**Rattus rattus* Black Rat; and

**Vulpes vulpes* Red Fox.

The EPBC Act Protected Matters searches indicate the potential presence of six introduced fauna within 10 km of the Project Area. The search results identified the following:

**Capra hircus* Goat;

**Canis lupus subsp. familiaris* Domestic Dog

**Felis catus* House Cat;

**Oryctolagus cuniculus* European Rabbit;

**Sus scrofa* Pig; and

**Vulpes vulpes* Red Fox

5. Field Assessment

5.1 Vegetation

5.1.1 Vegetation Types

A total of five vegetation types were recorded from the Project Area. These were dominated by *Acacia rostellifera* and *Melaleuca cardiophylla*, with density, plant height and species composition impacted by topography and geology.

5.1.2 Vegetation Condition

The vegetation condition of the Project Area was rated during the field survey using the Vegetation Condition Scale (after Keighery, 1994). The vegetation in the Project Area was predominantly *Good* to *Very Good* with areas of degradation due to grazing, firebreaks and historical mining activities.

5.1.3 Comparison with known Vegetation Associations

The vegetation types recorded within the Project Area broadly correspond with Vegetation Associations known from the location and immediate surrounds. The vegetation types on the western fringe of the Project Area are therefore considered to be *Vulnerable to Depleted* in extent. In particular, Vegetation Type 2 *Acacia rostellifera* Scrub is similar to Vegetation Association 371. Of note, this vegetation type is considered to be historically disturbed and regrowth patterns match the Association 371.



Vegetation on the limestone uplands is similar to Association 17 and 387 and considered to be of *Least Concern*.



Of note, Vegetation Associations are described at a broader scale than vegetation types. As such, vegetation types with a smaller areal extent (such as vegetation type 3 and 4 recorded in this project) may not be incorporated into an Association description, even though they may form part that Association.

5.2 Threatened and Priority Ecological Communities

There were no threatened or priority ecological communities recorded within the Project Area.

Table 7 Project Area Vegetation Types

Vegetation Type Number	Short Description	Description	Photograph	Location	Condition	Comparison to Known Associations	Status
1	Mixed Open Heath on Sandy Limestone Ridge	High Open Shrubland of <i>Acacia rostelifera</i> , <i>Melaleuca cardiophylla</i> , <i>Grevillea argyrophylla</i> , over Shrubland of <i>Olearia</i> sp. Kennedy Range, <i>Hibiscus huegelii</i> , over Low Shrubland of <i>Pimelea angustifolia</i> , <i>Diplopeltis petiolaris</i> , <i>Acanthocarpus preissii</i> over Scattered Grasses of <i>Avena barbata</i> , <i>Austrostipa</i> spp., over Mixed Herbs of <i>Lysimachia arvenscens</i> , <i>Goodenia beardiana</i> , <i>Erodium</i> sp. with Scattered Climbers of <i>Cuscuta</i> sp., <i>Dioscorea hastifolia</i> , <i>Commicarpus australis</i>		South and east areas, located on top of the slope	4	Vegetation Association 17	Least Concern
2	<i>Acacia rostelifera</i> Scrub	High Shrubland to Open Scrub of <i>Acacia rostelifera</i> over Shrubland of <i>Rhagodia latifolia</i> , <i>Stylobasium spathulatum</i> , <i>Olearia</i> sp. Kennedy Range over Low Shrubs of <i>Tetragonia implexicoma</i> over Grasses of <i>Ehrharta longiflora</i> , <i>Avena barbata</i> , <i>Austrostipa</i> spp., over Mixed Herbs of <i>Lysimachia arvenscens</i> , <i>Erodium</i> sp. over with Scattered Climbers of <i>Cuscuta</i> sp., <i>Dioscorea hastifolia</i> , <i>Commicarpus australis</i>		Lower topography areas, on the west side. Often associated with regrowth on old works	5	Vegetation Association 371	Vulnerable

Vegetation Type Number	Short Description	Description	Photograph	Location	Condition	Comparison to Known Associations	Status
3	Low Heath	Low Open Heath to Low Heath of <i>Melaleuca cardiophylla</i> , <i>Diplopeltis petiolaris</i> , <i>Bossiaea spinescens</i> , <i>Pimelea angustifolia</i> , <i>Opercularia vaginata</i> , over Scattered Grasses of * <i>Avena barbata</i> , <i>Austrostipa</i> spp., over Mixed Herbs of * <i>Sisymbrium irio</i> , <i>Zygophyllum billardieri</i> . with Scattered Climbers of <i>Dioscorea hastifolia</i> , with Open Rushes of <i>Desmocladus asper</i>		High Limestone hills in North-east of Lease	3	Uncertain. Possibly Vegetation Association 387	Least Concern
4	Melaleuca Thickets	Closed Scrub of <i>Melaleuca cardiophylla</i> with Mallee of <i>Eucalyptus</i> spp. over Low Shrubs of <i>Rhagodia latifolia</i> , <i>Lasiopetalum angustifolium</i> with Scattered Climbers of <i>Aphanopetalum clematideum</i> , <i>Dioscorea hastifolia</i>		South Facing Slopes	3	Vegetation Association 387	Least Concern

Vegetation Type Number	Short Description	Description	Photograph	Location	Condition	Comparison to Known Associations	Status
5	Cleared/Degraded	Cleared Tracks and firebreaks, old pits with regrowth of <i>Acacia rostellifera</i> , pasture grasses and weeds		Cleared tracks and firebreaks	6	nil	nil

5.3 Flora

5.3.1 Flora Records

A total of 75 flora taxa from 39 families were recorded from the Project Area. The number of records is considered to be a good reflection of the relatively small area surveyed, and a function of similar geology. The diversity is considered to be equivalent to that found in the local and regional areas in similar condition.

Dominant families recorded in the Project Area were:

- Asteraceae (daisies) eight taxa;
- Poaceae (grasses) five taxa;
- Fabaceae (peas, wattles) five taxa;
- Malvaceae (hibiscus family) five taxa; and
- Myrtaceae (eucalypt, melaleuca family) five taxa.

No genera were dominant within the Project Area, with only *Ptilotus* (mulla-mullas) recording more than two taxa.

A full list of flora recorded from the Project Area is located in Appendix C.

5.3.2 Conservation Significant Flora

No Threatened (Declared Rare) Flora taxa were recorded from the Project Area

No Priority Flora taxa were recorded from the Project Area.

No flora taxa at or occurring beyond their known range were recorded from the Project Area.

5.3.3 Invasive Flora

A total of 12 introduced/weed flora taxa were recorded from the Project Area. These taxa are considered to occur in the local and regional area largely as a result of historical agricultural practices and associated land clearing activities.

No Weeds of National Significance were recorded from the Project Area.

5.4 Fauna

5.4.1 Fauna Records

A level 1 fauna field survey was conducted in conjunction with the flora survey. The survey was limited to daylight hours and only examined terrestrial animals occurring in the Project Area. As a result of the small Project Area and limited survey time, a total of five birds and two mammals were recorded during the field survey.

The recorded taxa in the Project Area are located in Appendix C.

5.4.2 Introduced Fauna

There was one introduced fauna species recorded from the field survey:

- *Oryctolagus cuniculus* European Rabbit

5.5 Fauna Habitats

5.5.1 Fauna Habitat Types

Two broad habitat types were recorded in the Project Area:

- Mixed Scrub on Sandy Soils with Limestone; and
- Low Heath on Limestone Hill.

These habitats are closely associated with vegetation in the Project Area, and are found in similar condition in local and regional areas.

5.5.2 Habitat Linkages

The Project Area currently forms part of a north-east to south-east habitat link, following the limestone escarpment present in the local and regional area. To the east is fragmented habitat associated with cleared agricultural areas, and to the west lies Hutt Lagoon. The small amount of disturbance proposed as part of mining activities is not considered to fragment the existing habitat links due to areas of habitat present to the east of the Project Area that will not be impacted as part of any mining activities.

6. Conclusions

The Vegetation, Flora and Fauna Assessment of the Project Area found that:

- No Environmentally Sensitive Areas occur within the Project Area;
- No watercourses or wetlands occur in the Project Area;
- Two Vegetation Associations are known to occur within the Project Area. Vegetation Association 371 occurs on the western fringe of the Project Area, and Association 17 on the limestone uplands;
- A total of six vegetation types were recorded from the Project Area;
- Vegetation types recorded on the western fringe of the Project Area are similar to Vegetation Association 371, and considered to be *Vulnerable to Depleted*;
- Vegetation on the limestone uplands are considered to be of Least Concern and not under threat;
- The Project Area is considered to be of moderate biodiversity, but is not considered to be of higher biodiversity than the surrounding areas;
- A search on the EPBC Protected Matters and DPaW TEC/PEC databases, revealed no TECs occurring within 5 kilometres of the Project Area. PECs associated with Mound Springs occur between 5 and 9 km east of the Project Area. These will not be impacted by the proposed works.
- No TECs or PECs were recorded from the Project Area.
- A total of 75 flora taxa from 39 families were recorded from the Project Area;
- No Threatened (Declared Rare) or Priority Flora were recorded. Very marginal habitat for the Threatened *Caladenia bryceana* subsp. *cracens* occurs at the north-eastern portion of the Project Area. This is disturbed from feral fauna activity (rabbits, pigs). No threatened plants or evidence of any orchid species were recorded from this area;
- No flora taxa recorded at or beyond their known were recorded;
- Few fauna taxa were recorded, predominantly due to the small Project Area. No Threatened or Priority Fauna taxa were recorded from the Project Area;
- No known significant habitat is present in the Project Area. The site is geographically isolated from the Utcha Well and Hutt Lagoon. The proposed project will not impact fauna utilising these areas;

7. References

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http://www.bom.gov.au/climate/averages/tables/cw_008251.shtml

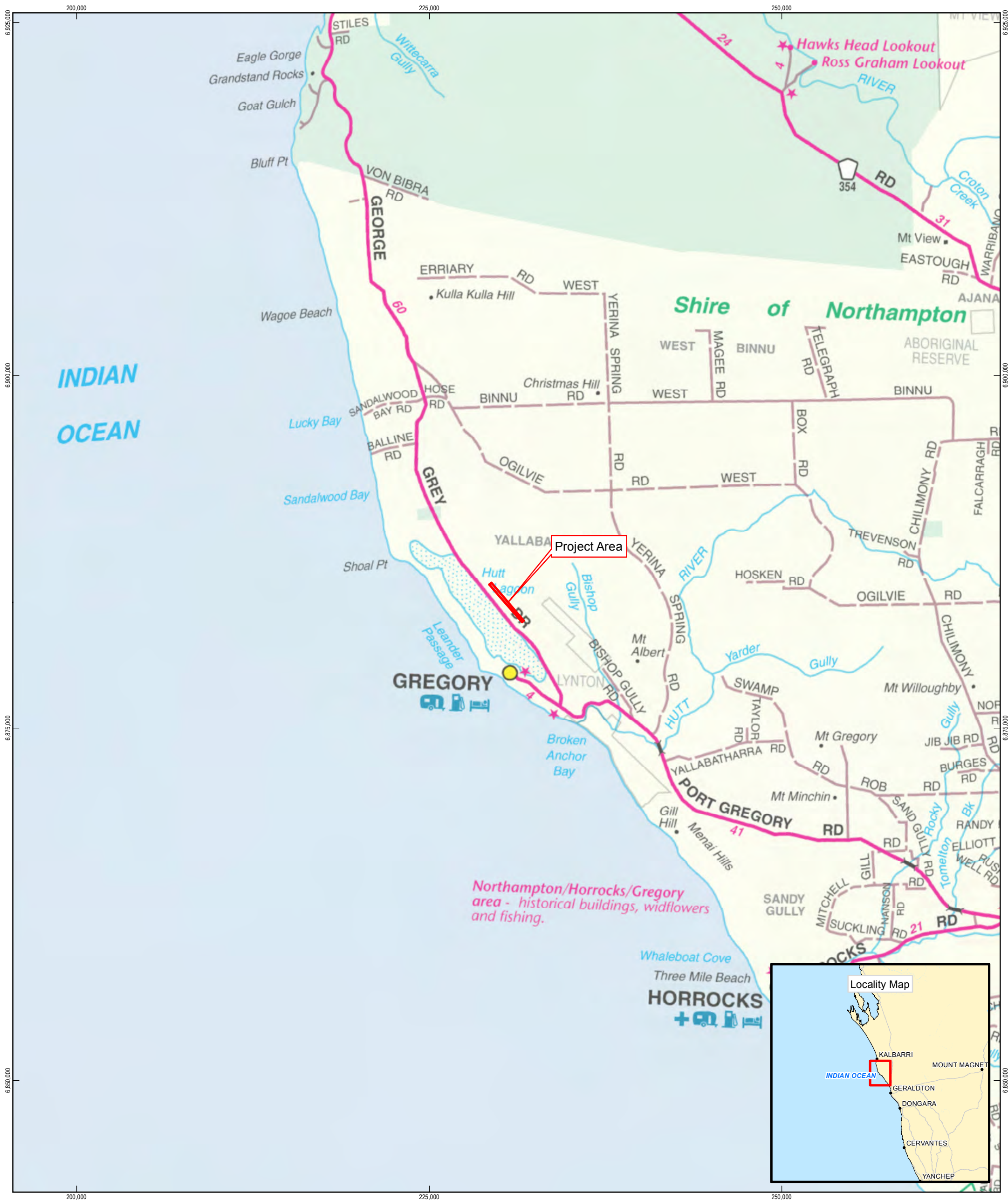
http://www.bom.gov.au/jsp/ncc/cdio/weatherData/av?p_nccObsCode=136&p_display_type=dailyDataFile&p_startYear=2013&p_c=-13123742&p_stn_num=008075 [7/08/2013]

Desmond, A and Chant, A (2001) *A Biodiversity Audit of Western Australia's 53 Biogeographical Subregions in 2002: Geraldton Sandplains (GS2- Geraldton Hills subregion)*. Accessed online at

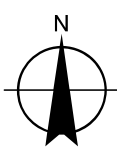
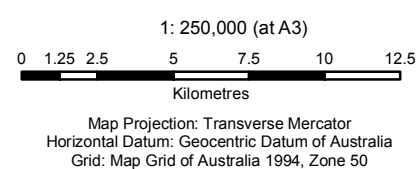
http://www.dec.wa.gov.au/pdf/science/bio_audit/geraldton_sandplains02_p265-292.pdf [7/08/2013]

Appendices

Appendix A - Figures



LEGEND
 Project Area



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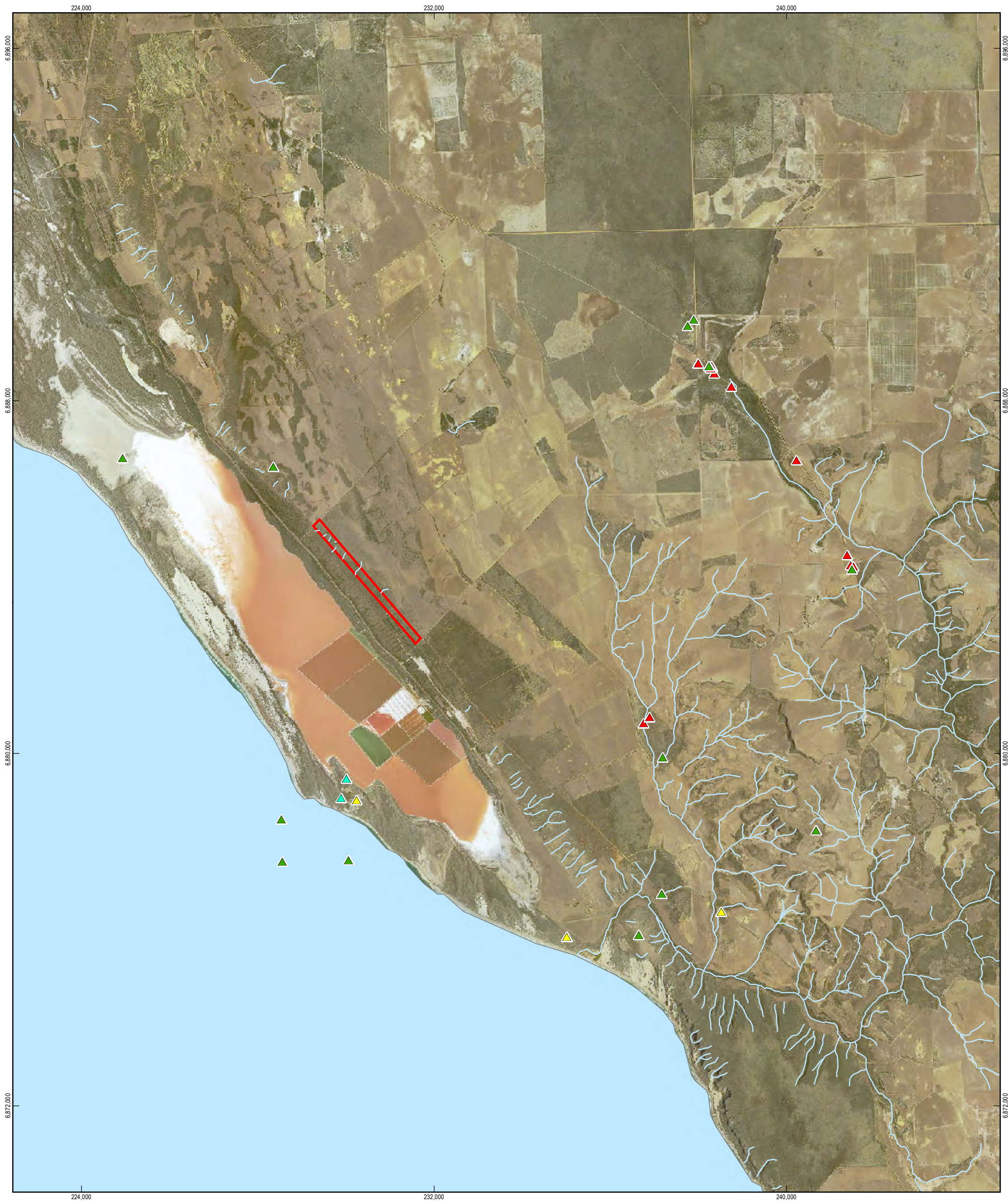
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GMA Garnet Pty Ltd
 Vegetation, Flora and Fauna Assessment
 Mining Tenement M70/968

Job Number | 61-29817
 Revision | 0
 Date | 24 Oct 2013

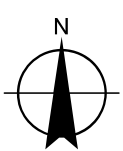
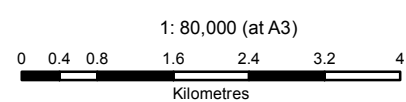
Port Gregory Location

Figure 1



LEGEND

- | | | |
|--|--|--------------|
| Threatened and Priority Species | Priority 3 - Poorly Known Taxa | Hydrology |
| (T) Threatened Flora - Extant Taxa | Priority 4 - Rare Taxa | Project Area |
| Priority 1 - Poorly Known Taxa | Priority 5 - Conservation Dependent Taxa | |
| Priority 2 - Poorly Known Taxa | | |



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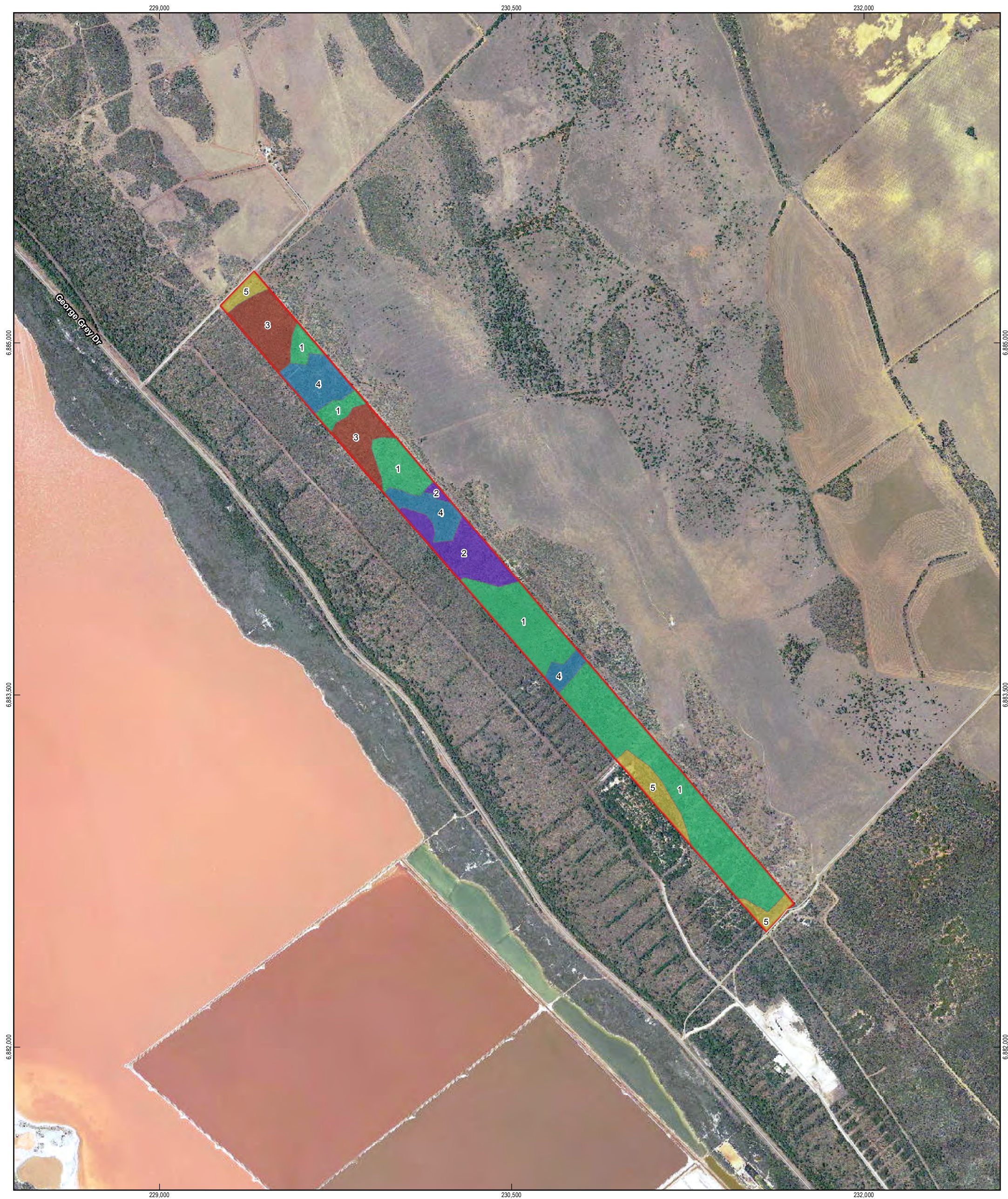
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Environmental Constraints Map

Figure 2



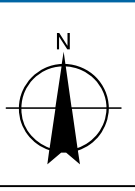
LEGEND

	Roads	Vegetation Type		3	
	Project Area		1		4
			2		5

1: 15,000 (at A3)

Metres

Map Projection: Transverse Mercator
Horizontal Datum: Geocentric Datum of Australia
Grid: Map Grid of Australia 1994, Zone 50



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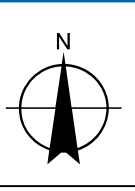
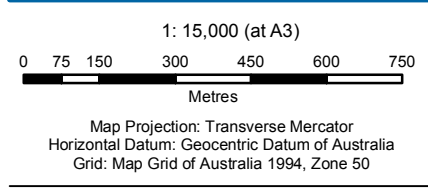
Vegetation Type

Figure 3



LEGEND

Roads	Vegetation Condition	4. Good
Project Area	2. Excellent	5. Degraded
	3. Very Good	6. Completely Degraded



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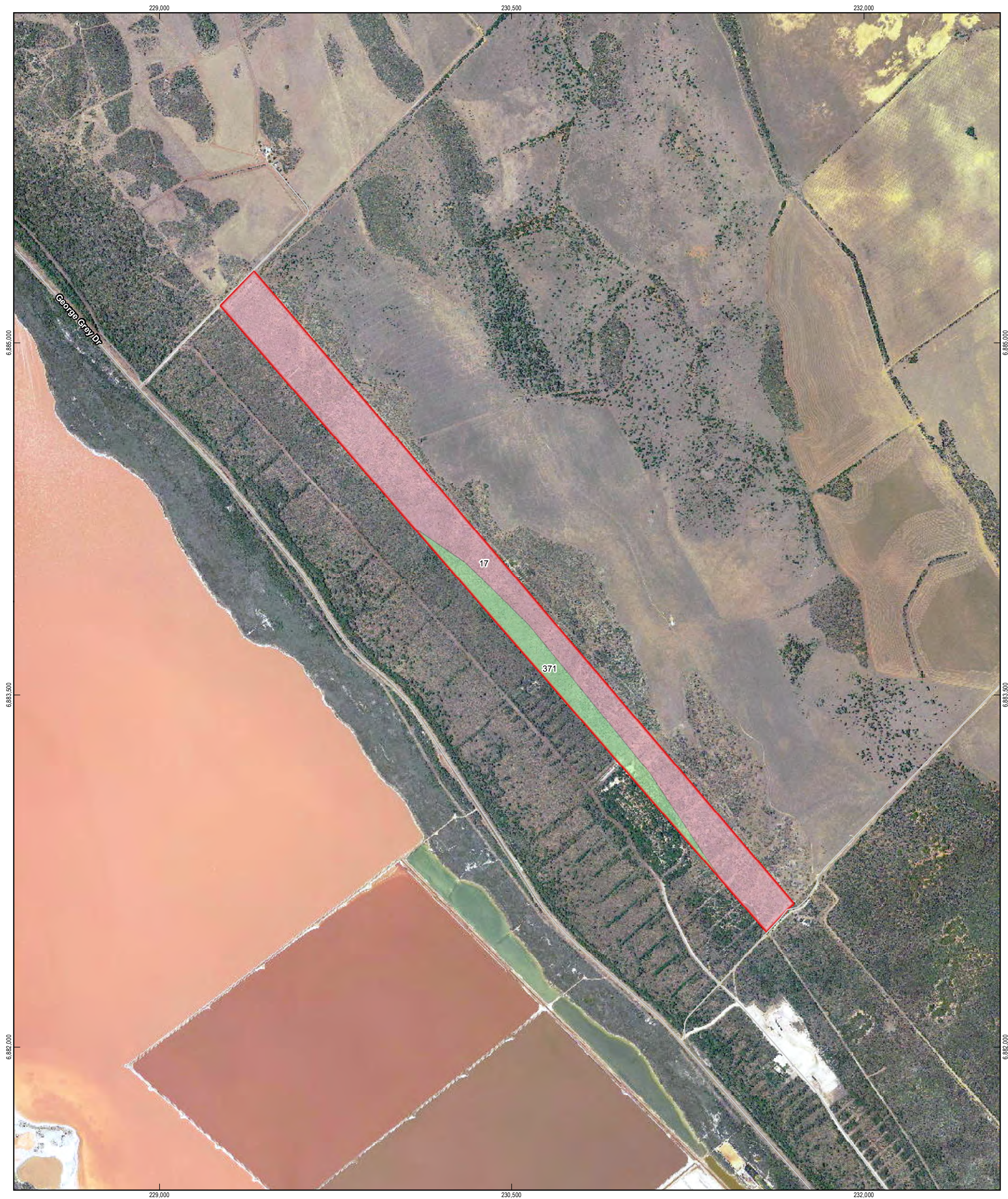
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Vegetation Condition

Figure 4



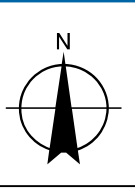
LEGEND

	Roads	Vegetation Association
	Project Area	17
		371

1: 15,000 (at A3)

Metres

Map Projection: Transverse Mercator
Horizontal Datum: Geocentric Datum of Australia
Grid: Map Grid of Australia 1994, Zone 50



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Vegetation Association

Figure 5

Appendix B – Conservation Categories

EPBC Act Conservation Categories

WC Act Conservation Categories

Department of Parks and Wildlife Categories

Table 8 Categories and Definitions for EPBC Act Listed Flora and Fauna Species

Conservation Category	Definition
<i>Extinct</i>	Taxa not definitely located in the wild during the past 50 years.
<i>Extinct in the Wild</i>	Taxa known to survive only in captivity.
<i>Critically Endangered</i>	Taxa facing an extremely high risk of extinction in the wild in the immediate future.
<i>Endangered</i>	Taxa facing a very high risk of extinction in the wild in the near future.
<i>Vulnerable</i>	Taxa facing a high risk of extinction in the wild in the medium term.
<i>Near Threatened</i>	Taxa that risk becoming <i>Vulnerable</i> in the wild.
<i>Conservation Dependent</i>	Taxa whose survival depends upon ongoing conservation measures. Without these measures, a conservation dependent taxon would be classified as <i>Vulnerable</i> or more severely threatened.
<i>Data Deficient (Insufficiently Known)</i>	Taxa suspected of being <i>Rare</i> , <i>Vulnerable</i> or <i>Endangered</i> , but whose true status cannot be determined without more information.
<i>Least Concern</i>	Taxa that are not considered <i>Threatened</i> .

Table 9 Conservation Codes and Descriptions for Threatened (Declared Rare) and Priority Flora or Fauna taxa

Code	Conservation category	Description
<i>Wildlife Conservation Act 1950</i>		
T S1	Schedule 1 under the WC Act	Threatened Fauna (Fauna that is rare or is likely to become extinct) Threatened Flora (Declared Rare Flora – Extant) Taxa that have been adequately searched for and are deemed to be in the wild either rare, in danger of extinction, or otherwise in need of special protection, and have been gazetted as such. CR: Critically Endangered – considered to be facing an extremely high risk of extinction in the wild. EN: Endangered – considered to be facing a very high risk of extinction in the wild. VU: Vulnerable – considered to be facing a high risk of extinction in the wild.
X	Schedule 2 under the WC Act	Presumed Extinct Fauna Presumed Extinct Flora (Declared Rare Flora – Extinct) Taxa which have been adequately searched for and there is no reasonable doubt that the last individual has died, and have been gazetted as such.

Code	Conservation category	Description
IA S1	Schedule 3 under the WC Act	Birds protected under an international agreement. Birds that are subject to an agreement between governments of Australia and Japan relating to the protection of migratory birds and birds in danger of extinction.
S S4	Schedule 4 under the WC Act	Other specially protected fauna. Fauna that is in need of special protection, otherwise than for the reasons mentioned in the above schedules.
DER Priority Listed		
1	Priority One: Poorly-known taxa	Taxa that are known from one or a few collections or sight records (generally less than five), all on lands not managed for conservation, e.g. agricultural or pastoral lands, urban areas, Shire, Westrail and Main Roads WA road, gravel and soil reserves, and active mineral leases and under threat of habitat destruction or degradation. Taxa may be included if they are comparatively well known from one or more localities but do not meet adequacy of survey requirements and appear to be under immediate threat from known threatening processes.
2	Priority Two: Poorly-known taxa	Taxa that are known from one or a few collections or sight records, some of which are on lands not under imminent threat of habitat destruction or degradation, e.g. national parks, conservation parks, nature reserves, State forest, vacant Crown land, water reserves, etc. Taxa may be included if they are comparatively well known from one or more localities but do not meet adequacy of survey requirements and appear to be under threat from known threatening processes.
3	Priority Three: Poorly-known taxa	Taxa that are known from collections or sight records from several localities not under imminent threat, or from few but widespread localities with either large population size or significant remaining areas of apparently suitable habitat, much of it not under imminent threat. Taxa may be included if they are comparatively well known from several localities but do not meet adequacy of survey requirements and known threatening processes exist that could affect them.
4	Priority Four: Rare, Near Threatened and other taxa in need of monitoring	(a) Rare. Taxa 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 taxa are usually represented on conservation lands. (b) Near Threatened. Taxa that are considered to have been adequately surveyed and that do not qualify for Conservation Dependent, but that are close to qualifying for Vulnerable. (c) Taxa that have been removed from the list of threatened species during the past five years for reasons other than taxonomy.
5	Priority 5: Conservation Dependent taxa	Taxa that are not threatened but are subject to a specific conservation program, the cessation of which would result in the taxon becoming threatened within five years.

Appendix C – Project Area Flora and Fauna Lists

[Project Area Fauna List](#)

[Project Area Flora List](#)

Table 10 Project Area Flora List

Family	Genus	Species	Common Name	Status	Inc	Q1	Q2	Q3	Q4
Aizoaceae	<i>Tetragonia</i>	<i>implexica</i>			X		X		
Amaranthaceae	<i>Ptilotus</i>	<i>drummondii</i>			X				
Amaranthaceae	<i>Ptilotus</i>	<i>eriotrichus</i>				X			
Amaranthaceae	<i>Ptilotus</i>	<i>gaudichaudii</i>			X				
Aphanopetalaceae	<i>Aphanopetalum</i>	<i>clematideum</i>			X		X		
Apocynaceae	<i>Alyxia</i>	<i>buxifolia</i>	Dysentery Bush		X				
Araliaceae	<i>Trachymene</i>	<i>ornata</i>	Spongefruit		X				
Asparagaceae	<i>Acanthocarpus</i>	<i>preissii</i>				X			X
Asparagaceae	<i>Dichopogon</i>	<i>fimbriatus</i>	Chocolate Lily						X
Asparagaceae	<i>Thysanotus</i>	<i>manglesianus</i>			X				
Asparagaceae	<i>Thysanotus</i>	sp. (insufficient material)				X			
Asteraceae	<i>Brachycome</i>	<i>ciliocarpa</i>			X				
Asteraceae	<i>Hedypnois</i>	<i>rhagadioloides</i>	Cretan Weed	*	X				
Asteraceae	<i>Millotia</i>	<i>myosotidifolia</i>			X				
Asteraceae	<i>Olearia</i>	sp. Kennedy Range (G. Byrne 66)				X			X
Asteraceae	<i>Reichardia</i>	<i>tingitana</i>	False Sowthistle	*	X				
Asteraceae	<i>Senecio</i>	<i>glossanthus</i>	Slender Groundsel		X				
Asteraceae	<i>Sonchus</i>	<i>oleraceus</i>	Common Sowthistle	*	X				
Asteraceae	<i>Waitzia</i>	<i>podolepis</i>				X		X	X
Brassicaceae	<i>Raphanus</i>	<i>raphanistrum</i>	Wild Radish	*	X				
Brassicaceae	<i>Sisymbrium</i>	<i>irio</i>	London Rocket	*		X		X	X
Caryophyllaceae	<i>Petrorhagia</i>	<i>dubia</i>		*	X			X	
Chenopodiaceae	<i>Rhagodia</i>	<i>latifolia</i>				X	X	X	
Convolvulaceae	<i>Cuscuta</i>	<i>planiflora</i>		*		X			
Convolvulaceae	<i>Duperreya</i>	<i>sericea</i>			X				
Dilleniaceae	<i>Hibbertia</i>	<i>spicata</i>							
Dioscoreaceae	<i>Dioscorea</i>	<i>hastifolia</i>	Warrine			X		X	X
Euphorbiaceae	<i>Beyeria</i>	<i>cinerea</i> subsp. <i>borealis</i>							
Euphorbiaceae	<i>Euphorbia</i>	<i>drummondii</i>	Caustic Weed		X				
Euphorbiaceae	<i>Euphorbia</i>	<i>tannensis</i>				X			
Fabaceae	<i>Acacia</i>	<i>rostelifera</i>	Summer - scented Wattle			X			
Fabaceae	<i>Acacia</i>	<i>spathulifolia</i>			X				
Fabaceae	<i>Bossiaea</i>	<i>spinescens</i>							X
Fabaceae	<i>Senna</i>	<i>glutinosa</i> subsp. <i>chatelainiana</i>			X				
Fabaceae	<i>Templetonia</i>	<i>retusa</i>	Cockies Tongues		X		X		

Family	Genus	Species	Common Name	Status	Inc	Q1	Q2	Q3	Q4
Geraniaceae	<i>Erodium</i>	sp. (insufficient material)				X			
Goodeniaceae	<i>Goodenia</i>	<i>beardiana</i>				X		X	X
Goodeniaceae	<i>Scaevola</i>	<i>tomentosa</i>	Ragged Fanflower		X				
Laureaceae	<i>Cassytha</i>	sp. (insufficient material)			X				
Malvaceae	<i>Alyogyne</i>	<i>huegii</i>	Lilac Hibiscus			X			
Malvaceae	<i>Androcalva</i>	<i>gaudichaudii</i>			X				
Malvaceae	<i>Guichenotia</i>	<i>ledifolia</i>			X				
Malvaceae	<i>Lasiopetalum</i>	<i>angustifolium</i>	Narrow Leaved Lasiopetalum		X		X		
Malvaceae	<i>Malva</i>	<i>parviflora</i>	Marshmallow	*	X				
Myrtaceae	<i>Eucalyptus</i>	? <i>fruiticosa</i>					X		
Myrtaceae	<i>Eucalyptus</i>	<i>dolichocera</i>			X				
Myrtaceae	<i>Melaleuca</i>	<i>campanae</i>							X
Myrtaceae	<i>Melaleuca</i>	<i>cardiophylla</i>	Tangling Melaleuca			X	X	X	X
Myrtaceae	<i>Thryptomene</i>	<i>baeckeacea</i>							
Nyctaginaceae	<i>Commicarpus</i>	<i>australis</i>	Perennial Tar Vine			X			
Phyllanthaceae	<i>Phyllanthus</i>	<i>calycinus</i>	False Boronia			X			X
Phyllanthaceae	<i>Poranthera</i>	<i>microphylla</i>	Small Poranthera		X				
Poaceae	<i>Austrostipa</i>	<i>tenuifolia</i>				X			
Poaceae	<i>Austrostipa</i>	<i>elegantissima</i>			X				
Poaceae	<i>Avena</i>	<i>barbata</i>	Wild Oat	*		X			X
Poaceae	<i>Ehrharta</i>	<i>longiflora</i>	Annual Veldt Grass	*	X		X	X	
Poaceae	<i>Phalaris</i>	<i>minor</i>	Lesser Canary Grass	*	X				X
Polygalaceae	<i>Comesperma</i>	<i>integerrimum</i>			X				
Portulacaceae	<i>Calandrinia</i>	<i>polyandra</i>	Parakeelya		X		X	X	X
Primulaceae	<i>Lysimachia</i>	<i>arvensis</i>	Pimpernel	*		X		X	
Proteaceae	<i>Grevillea</i>	<i>argyrophylla</i>	Silvery-leaved Grevillea			X			
Ranunculaceae	<i>Clematis</i>	<i>linearifolia</i>			X			X	
Restionaceae	<i>Desmocladius</i>	<i>asper</i>							X
Rubiaceae	<i>Opercularia</i>	<i>vaginata</i>	Dog Weed		X				X
Rutaceae	<i>Diplolaena</i>	<i>grandiflora</i>	Wild Rose		X				
Sapindaceae	<i>Diplopeltis</i>	<i>petiolaris</i>				X			X
Scrophulariaceae	<i>Eremophila</i>	<i>glabra</i> subsp. <i>albicans</i>			X				
Scrophulariaceae	<i>Myoporum</i>	<i>montanum</i>			X				
Solanaceae	<i>Solanum</i>	<i>oldfieldii</i>				X			
Surianaceae	<i>Stylobasium</i>	<i>spathulatum</i>	Pebble Bush		X				
Thymelaceae	<i>Pimelea</i>	<i>angustifolia</i>	Narrow-leaved Pimelea			X		X	X

Family	Genus	Species	Common Name	Status	Inc	Q1	Q2	Q3	Q4
Thymelaceae	<i>Pimelea</i>	<i>microcephala</i>	Shrubby Riceflower		X			X	
Urticaceae	<i>Parietaria</i>	<i>debilis</i>	Pellitory		X		X		
Vitaceae	<i>Clematicissus</i>	<i>angustissima</i>			X				X
Zygophyllaceae	<i>Zygophyllum</i>	<i>billardierei</i>				X		X	

Where: Inc = incidental records; Q1 to Q4 = flora taxa recorded in quadrats

Table 11 Project Area Fauna Lists

Type	Family	Genus	Species	Common Name	Conservation Code			Data	Site
					Exotic	EPBC Act	WC Act	DEC	Source
Birds	Acanthizidae	<i>Acanthiza</i>	<i>chrysorrhoa</i>	Yellow-rumped Thornbill				NM	
Birds	Acanthizidae	<i>Acanthiza</i>	<i>uropygialis</i>	Chestnut-rumped Thornbill				NM	
Birds	Acanthizidae	<i>Aphelocephala</i>	<i>leucopsis</i>	Southern Whiteface				NM	
Birds	Acanthizidae	<i>Calamanthus</i>	<i>campestris</i>	Rufous Fieldwren				NM	
Birds	Acanthizidae	<i>Sericornis</i>	<i>frontalis</i>	White-browed Scrubwren				NM	
Birds	Accipitridae	<i>Accipiter</i>	<i>fasciatus</i>	Brown Goshawk		Ma		NM	
Birds	Accipitridae	<i>Aquila</i>	<i>audax</i>	Wedge-tailed Eagle				NM	
Birds	Accipitridae	<i>Circus</i>	<i>approximans</i>	Swamp Harrier		Ma		NM	
Birds	Accipitridae	<i>Circus</i>	<i>assimilis</i>	Spotted Harrier				NM	
Birds	Accipitridae	<i>Haliaeetus</i>	<i>leucogaster</i>	White-bellied Sea-Eagle		Ma; Mi	S3	EPBC; NM	
Birds	Accipitridae	<i>Haliastur</i>	<i>sphenurus</i>	Whistling Kite		Ma		NM	
Birds	Accipitridae	<i>Hamirostra</i>	<i>melanosternon</i>	Black-breasted Buzzard				NM	
Birds	Accipitridae	<i>Pandion</i>	<i>cristatus</i>	Osprey		Ma; Mi		EPBC	
Birds	Anatidae	<i>Anas</i>	<i>gracilis</i>	Grey Teal				NM	
Birds	Anatidae	<i>Anas</i>	<i>rhynchotis</i>	Australasian Shoveler				NM	
Birds	Anatidae	<i>Anas</i>	<i>supercilliosa</i>	Pacific Black Duck				NM	
Birds	Anatidae	<i>Aythya</i>	<i>australis</i>	Hardhead				NM	
Birds	Anatidae	<i>Biziura</i>	<i>lobata</i>	Musk Duck		Ma		NM	
Birds	Anatidae	<i>Chenonetta</i>	<i>jubata</i>	Australian Wood Duck				NM	
Birds	Anatidae	<i>Cygnus</i>	<i>atratus</i>	Black Swan				NM	
Birds	Anatidae	<i>Malacorhynchus</i>	<i>membranaceus</i>	Pink-eared Duck				NM	
Birds	Anatidae	<i>Tadorna</i>	<i>tadornoides</i>	Australian Shelduck				NM	
Birds	Apodidae	<i>Apus</i>	<i>pacificus</i>	Fork-tailed Swift		Ma; Mi	S3	NM	
Birds	Ardeidae	<i>Ardea</i>	<i>ibis</i>	Cattle Egret		Ma; Mi	S3	EPBC	
Birds	Ardeidae	<i>Ardea</i>	<i>modesta</i>	Eastern Great Egret		Ma; Mi	S3	NM	
Birds	Ardeidae	<i>Ardea</i>	<i>pacifica</i>	White-necked Heron				NM	
Birds	Artamidae	<i>Artamus</i>	<i>cinerus</i>	Black-faced Woodswallow				NM	
Birds	Artamidae	<i>Artamus</i>	<i>minor</i>	Little Woodswallow				NM	
Birds	Artamidae	<i>Artamus</i>	<i>personatus</i>	Masked Woodswallow				NM	
Birds	Campephagidae	<i>Coracina</i>	<i>novaeollandiae</i>	Black-faced Cuckoo-shrike		Ma		NM	
Birds	Casuariidae	<i>Dromaius</i>	<i>novaeollandiae</i>	Emu				NM	
Birds	Charadriidae	<i>Charadrius</i>	<i>leschenaultii</i>	Greater Sand Plover		Ma; Mi	S3	EPBC; NM	
Birds	Charadriidae	<i>Charadrius</i>	<i>ruficapillus</i>	Red-capped Plover		Ma		NM	
Birds	Charadriidae	<i>Erythrogonys</i>	<i>cinctus</i>	Red-kneed Dotterel				NM	

Type	Family	Genus	Species	Common Name	Conservation Code			Data	Site	
					Exotic	EPBC Act	WC Act	DEC	Source	Record
Birds	Charadriidae	<i>Pluvialis</i>	<i>fulva</i>	Pacific Golden Plover		Ma; Mi	S3		EPBC	
Birds	Charadriidae	<i>Pluvialis</i>	<i>squatarola</i>	Grey Plover		Ma; Mi	S3		NM	
Birds	Cincolomatidae	<i>Psophodes</i>	<i>occidentalis</i>	Chiming Wedgebill					NM	
Birds	Columbidae	<i>Columbia</i>	<i>livia</i>	Domestic Pigeon	*				EPBC; NM	
Birds	Columbidae	<i>Geopelia</i>	<i>cuneata</i>	Diamond Dove					NM	
Birds	Columbidae	<i>Geopelia</i>	<i>striata</i>	Zebra Dove					NM	
Birds	Columbidae	<i>Ocyphaps</i>	<i>lophotes</i>	Crested Pigeon					NM	
Birds	Columbidae	<i>Phaps</i>	<i>chalcoptera</i>	Common Bronzewing					NM	
Birds	Columbidae	<i>Streptopelia</i>	<i>senegalensis</i>	Laughing Turtle-Dove	*				EPBC; NM	
Birds	Corvidae	<i>Corvus</i>	<i>bennetti</i>	Little Crow					NM	
Birds	Corvidae	<i>Corvus</i>	<i>coronoides</i>	Australian Raven					NM	X
Birds	Cracticidae	<i>Cracticus</i>	<i>nigrogularis</i>	Pied Butcherbird					NM	
Birds	Cracticidae	<i>Cracticus</i>	<i>tibicen</i>	Australian Magpie					NM	
Birds	Cracticidae	<i>Cracticus</i>	<i>torquatus</i>	Grey Butcherbird					NM	
Birds	Curculidae	<i>Cacomantis</i>	<i>pallidus</i>	Pallid Cuckoo		Ma			NM	
Birds	Dicaeidae	<i>Dicaeum</i>	<i>hirundinaceum</i>	Mistletoebird					NM	
Birds	Dicruridae	<i>Grallina</i>	<i>cyanoleuca</i>	Magpie-lark					NM	
Birds	Dicruridae	<i>Rhipidura</i>	<i>leucophrys</i>	Willie Wagtail					NM	X
Birds	Diomedeidae	<i>Diomedea</i>	<i>exulans</i> subsp. <i>amsterdamensis</i>	Amsterdam Albatross		En; Ma; Mi	S1		EPBC	
Birds	Diomedeidae	<i>Diomedea</i>	<i>exulans</i> subsp. <i>exulans</i>	Tristan Albatross		En; Ma; Mi	S1		EPBC	
Birds	Diomedeidae	<i>Diomedea</i>	<i>exulans</i> (sensu lato)	Wandering Albatross		Vu; Ma; Mi	S1, S3		EPBC	
Birds	Diomedeidae	<i>Thalassarche</i>	<i>chlororhynchos</i>	Indian Yellow-nosed Albatross		Vu; Ma; Mi	S1		EPBC	
Birds	Diomedeidae	<i>Thalassarche</i>	<i>cauta</i> subsp. <i>cauta</i>	Shy Albatross		Vu; Ma; Mi	S1		EPBC	
Birds	Estrillidae	<i>Taeniopygia</i>	<i>guttata</i>	Zebra Finch					NM	
Birds	Falconidae	<i>Falco</i>	<i>berigora</i>	Brown Falcon					NM	
Birds	Falconidae	<i>Falco</i>	<i>cenchroides</i>	Australian Kestrel		Ma			NM	
Birds	Falconidae	<i>Falco</i>	<i>longipennis</i>	Australian Hobby					NM	
Birds	Falconidae	<i>Falco</i>	<i>peregrinus</i>	Peregrine Falcon					NM	
Birds	Haematopodidae	<i>Haematopus</i>	<i>fuliginosus</i>	Sooty Oystercatcher					NM	
Birds	Haematopodidae	<i>Haematopus</i>	<i>longirostris</i>	Pied Oystercatcher					NM	
Birds	Halcyonidae	<i>Todiramphus</i>	<i>sanctus</i>	Sacred Kingfisher		Ma			NM	
Birds	Hirundinidae	<i>Hirundo</i>	<i>neoxena</i>	Welcome Swallow					NM	
Birds	Laridae	<i>Anous</i>	<i>tenuirostris</i> subsp. <i>melanops</i>	Australian Lesser Noddy		V; Ma	S1		NM	
Birds	Laridae	<i>Catharacta</i>	<i>skua</i>	Great Skua		Ma			EPBC	
Birds	Laridae	<i>Hydroprogne</i>	<i>caspia</i>	Caspian tern		Ma; Mi	S3		EPBC	

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Birds	Laridae	<i>Larus</i>	<i>pacificus</i>	Pacific Gull		Ma			NM	
Birds	Laridae	<i>Onychoprion</i>	<i>anarhethus</i>	Bridled Tern		Ma; Mi	S3		EPBC	
Birds	Laridae	<i>Sterna</i>	<i>nilotica</i> subsp. <i>macrotarsa</i>	Australian Gull-billed Tern					NM	
Birds	Maluridae	<i>Malurus</i>	<i>lamberti</i>	Variiegated Fairy-wren					NM	
Birds	Maluridae	<i>Malurus</i>	<i>lamberti</i> subsp. <i>assimillis</i>	Variiegated Fairy-wren					NM	
Birds	Maluridae	<i>Malurus</i>	<i>leucopterus</i>	White-winged Fairy-wren					NM	
Birds	Maluridae	<i>Malurus</i>	<i>pulcherrimus</i>	Blue-breasted Fairy-wren					NM	
Birds	Maluridae	<i>Malurus</i>	<i>splendens</i>	Splendid Fairy-wren					NM	
Birds	Megapodiidae	<i>Leipoa</i>	<i>ocellata</i>	Malleefowl		Vu; Mi	S1		EPBC	
Birds	Meliphagidae	<i>Acanthagenys</i>	<i>rufogularis</i>	Spiny-cheeked Honeyeater					NM	
Birds	Meliphagidae	<i>Anthochaera</i>	<i>lunulata</i>	Western Little Wattlebird					NM	
Birds	Meliphagidae	<i>Epthianura</i>	<i>albifrons</i>	White-fronted Chat					NM	
Birds	Meliphagidae	<i>Epthianura</i>	<i>aurifrons</i>	Orange Chat					NM	
Birds	Meliphagidae	<i>Epthianura</i>	<i>tricolor</i>	Crimson Chat					NM	
Birds	Meliphagidae	<i>Lichenostomus</i>	<i>virescens</i>	Singing Honeyeater						X
Birds	Meliphagidae	<i>Lichmera</i>	<i>indistincta</i>	Brown Honeyeater					NM	
Birds	Meliphagidae	<i>Manorina</i>	<i>flavigula</i>	Yellow-throated Miner					NM	
Birds	Meliphagidae	<i>Phylidonyris</i>	<i>albifrons</i>	White-fronted Honeyeater					NM	
Birds	Meropidae	<i>Merops</i>	<i>ornatus</i>	Rainbow Bee-eater		Ma; Mi	S3		EPBC	
Birds	Otididae	<i>Ardeotis</i>	<i>australis</i>	Australian Bustard				P4	NM	
Birds	Pachycephalidae	<i>Colluricincla</i>	<i>harmonica</i>	Grey Shrike-thrush					NM	X
Birds	Pachycephalidae	<i>Oreoica</i>	<i>gutturalis</i>	Crested Bellbird					NM	
Birds	Pachycephalidae	<i>Pachycephala</i>	<i>pectoralis</i>	Golden Whistler					NM	
Birds	Pachycephalidae	<i>Pachycephala</i>	<i>rufiventris</i>	Rufous Whistler					NM	X
Birds	Pardalotidae	<i>Acanthiza</i>	<i>iredalei</i> subsp. <i>iredalei</i>	Slender-billed Thornbill		Vu			EPBC	
Birds	Pardalotidae	<i>Pardalotus</i>	<i>striatus</i>	Striated Pardalote					NM	
Birds	Pelecanidae	<i>Pelecanus</i>	<i>conspicillatus</i>	Australian Pelican		Ma			NM	
Birds	Petroicidae	<i>Eopsaltria</i>	<i>australis</i> subsp. <i>griseogularis</i>	Western Yellow Robin					NM	
Birds	Phalacrocoracidae	<i>Phalacrocorax</i>	<i>carbo</i>	Great Cormorant					NM	
Birds	Phalacrocoracidae	<i>Phalacrocorax</i>	<i>sulcirostris</i>	Little Black Cormorant					NM	
Birds	Phalacrocoracidae	<i>Phalacrocorax</i>	<i>varius</i>	Pied Cormorant					NM	
Birds	Podargidae	<i>Podargus</i>	<i>strigoides</i>	Tawny Frogmouth					NM	
Birds	Podicipedidae	<i>Poliiocephalus</i>	<i>poliocephalus</i>	Hoary-headed Grebe					NM	
Birds	Pomatostomidae	<i>Pomatostomus</i>	<i>superciliosus</i>	White-browed Babbler					NM	
Birds	Procellariidae	<i>Ardenna</i>	<i>carneipes</i>	Flesh-footed Shearwater		Ma; Mi	S3		EPBC	

Type	Family	Genus	Species	Common Name	Conservation Code			Data	Site
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Birds	Procellariidae	<i>Macronectes</i>	<i>giganteus</i>	Southern Giant-Petrel		En; Ma; Mi	P4	EPBC	
Birds	Procellariidae	<i>Macronectes</i>	<i>halli</i>	Northern Giant-Petrel		Vu; Ma; Mi		EPBC	
Birds	Procellariidae	<i>Pterodroma</i>	<i>mollis</i>	Soft-Plumaged Petrel		Vu; Ma		EPBC	
Birds	Psittacidae	<i>Calyptorhynchus</i>	<i>latirostris</i>	Carnaby's Cockatoo		En	S1	EPBC; NM	
Birds	Psittacidae	<i>Nymphicus</i>	<i>hollandicus</i>	Cockatiel				NM	
Birds	Rallidae	<i>Fullica</i>	<i>atra</i>	Eurasian Coot				NM	
Birds	Rallidae	<i>Porzana</i>	<i>fluminea</i>	Australian Spotted Crake				NM	
Birds	Rallidae	<i>Porzana</i>	<i>tabuensis</i>	Spotless Crake		Ma		NM	
Birds	Recurvirostridae	<i>Cladorhynchus</i>	<i>leucocephalus</i>	Banded Stilt				NM	
Birds	Recurvirostridae	<i>Himantopus</i>	<i>himantopus</i>	Black-winged Stilt		Ma		NM	
Birds	Recurvirostridae	<i>Recurvirostra</i>	<i>novaehollandiae</i>	Red-necked Avocet		Ma		NM	
Birds	Rostratulidae	<i>Rostratula</i>	<i>benghalensis</i>	Painted Snipe		Vu; Mi	S1	EPBC	
Birds	Scolopacidae	<i>Actitis</i>	<i>hypoleucos</i>	Common Sandpiper		Ma; Mi	S3	NM	
Birds	Scolopacidae	<i>Arenaria</i>	<i>interpres</i>	Ruddy Turnstone		Ma; Mi	S3	EPBC; NM	
Birds	Scolopacidae	<i>Calidris</i>	<i>acuminata</i>	Sharp-tailed Sandpiper		Ma; Mi	S3	EPBC; NM	
Birds	Scolopacidae	<i>Calidris</i>	<i>alba</i>	Sanderling		Ma; Mi	S3	EPBC; NM	
Birds	Scolopacidae	<i>Calidris</i>	<i>canutus</i>	Red Knot		Ma; Mi	S3	EPBC	
Birds	Scolopacidae	<i>Calidris</i>	<i>ferruginea</i>	Curlew Sandpiper		Ma; Mi	S3	EPBC; NM	
Birds	Scolopacidae	<i>Calidris</i>	<i>ruficollis</i>	Red-necked Stint		Ma; Mi	S3	EPBCNM	
Birds	Scolopacidae	<i>Calidris</i>	<i>subminuta</i>	Long-toed Stint		Ma; Mi	S3	NM	
Birds	Scolopacidae	<i>Calidris</i>	<i>tenuirostris</i>	Great Knot		Ma; Mi	S3	NM	
Birds	Scolopacidae	<i>Limosa</i>	<i>lapponica</i>	Bar-tailed Godwit		Ma; Mi	S3	NM	
Birds	Scolopacidae	<i>Limosa</i>	<i>limosa</i>	Black-tailed Godwit		Ma; Mi	S3	NM	
Birds	Scolopacidae	<i>Numenius</i>	<i>madagascariensis</i>	Eastern Curlew		Ma; Mi	S3	EPBC	
Birds	Scolopacidae	<i>Numenius</i>	<i>minutus</i>	Little Curlew		Ma; Mi	S3	NM	
Birds	Scolopacidae	<i>Numenius</i>	<i>phaeopus</i>	Whimbrel		Ma; Mi	S3	NM	
Birds	Scolopacidae	<i>Phalaropus</i>	<i>lobatus</i>	Red-necked Phalarope		Ma; Mi	S3	NM	
Birds	Scolopacidae	<i>Philomachus</i>	<i>pugnax</i>	Ruff		Ma; Mi	S3	NM	
Birds	Scolopacidae	<i>Tringa</i>	<i>brevipes</i>	Grey-tailed Tattler		Ma; Mi	S3	EPBC; NM	
Birds	Scolopacidae	<i>Tringa</i>	<i>glareola</i>	Wood Sandpiper		Ma; Mi	S3	NM	
Birds	Scolopacidae	<i>Tringa</i>	<i>nebularia</i>	Common Greenshank		Ma; Mi	S3	NM	
Birds	Scolopacidae	<i>Tringa</i>	<i>stagnatilis</i>	Marsh Sandpiper		Ma; Mi	S3	NM	
Birds	Strigidae	<i>Ninox</i>	<i>novaeseelandiae</i>	Boobook Owl		Ma		NM	
Birds	Sylviidae	<i>Acrocephalus</i>	<i>australis</i>	Australian Reed Warbler				NM	
Birds	Sylviidae	<i>Cincloramphus</i>	<i>mathewsi</i>	Rufous Songlark				NM	

Type	Family	Genus	Species	Common Name	Conservation Code			Data	Site	
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Birds	Sylviidae	<i>Megalurus</i>	<i>gramineus</i>	Little Grassbird					NM	
Birds	Threskiornithidae	<i>Platalea</i>	<i>flavipes</i>	Yellow-billed Spoonbill					NM	
Birds	Threskiornithidae	<i>Threskiornis</i>	<i>molucca</i>	Australian White Ibis		Ma			NM	
Birds	Threskiornithidae	<i>Threskiornis</i>	<i>spinicollis</i>	Straw-necked Ibis		Ma			NM	
Birds	Zosteropidae	<i>Zosterops</i>	<i>lateralis</i>	Silvereye					NM	
Mammals	Bovidae	<i>Capra</i>	<i>hircus</i>	Goat	*				EPBC	
Mammals	Canidae	<i>Canis</i>	<i>lupus</i> subsp. <i>familiaris</i>	Domestic Dog	*				EPBC	
Mammals	Canidae	<i>Vulpes</i>	<i>vulpes</i>	Red Fox	*				EPBC	
Mammals	Felidae	<i>Felis</i>	<i>catus</i>	Cat	*				EPBC	
Mammals	Leporidae	<i>Oryctolagus</i>	<i>cuniculus</i>	European Rabbit	*				EPBC	X
Mammals	Macropodidae	<i>Macropus</i>	<i>eugenii</i> subsp. <i>derbianus</i>	Tammar Wallaby				P5	NM	
Mammals	Macropodidae	<i>Macropus</i>	<i>fuliginosus</i>	Western Grey Kangaroo					NM	X
Mammals	Muridae	<i>Mus</i>	<i>musculus</i>	House Mouse	*				NM	
Mammals	Muridae	<i>Rattus</i>	<i>rattus</i>	Black Rat	*				NM	
Mammals	Suridae	<i>Sus</i>	<i>scrofa</i>	Pig	*				EPBC	
Mammals	Vespertilionidae	<i>Nyctophilus</i>	<i>geoffroyi</i>	Lesser Long-eared Bat					NM	
Reptiles	Agamidae	<i>Ctenophorus</i>	<i>maculatus</i> subsp. <i>maculatus</i>	Spotted Military Dragon					NM	
Reptiles	Agamidae	<i>Ctenophorus</i>	<i>reticulatus</i>	Western Netted Dragon					NM	
Reptiles	Diplodactylidae	<i>Strophurus</i>	<i>spinigerus</i> subsp. <i>spinigerus</i>	South-western Spiny-tailed Gecko					NM	
Reptiles	Elapidae	<i>Pseudechis</i>	<i>australis</i>	Mulga Snake					NM	
Reptiles	Elapidae	<i>Pseudonaja</i>	<i>mengdeni</i>	Western Brown Snake					NM	
Reptiles	Gekkonidae	<i>Gehyra</i>	<i>variegata</i>	Tree Dtella					NM	
Reptiles	Gekkonidae	<i>Heteronotia</i>	<i>binoei</i>	Bynoe's Gecko					NM	
Reptiles	Pygopodidae	<i>Delma</i>	<i>grayii</i>	Side-barred Delma					NM	
Reptiles	Pygopodidae	<i>Delma</i>	<i>tincta</i>	Excitable Delma					NM	
Reptiles	Pygopodidae	<i>Lialis</i>	<i>burtonis</i>	Burton's Legless Lizard					NM	
Reptiles	Scincidae	<i>Lerista</i>	<i>lineopunctulata</i>	Dotted-line Robust Slider					NM	
Reptiles	Scincidae	<i>Lerista</i>	<i>praepedita</i>	Blunt-tailed West Coast Slider					NM	
Reptiles	Scincidae	<i>Morethia</i>	<i>lineocellata</i>	West Coast Morethia Skink					NM	
Invertebrates	Idiopidae	<i>Idiosoma</i>	<i>nigrum</i>	Shield-backed Trapdoor Spider		Vu	S1		EPBC	

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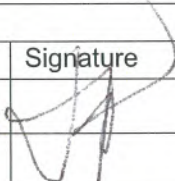
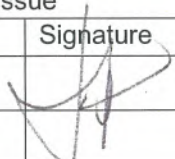
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GMA Garnet Pty Ltd

Report for Port Gregory Mine

Targeted Flora Survey

September 2014

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Appendix A – Figures

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1. Introduction

1.1 Project Background

GMA Garnet Pty Ltd (GMA Garnet) operates an open alluvial garnet mine within mining tenement M70/856 with proposed expansion into adjacent tenements M70/926 and M70/927. GMA Garnet operates wet processing facilities (Hose Wet Plant) on G70/171. The tenements are registered under the parent company, Garnet International Resources Pty Ltd, located between Northampton and Kalbarri.

GMA Garnet is currently undertaking mining operations on an ore body located within M70/204. For the continuation of the operation GMA Garnet is proposing to undertake exploration drilling in the adjacent M70/968 (Figure 1).

GHD Pty Ltd (GHD) completed a baseline biological survey for GMA Garnet in August 2013 as a part of their mining proposal for tenement M70/968. The survey precluded that no conservation significant flora were recorded from the Project Area. GHD (2013) did however identify very marginal habitat for *Caladenia bryceana* subsp. *cracens*.

Subsequent to the submission of GHD (2013) report, the Department of Parks and Wildlife (DPaW) requested that an additional survey is undertaken, targeting very marginal habitat for the presence of *Caladenia bryceana* subsp. *cracens*. DPaW also considered that the 2013 survey was conducted during a season of lower-than-average rainfall, which may have resulted in poor germination of this taxon and potentially missed during the field survey.

On the advice of the DPaW the Department of Mines and Petroleum (DMP) has requested a targeted flora survey for the Threatened Flora species *Caladenia bryceana* subsp. *cracens*.

1.2 Purpose of this report

The purpose of this report is to present the results of this targeted flora survey. The results of the survey will assist with project design and preparation of environmental documents as required for the project.

1.3 Scope and limitations

1.3.1 Project Area

The targeted survey was undertaken at GMA Garnet in mining tenement M70/968 (Project Area). An overview of the Project Area is provided in Figure 1.

1.3.2 Scope of Work

The following scope of work will be undertaken as a part of the targeted flora assessment:

- Desktop Assessment - review of previous report and literature search;
- A targeted survey for the Threatened Flora species *Caladenia bryceana* subsp. *cracens*;
- Development of report – Report findings, conclusions and recommendations

1.3.3 Report Limitations and Assumptions

Limitations

This report: has been prepared by GHD for GMA Garnet Pty Ltd and may only be used and relied on by GMA Garnet Pty Ltd for the purpose agreed between GHD and the GMA Garnet Pty Ltd as set out in section 1.3.2 of this report.

GHD otherwise disclaims responsibility to any person other than GMA Garnet Pty Ltd arising in connection with this report. GHD also excludes implied warranties and conditions, to the extent legally permissible.

The services undertaken by GHD in connection with preparing this report were limited to those specifically detailed in the report and are subject to the scope limitations set out in the report.

The opinions, conclusions and any recommendations in this report are based on conditions encountered and information reviewed at the date of preparation of the report. GHD has no responsibility or obligation to update this report to account for events or changes occurring subsequent to the date that the report was prepared.

The opinions, conclusions and any recommendations in this report are based on assumptions made by GHD described in this report. GHD disclaims liability arising from any of the assumptions being incorrect.

GHD has prepared this report on the basis of information provided by GMA Garnet Pty Ltd and others who provided information to GHD (including Government authorities), which GHD has not independently verified or checked beyond the agreed scope of work. GHD does not accept liability in connection with such unverified information, including errors and omissions in the report which were caused by errors or omissions in that information.

The opinions, conclusions and any recommendations in this report are based on information obtained from, and testing undertaken at or in connection with, specific sample points. Site conditions at other parts of the site may be different from the site conditions found at the specific sample points.

Investigations undertaken in respect of this report are constrained by the particular site conditions, such as the location of buildings, services and vegetation. As a result, not all relevant site features and conditions may have been identified in this report.

Site conditions (including the presence of hazardous substances and/or site contamination) may change after the date of this Report. GHD does not accept responsibility arising from, or in connection with, any change to the site conditions. GHD is also not responsible for updating this report if the site conditions change.

Targeted Assessment Limitations

The limitations and constraints associated with the field assessment of the Project Area are discussed in

Table 1 Field Survey Constraints

Variable	Impact on survey outcomes
Access Problems	The entire Project Area could be accessed for this survey.
Experience Levels	The Principal Ecologist and Environmental Scientist who executed this survey were practitioners suitably qualified in their field.
Timing, Weather, Season	The survey was undertaken during late Winter between 13 and 14 August 2014. In three months (May, June and July) prior to the survey, 119 mm of rainfall was recorded and the long-term average is 211.3 mm. However, rainfall recorded in April was above average, with approximately 40 mm recorded during this period, with a long-term average of 22.5 mm

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Variable	Impact on survey outcomes
	(BoM, 2014b). Flora composition changes over time, with flora species having specific growing periods, especially annuals and ephemerals (some plants lasting for a markedly brief time, some only a day or two). Therefore, the results of future botanical surveys in this location may differ from the results of this survey.
Completeness	The entire Project Area was traversed by foot, targeting areas considered as marginal habitat.
Determination	The taxonomy and conservation status of the Western Australian flora is dynamic. This report was prepared with reliance on taxonomy and conservation current at the time issuing, but it should be noted this may change.

Assumptions

This report uses the Project Area as provided by GMA Garnet. Any change to the extent of the study area may alter the results and recommendations presented in this assessment.

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2. Methodology

2.1 Desktop Assessment

The desktop assessment was carried out prior to the field survey in order to consider biological constraints which may be in, or adjoining, the Project Area. This included literature research and review of previous reports to identify information pertaining to the Project Area and which may provide information on any aspect of ecological significance.

2.2 Targeted Flora Assessment Planning Considerations

Consideration for the targeted flora assessment was undertaken with reference to the *Environmental Protection Authority (EPA) Guidance Statement No. 51* (EPA, 2004) and *Survey Guidelines for Australia's Threatened Orchids* (Commonwealth of Australia, 2013).

2.2.1 Key Personnel

The key personnel who undertook the targeted flora survey have encountered the target species growing in its natural habitat. The key personnel includes, Joshua Foster (Principal Ecologist) with 15 years experience in baseline biological survey and target searches. Steven Petts (Environmental Scientist) with three years experience in baseline biological surveys and targeted searches.

2.2.2 Timing

The targeted flora assessment was undertaken from the 13 to 14 August, 2014. GHD liaised with Alanna Chant for the Department of Parks and Wildlife with regards to optimal flowering time for 2014. The purpose of this was to ensure that the survey was undertaken at an appropriate time to ensure the maximum likelihood of observing this taxon.

2.2.3 Survey Design

GHD previously completed a baseline biological survey with the Project Area, which identified potential microhabitats that were considered more likely to contain *Caladenia bryceana* subsp. *cracens*. At the time of the survey no *Caladenia bryceana* subsp. *cracens* were recorded.

GHD undertook systematic targeted search parallel transects in potential habitat for this species. Transects were walked at six metre intervals and searches were undertaken three metres either side of each transect.

2.2.4 Survey Effort

A baseline biological survey and targeted flora survey have been undertaken in the Project Area. The baseline biological survey effort identified very marginal habitat for the Threatened species. This was disturbed from feral fauna activity. No threatened plants or evidence of any orchid species were recorded with the Project Area.

3. Desktop Review

3.1 Climate

The region experiences a Mediterranean type climate, characterised by warm to hot dry summers and mild wet winters.

The closest Bureau of Meteorology (BoM) weather station that provides continuous reliable data to the Project Area is located at Kalbarri (Site Number 008251). A summary of maximum and minimum temperature statistics is provided below:

- Mean Daily Maximum Temperature 20.6°C in July to 34.2°C in February; and
- Mean Daily Minimum Temperature 9.7 °C in July to 21.7 °C in February.

(BoM, 2014a)

The average annual rainfall measured at Lynton (Site number 008075) is 399.1 mm with the average monthly rainfall ranging 3.4 mm in December to 95.4 mm in June. The majority of rainfall occurs in during the winter months and is generally associated with frontal systems from the south west. The summer rains are associated with isolated thunderstorms and tropical lows (BoM, 2014b).

3.2 *Caladenia bryceana* subsp. *cracens*

3.2.1 Description

Caladenia bryceana subsp. *cracens* is tuberous perennial herb that typically grows to a height of between three to eight centimetres. The flowers are a distinctive green and yellow colour. It is distinguish from other species such as by their curled petals and sepals. It often lacks calli this grows from the middle of the labellum. It flows from August to early September (DPaW, 2014).

3.2.2 Habitat

Caladenia bryceana subsp. *cracens* only occurs in Western Australia between Northampton and Kalbarri. The species inhabits low heath in shallow soil on coastal limestones. A number of populations have been recorded in the region and generally within pastoral leases, private land, national parks and reserves.

3.2.3 Threats

Australian Government (2008) identified a number of threats to the Northern Dwarf Spider-orchid including:

- Change in hydrology;
- Grazing by feral rabbits and goats;
- Invasive weeds; and
- Firebreaks and road maintenance.

3.3 Review of Previous Survey

In 2013, GHD undertook a baseline biological study of the Project Area and recorded the following information pertaining to the area:

- A total of five vegetation types were recorded from the Study Area. These were dominated by *Acacia rostellifera* and *Melaleuca cardiophylla*, with density, plant height and species composition impacted by topography and geology (GHD, 2013);
- The vegetation condition in the Project Area was rated during the field surveys using the Vegetation Condition Scale (after Keighery, 1994). The vegetation in the Project Area was predominantly Good to Very Good with areas of degradation due to grazing, firebreaks and historical mining activities;
- No Threatened (Declared Rare) Flora taxa were recorded from the Project Area;
- No Priority Flora taxa were recorded in the Project Area;
- No flora taxa at or occurring beyond their known range were recorded from the Project Area; and
- Habitat recorded within the north-eastern portion of the Project Area was considered to be very marginal habitat for the *Caladenia bryceana* subsp. *cracens*. The habitat identified appeared to be disturbed from feral fauna activity (rabbits, pigs). No plants or evidence of any orchid species were recorded from this area.

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4. Field Assessment

The targeted flora assessment was undertaken between 13 and 14 August. The survey was conducted during the period of the year coinciding known flowering time of *Caladenia bryceana* subsp. *cracens* (August to early September) (DPaW, 1998-). Previous heavy rainfall in April and May indicated an early flowering season (Alanna Chant *pers. comm.*). Furthermore, the abundance of weed indicates the area has received adequate rainfall.

4.1 Influence of Climate

The weather conditions for the survey were fine and cool. In three months (May, June and July) prior to the survey, 119 mm of rainfall was recorded and the long-term average is 211.3 mm. However, rainfall recorded in April was above average, with approximately 40 mm recorded during this period, with a long-term average of 22.5 mm (BoM, 2014b).

4.2 Soil

The soil of the Project Area was generally brown sand, sometimes overlying limestone. Plate 1 demonstrates the typical soil type for the area.



Plate 1 Soil Type

4.3 Fire History

The existing vegetation growth within the Project Area indicates that the last fire event occurred more than 20 years ago.

4.4 Threatened Flora

GHD did not record any Threatened Flora listed under the EPBC Act and WC Act.

4.4.1 Habitat

Potential habitat was considered extremely marginal because it has been impacted by weeds species and considered unsuitable habitat for *Caladenia bryceana* subsp. *cracens*. Plate 2 demonstrates the habitat found within the Project Area.



Plate 2 Marginal habitat

GHD noted evidence of wild pigs impacting Project Area (Plate 3). Such an impact indicates threats posed to extremely marginal habitat with the Project Area.



Plate 3 Pig Impact

4.5 Priority Flora

From the field survey GHD recorded priority species which hold a DPaW status, including:

Melaleuca huttensis Priority 1; and

Anthocercis intricata Priority 3.

4.5.1 *Melaleuca huttensis* – Priority 1

Melaleuca huttensis is a listed DPaW Priority 1 flora taxon. It is described as an upright shrub that grows to approximate height of three metres. This species flowers cream to yellow during June and July, sometimes September. *M. huttensis* is typically found growing along lower slopes of undulating plains and sandplains overlain by light yellow or beige sand (DPaW, 1998a-).



Plate 4 *Melaleuca huttensis*

In 2014 GHD recorded approximately 23 individual plants from three locations within the Project Area. The plants were recorded growing along the middle to lower slope of the sanddune. GHD traversed the entire Project Area by foot to identify any additional plants, no plants were identified. The locations of these plants are provided in Table 2 and Figure 2.

Table 2 *Melaleuca huttensis* recorded locations

Taxon	Status	Size of area	Plant Counts	Easting	Northing
<i>Melaleuca huttensis</i>	1	20 m radius	18	229370	6885133
<i>Melaleuca huttensis</i>	1	5 m radius	3	229386	6885127
<i>Melaleuca huttensis</i>	1	2 m radius	2	229361	6885088

GHD notes that larger populations of *Melaleuca huttensis* occurs immediately adjacent to the Project Area. GHD recorded three additional locations and at one location recorded in excess of 1000 individual plants. At each of the other locations approximately 50 individual species were recorded (Figure 2).

GHD undertook a search on the *NatureMap* database, which indicates nine records of this species are known within the Shire of Northampton (DPaW, 2007-). The closest recorded location is approximately five kilometres north-east of the Project Area, situated along Ogilvie

Road West (DPaW, 2007-). In 2014, GHD conducted a survey on behalf DPaW along Horrocks Road, located approximately 10 km from the Project Area. GHD recorded between 21,000 and 740,000 plants within an area of 106 hectares.

The removal of these species is likely to impact only >0.003% of the population within 10 km of the Project Area. It is unlikely that the removal of these plants will impact on the status of this species within the local area.



Plate 5 Population of <1000 individual plant of *M. huttensis* in adjacent area.

4.5.2 *Anthocercis intricata*

Anthocercis intricata is a DPaW listed Priority 3 flora taxon. It is described as a dense, spinescent shrub, growing to approximate height of between 0.9 to 3.0 m high. It has white to cream flowers occurring between June and September (Plate 6). This species typically occurs on sand or loam over limestone, associated with consolidated sand dunes (DPaW, 1998-). This is a wide-ranging coastal species with records known from Shark Bay in the north to Leeman in the south.



Plate 6 *Anthocercis intricata*

In 2014, GHD recorded approximately 54 individual plants from three locations were recorded from the Project Area. This species was associated with previous disturbances and was recorded growing along existing firebreaks track. GHD traversed the entire Project Area by foot to identify any additional plants, no plants were identified. The locations of these plants are provided in Table 3 and Figure 3.

Table 3 *Anthocercis intricata* recorded locations

Taxon	Status	Size of Area	Count	Easting	Northing
<i>Anthocercis intricata</i>	3	10 m in radius	50	229517	68850331
<i>Anthocercis intricata</i>	3	-	1	229648	6885022
<i>Anthocercis intricata</i>	3	-	3	230363	6884164

Larger populations this species were noted five kilometres south of the Project Area. From one location GHD recorded a population of in excess of 80 individual plants (Figure 3).

GHD undertook a search on the *NatureMap* database, which indicates 12 records of this species are known within the Shire of Northampton (DPaW, 2007-). The closest recorded location is approximately 17 kms south of the Project Area, situated along near Lynton along George Grey Drive. According to Florabase records in excess of the 100 individual plants were recorded from this location (DPaW, 1998-). Approximately 27 km north of the Project Area in excess of 1000 individual plants have been recorded along George Grey Drive (DPaW, 2007-; DPaW, 1998-).

The removal these 54 individual plants is expected to only impact on 5% of the population within 30 km of the Project Area.

5. Conclusions

GHD undertook a targeted field assessment of *Caladenia bryceana* subsp. *cracens*, within previously identified marginal habitat (GHD, 2013). The targeted field assessment results indicated the following:

- Potential habitat was considered extremely marginal because it has been impacted by weeds species; and
- GHD noted evidence of disturbances such as wild pigs impacting the extremely marginal habitat.

GHD identified two priority species including *Melaleuca huttensis* – Priority 1 and *Anthocercis intricata* – Priority 3 from the Project Area. GHD concluded that:

- Approximately 23 individual plants of *Melaleuca huttensis* were recorded by GHD in 2014 from the Project. The removal of these plants is likely to impact less than 0.0003% of the population identified within 10 km of the Project Area (DPaW, 2007- and DPaW, 1998-).
- GHD recorded approximately 54 individual plants of *Anthocercis intricata* from the Project Area. The removal of these species is likely to impact 5% of the population known within 30 km of the Project Area (DPaW, 2007- and DPaW, 1998-).

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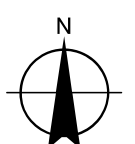
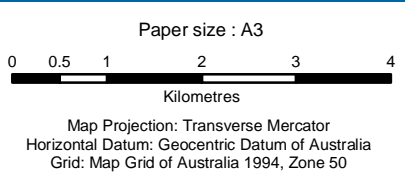
Appendices

Appendix A – Figures

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- LEGEND**
- Project Area
 - Tenement Boundary

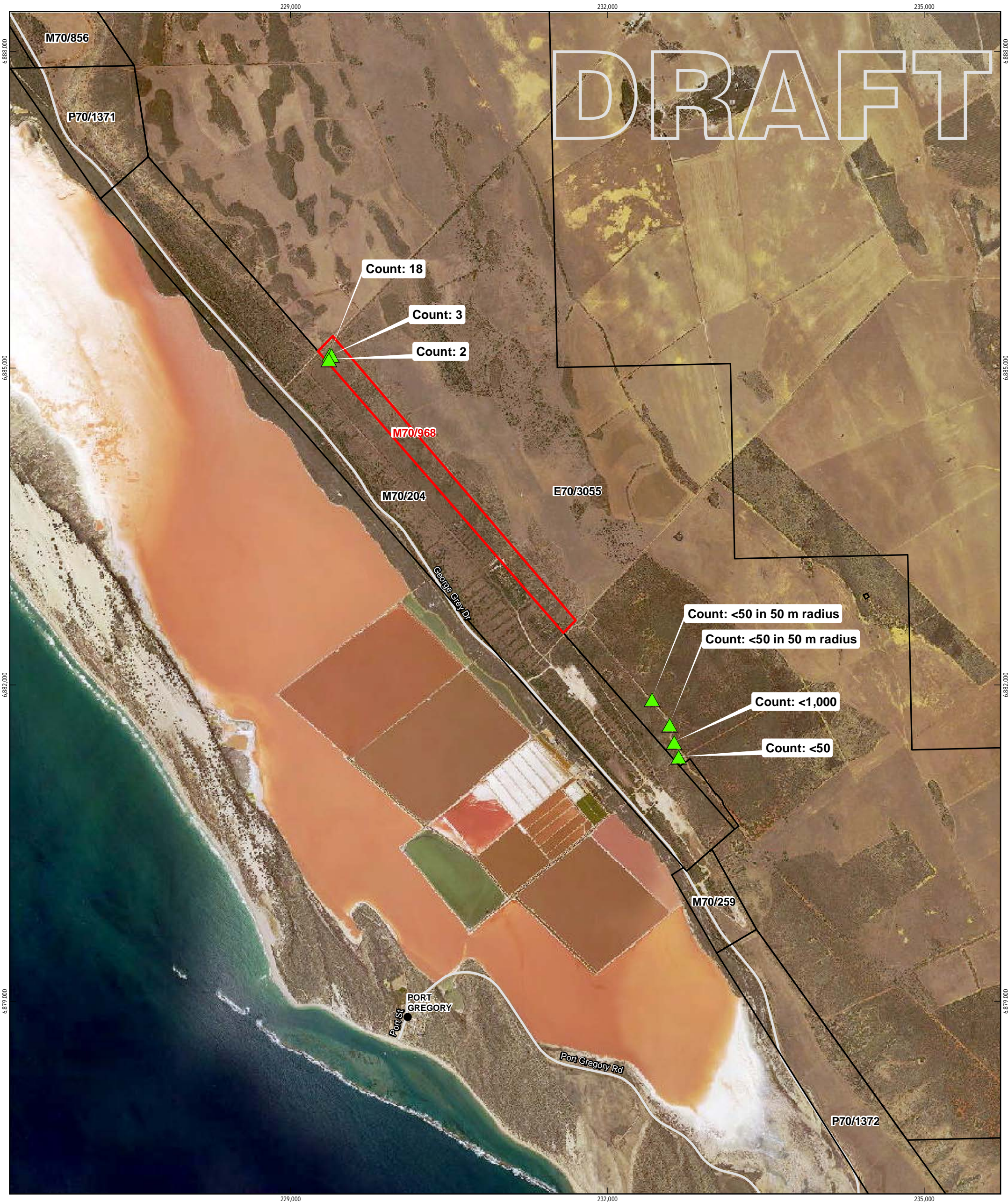


GMA Garnet
Targeted Flora Survey 2014

Job Number	61-31102
Revision	B
Date	25 Sep 2014

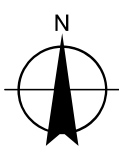
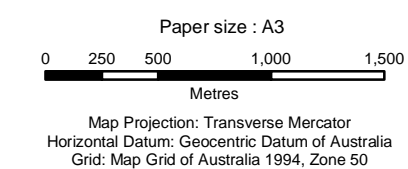
Locality map

Figure 1



LEGEND

- ▲ *Melaleuca huttensis*
- Project Area
- Tenement Boundary

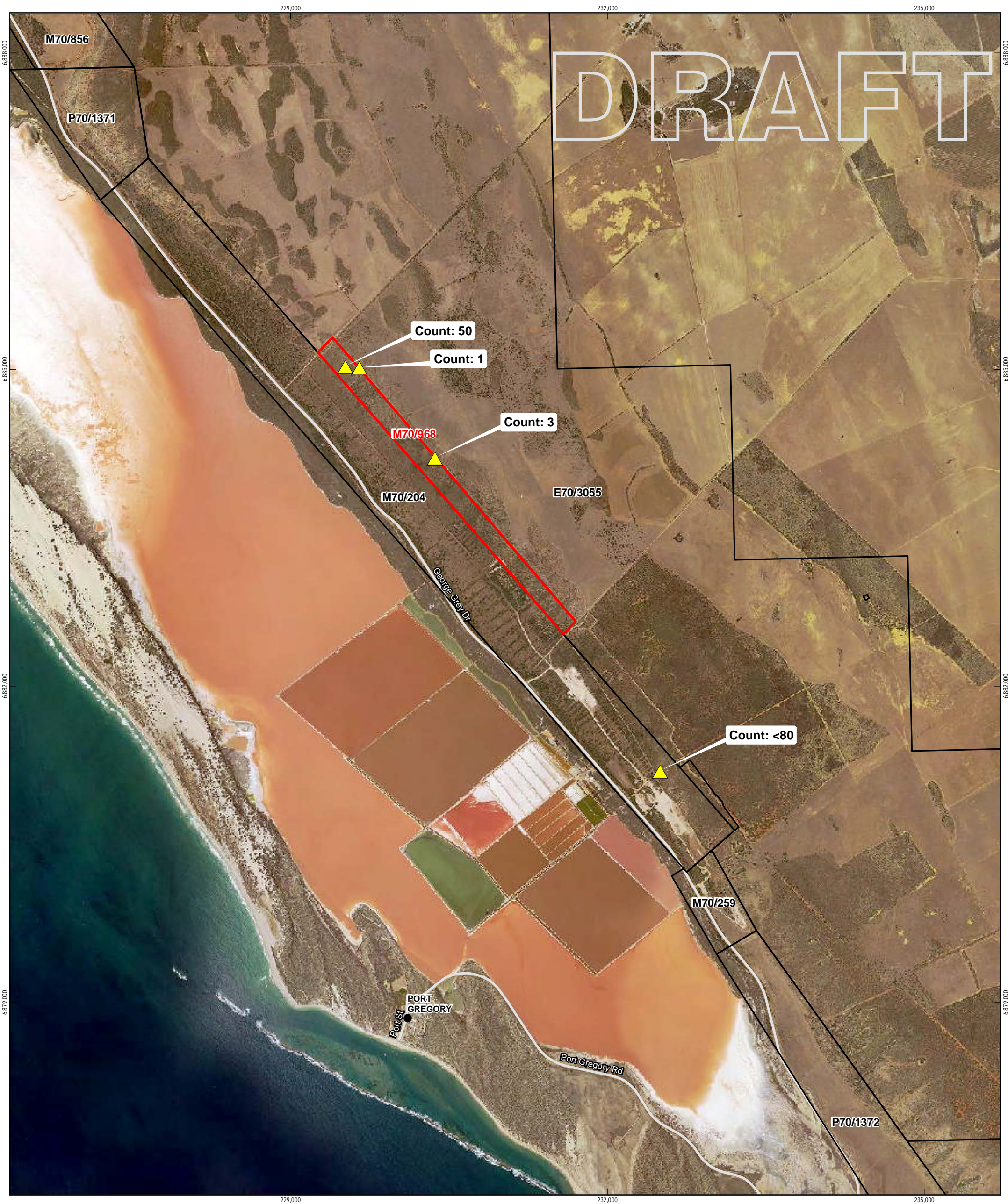


GMA Garnet
Targeted Flora Survey 2014




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Revision	B
Date	26 Sep 2014

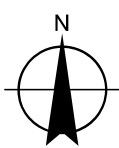
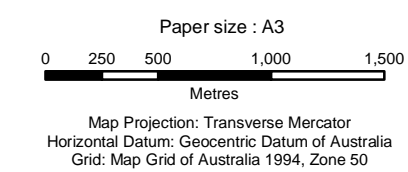
Melaleuca huttensis locations
recorded by GHD 2014

Figure 2



LEGEND

-  *Anthocercis intricata*
-  Project Area
-  Tenement Boundary



GMA Garnet
Targeted Flora Survey 2014

Job Number | 61-31102
Revision | B
Date | 26 Sep 2014

Anthocercis intricata locations
recorded by GHD 2014

Figure 3

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Attachment 2 Environmental Risk Assessment Criteria

The Australian and New Zealand Standard on Risk Management (AS/NZS 4360) defines risk as the product of the likelihood of an event occurring and consequence. The risk matrix has been developed based on the AS/NZS 4360:2004 to assess the level of risk from activities undertaken in this project. To maximise the benefit of environmental management, manpower and other resources must be allocated to issues on a priority basis. It is generally accepted that the highest risk issues receive the highest priority.

GMA implements the following mitigation strategy to help manage the risks including:

- Avoid – avoid impacts where possible
- Minimise – if impacts cannot be avoided, minimise, and manage appropriately.
- Rectify – repair, rehabilitate and restore affected areas as soon as possible.
- Reduce – reduce affected area through preservation and maintenance throughout the life of the mine.
- Offset – where negative impacts still occur, develop an offset package to achieve a net benefit.

Each risk identified was assessed against the DEMIRS environmental factors, as shown in the table below. Each factor was considered relevant throughout all phases of the project.

Objectives for Environmental Factors

Factor	Objective
Biodiversity	To maintain representation, diversity, viability and ecological function at the species, population and community level.
Water Resources	To maintain the hydrological regimes, quality and quantity of groundwater and surface water to the extent that existing and potential uses, including ecosystem maintenance, are protected.
Land and Soils	To maintain the quality of land and soils so that environmental values are protected.
Rehabilitation and Mine Closure	Mining activities are rehabilitated and closed in a manner to make them physically safe to humans and animals, geo-technically stable, geochemically non-polluting/noncontaminating, and capable of sustaining an agreed post-mining land use, and without unacceptable liability to the State.

The Baseline Environmental Data supported the identification of the potential environmental risks associated with the Project in all phases (construction, operations, mine closure/care and maintenance).

The project's potential risk pathway has been identified and the consequence and likelihood of each risk have been assessed.

Likelihood Descriptor

Descriptor	Frequency	Probability
Almost Certain	Twice or more per year	Event will occur during the Project / period under review.
		High number of known incidents.
Likely	Once per year	Event likely to occur during the Project / period under review.
		Regular incidents known
Possible	Once in 5 years	Event may occur in some instances during the Project / period under review
		Occasional incidents known.
Unlikely	Once in 10 years	Event is not likely to occur during the Project / period under review
		Some occurrences known.
Rare	Once in 20 years	Event will occur in exceptional circumstances during the Project / period under review.
		Very few or no known occurrences.

Consequence Descriptor

Factor	Insignificant	Minor	Moderate	Major	Severe
Biodiversity	Alteration or disturbance to an isolated area with no effect on habitat or ecosystem. Loss of an individual plant / animal of conservation significance.	Alteration or disturbance to <10% of a habitat or ecosystem resulting in a recoverable impact within 2 years. Loss of multiple plants / animals of conservation significance.	Alteration or disturbance to 10- 40% of a habitat or ecosystem resulting in a recoverable impact within 2-5 years. Loss of <50% known local population of plant / animal of conservation significance.	Alteration or disturbance to 40-70% of a habitat or ecosystem resulting in a recoverable impact within 5-15 years. Loss of >50% known local population of plant / animal species with possible loss of entire local population.	Alteration or disturbance to >70% of a habitat or ecosystem resulting in a recoverable impact >15 years. Local loss of conservation significant or listed species. Extinction of a species.
Water Resources	Negligible change to hydrological processes, water availability or water Quality	Short-term modification of hydrological processes, water availability and quality within project tenure, but no change in beneficial use.	Medium-term modification of hydrological processes, water availability and water quality within project tenure, but no change in beneficial use. Short-term modification of hydrological processes, water availability and	Long-term modification of hydrological processes, water availability and water quality within project tenure, but no change in beneficial use. Medium-term modification of hydrological processes, water availability and	Long-term or permanent modification of hydrological processes, water availability or water quality outside project tenure, with impacts to a water-dependent environmental value and/or change in beneficial use.

Factor	Insignificant	Minor	Moderate	Major	Severe
			water quality outside project tenure, but no change in beneficial use.	water quality outside project tenure, with change in beneficial use.	
Land and Soils	Clean-up by site personnel, rectified immediately. Confined to immediate area around source.	Clean-up by site personnel, remediation within 1 year. Confined to operational area.	Clean-up by site personnel, remediation within 1-3 years. Minor impact outside disturbance envelope or minor impact to soil stockpiles.	Clean-up requiring external specialist, remediation within 3-10 years. Impact has migrated outside the disturbance envelope or contamination of soil stockpiles.	Clean-up requiring external specialist. Remediation >10 years, or permanent residual impact. Impact outside the tenement boundary.
Rehabilitation and Mine Closure	Site is safe, stable a non-polluting. Post mining land use is not adversely affected.	Site is safe, all major landforms are stable, and any stability or pollution issues are contained and require no residual management. Post mining land use is not adversely affected	Site is safe, and any stability or pollution issues require minor, ongoing maintenance by end land-user. Post mining land use cannot proceed without some management.	Site cannot be considered safe, stable or non-polluting without long-term management or intervention. Post mining land use cannot proceed without ongoing management.	Site is unsafe, unstable and/or causing pollution or contamination that will cause an ongoing residual affect. Post mining land use cannot be achieved.

Risk Matrix

	Risk Matrix	Insignificant	Minor	Moderate	Major	Severe
Likelihood	5 Almost Certain	M	H	H	E	E
	4 Likely	M	M	H	H	E
	3 Possible	L	M	M	H	H
	2 Unlikely	L	L	M	H	H
	1 Rare	L	L	L	M	M

Level of Consequence

Descriptor	Explanation
Low	Risk rating is based on subjective opinion or relevant past experience. Baseline data/information has limitations, with only general conclusions possible and further work is required.
Medium	Risk rating is based on similar conditions being observed previously. Baseline data/information has some gaps or minor further work required
High	Risk rating is based on testing, modelling or experiments. Baseline data/information is complete and analysis appropriate for level of data.

Acceptability of Risk Level (Inherit)

Risk Level	Acceptability	Treatment
Extreme	Unacceptable	Risk will not be tolerated. Modification of activity required and Mining Proposal amended.
High	May be acceptable, with specific risk treatments.	Risk may be tolerated with application of high reliability risk treatments. Environmental outcome / Closure objective required
Moderate	Acceptable, with relevant risk treatments.	Risk is tolerable with application of appropriate risk treatments. Environmental outcome / Closure objective required.
Low	Acceptable	Risk is acceptable, but still requires industry best practice environmental management.

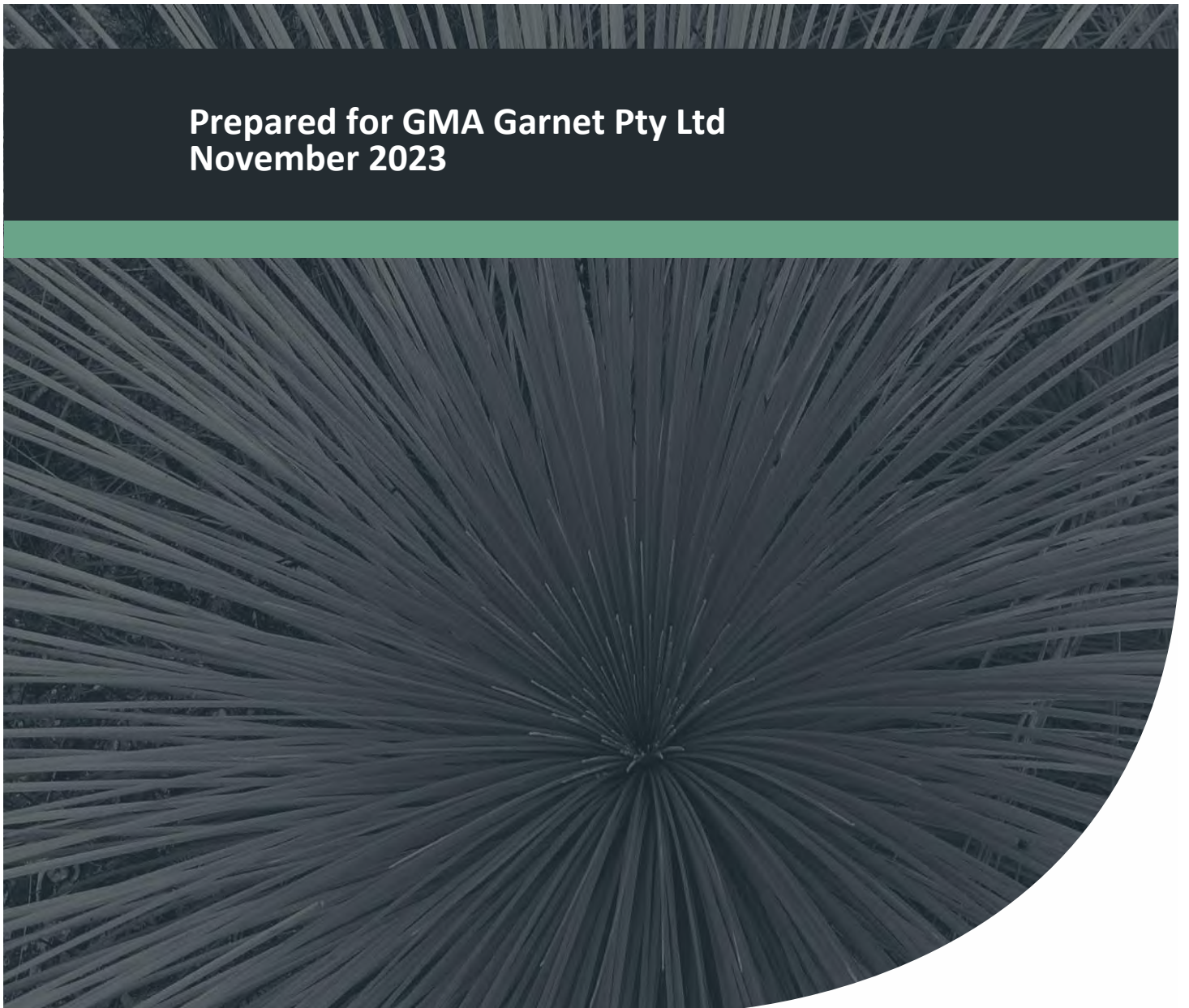
Attachment 3 Rehabilitation Monitoring 2023 Results

2023 Rehabilitation Monitoring

Lynton Mine

Project No: EP22-057(02)

**Prepared for GMA Garnet Pty Ltd
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2023 Rehabilitation Monitoring

Lynton Mine



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Executive Summary

Emerge Associates (Emerge) were engaged by GMA Garnet Pty Ltd (GMA) to undertake monitoring of rehabilitation at the Lynton Garnet Mine (Lynton Mine) in Yallabatharra (herein referred to as the 'site').

The objectives and management targets for rehabilitation at Lynton Mine are specified in the *Rehabilitation Management Plan – Port Gregory (RMP)* (GMA 2020). The key objective relevant to the rehabilitation is “to re-establish vegetation in line with practical completion and (that is) is self-sustaining” (GMA 2020). The management targets to achieve this objective are as follows:

- The practical completion criteria for native vegetation:
 - An average of 75% species diversity of adjacent reference sites, +/-5%, for five years.
 - An average of 50% plant cover in the ground and mid layers of adjacent reference sites, +/- 5%, for five years.
- The key upper storey species recorded in the vegetation type / adjacent reference site are present and likely to form an upper storey over time.

Botanists from Emerge conducted a field survey in August 2023 during which existing rehabilitation and remnant vegetation (reference) monitoring quadrats were surveyed, and new rehabilitation and reference monitoring quadrats were established. Three reference vegetation types apply to the monitoring within the site:

- *Acacia rostellifera* scrub
- mixed open heath on sandy limestone ridge
- *Melaleuca* thickets.

A total of 24 native and 13 non-native (weed) species were recorded with the rehabilitation quadrats, and 37 native and 13 weed species were recorded within the reference quadrats.

The 2023 rehabilitation monitoring indicates the following:

- The older *Acacia rostellifera* scrub rehabilitation quadrats (2010 and 2013) meet the minimum completion criteria for native species diversity.
- The newer *Acacia rostellifera* scrub rehabilitation quadrat (2021) and all of the mixed open heath on sandy limestone ridge and *Melaleuca* thickets rehabilitation quadrats are not trending towards meeting the minimum completion criteria for native species diversity.
- Rehabilitation is generally not trending towards meeting the completion criteria for the middle and ground cover stratum percentage cover completion criteria across all three vegetation types.
- The percentage cover is trending towards meeting the completion criteria for the 2021 *Acacia rostellifera* scrub rehabilitation (middle stratum), the 2018 and 2022 mixed open heath on sandy limestone ridge rehabilitation (middle stratum), the 2022 *Melaleuca* thickets rehabilitation (middle stratum) and the 2021 *Melaleuca* thickets rehabilitation (groundcover stratum).
- Older *Acacia rostellifera* scrub rehabilitation quadrats contain key upper stratum species, whilst newer *Acacia rostellifera* scrub (2021) and mixed open heath on sandy limestone ridge

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rehabilitation quadrats (2018, 2021 and 2022) all contain the key upper stratum species as juveniles.

- The *Melaleuca* thickets rehabilitation quadrats do not contain the key upper stratum species and are therefore not meeting the requirements of the RMP.

The 2010 and 2013 *Acacia rostellifera* scrub rehabilitation areas, which are more than five years old, are meeting species diversity criteria but have not achieved, middle and ground stratum cover criteria. Generally, more recently rehabilitated areas are yet to developed to the point that either species diversity or cover targets are correspondingly met.

The rehabilitation areas need to have been established for at least five years before they can be considered to have met the targets specified in the RMP. Hence it is really too early to expect that most of the rehabilitation areas would have matured sufficiently to achieve all criteria and targets. Future monitoring will assist in determining whether the rehabilitation is on track to meet the completion criteria outlined in the RMP.

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Figure 1: Site Location

Figure 2: Quadrat Locations

Appendices

Appendix A

Species List

Appendix B

Quadrat Data

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Abbreviation Tables

Table A1: Abbreviations – Organisations

Organisations	
EPA	Environmental Protection Authority
GMA	GMA Garnet Pty Ltd

Table A2: Abbreviations – General terms

General terms	
IBRA	Interim Biogeographic Regionalisation of Australia
RMP	Rehabilitation management plan
WoNS	Weeds of National Significance

Table A3: Abbreviations – Legislation

Legislation	
BAM Act	<i>Biosecurity and Agriculture Management Act 2007</i>

Table A4: Abbreviations – Units of measurement

Units of measurement	
ha	Hectare
km	Kilometre
Mm	Millimetre

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1 Introduction

1.1 Project background

Emerge Associates (Emerge) were engaged by GMA Garnet Pty Ltd (GMA) to undertake monitoring of rehabilitation works at the Lynton Garnet Mine (Lynton Mine) in Yallabatharra.

Lynton Mine is located on mining tenements M70/204, M70/259, M70/968 and M70/1331, with the majority of the rehabilitation monitoring activities associated with this scope of works contained within the M70/204 and M70/968 lease area. A single reference monitoring site is located within M70/1380. The mining leases where monitoring occurred are herein referred to as the 'site'. The site is located approximately 86 kilometres (km) north-west of Geraldton within the Shire of Northampton.

The site is approximately 2033 hectares (ha) in size and is bounded by rural landholdings to the north, east and south, and George Grey Drive to the east. The location and extent of the site is shown in **Figure 1**.

1.2 Purpose and scope of work

The scope of work was specifically to undertake an assessment of rehabilitation works within the site, comprising:

- monitoring eight existing permanent quadrats within remnant vegetation areas (LQ04, LQ05, LQ07, LQ08, LQ09, LQ17, LQ18 and LQ19).
- monitoring ten existing permanent quadrats within rehabilitation areas (LQ01, LQ02, LQ03, LQ06, LQ10, LQ11, LQ12, LQ13, LQ14 and LQ20).
- re-establishing two quadrats within the rehabilitation area (LQ15) and remnant vegetation (LQ16)
- establishing and monitoring two quadrats (LQ21 and LQ22) within rehabilitation areas.

As part of this scope of work, the following tasks were undertaken:

- Desktop review of relevant background information pertaining to the site and surrounds, including a review of previous monitoring.
- A field survey to record a comprehensive list of flora species and assess vegetation type and condition in quadrats, consistent with previous monitoring. Where relevant, the monitoring was undertaken in accordance with the Environmental Protection Authority's (EPA's) technical guidance (EPA 2016).
- Documentation of the methodology, field survey and results into a report.

1.3 Previous monitoring

Rehabilitation monitoring has previously been undertaken by GHD at Lynton Mine within quadrats LQ13, LQ14, LQ17 and LQ18 (M70/968) and LQ07, LQ08, LQ09, LQ10, LQ11 and LQ12 (M70/204) (GHD 2019a, b). Rehabilitation monitoring has previously been undertaken by Emerge Associates

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within quadrats LQ01, LQ02, LQ03, LQ04, LQ05, LQ06, LQ19 and LQ20 (Emerge Associates 2022). LQ15 and LQ16 had previously been monitored by GHD but have since been impacted and required re-establishment in 2023.

1.4 Rehabilitation objectives

Rehabilitation within the site is guided by the *Rehabilitation Management Plan – Port Gregory* (RMP) which provides objectives and management targets for the Lynton Mine and adjacent Hose Mine (GMA 2020). The extent of the rehabilitation areas within the site are shown in **Figure 2**.

The key objective relevant to the monitoring is “to re-establish vegetation in line with practical completion and is self-sustaining” (GMA 2020). The management targets to achieve this objective are as follows:

- The practical completion criteria for native vegetation:
 - An average of 75% species diversity of adjacent reference sites, +/-5%, for five years.
 - An average of 50% plant cover in the ground and mid layers of adjacent reference sites, +/- 5%, for five years.
- The key upper storey species recorded in the vegetation type / adjacent reference site are present and likely to form an upper storey over time.

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2 Environmental Context

2.1 Climate

Climate influences the types of vegetation that grow in a region and the life cycles of the flora present. It is therefore critical for rehabilitation monitoring to respond appropriately to climatic conditions to ensure that surveys are conducted during times when flora species are easiest to detect and identify.

The site lies within the Geraldton Sandplains *Interim Biogeographic Regionalisation for Australia* (IBRA) region and within the Geraldton Hills subregion (Environment Australia 2000). The Geraldton Hills subregion experiences a semi-arid (dry) warm Mediterranean climate which is characterised by hot, dry summers and mild, wet winters (DEC 2002).

An average of 336 millimetres (mm) of rainfall is recorded annually from the Kalbarri weather station (no. 8251), which is the closest weather station to the site that records both temperature and rainfall. The Kalbarri weather station is located approximately 48 km north of the site. The majority of the rainfall is received between the months of May to July. Mean minimum temperatures at the Kalbarri weather station range from 9.7°C in July to 20.7°C in February, while mean maximum temperatures range from 21.9°C in July to 34.0°C in February (BoM 2023).

Kalbarri received 72.3 mm of rain in the three months (May to July) prior to monitoring, which is less than the long-term average of 197.7 mm over the same period. The amount of rainfall recorded prior to the survey is less than the mean and may have the potential to impact the flowering and emergence of native flora.

2.2 Vegetation

The RMP identified three vegetation types within the rehabilitation areas prior to clearing, as detailed in **Table 1** below. The reference and rehabilitation monitoring quadrats that occur within each vegetation type have been specified below.

Table 1: Vegetation types within the site (GMA 2020)

Vegetation	Description	Quadrat
<i>Acacia rostellifera</i> scrub	High shrubland to open scrub of <i>Acacia rostellifera</i> over shrubland of <i>Rhagodia latifolia</i> , <i>Stylobasium spathulatum</i> , <i>Olearia</i> sp. Kennedy Range over low shrubs of <i>Tetragonia implexicoma</i> over grasses of <i>*Ehrharta longiflora</i> , <i>*Avena barbata</i> , <i>Austrostipa</i> spp., over mixed herbs of <i>*Lysimachia arvensis</i> , <i>Erodium</i> sp. over with scattered climbers of <i>*Cuscuta</i> sp., <i>Dioscorea hastifolia</i> , <i>Commicarpus australis</i> .	LQ06, LQ07, LQ08, LQ09, LQ10, LQ11, LQ12, LQ19, LQ20
Mixed open heath on sandy limestone ridge	Low open heath to low heath of <i>Melaleuca cardiophylla</i> , <i>Diplopeltis petiolaris</i> , <i>Bossiaea spinescens</i> , <i>Pimelea angustifolia</i> , <i>Opercularia vaginata</i> , over scattered grasses of <i>*Avena barbata</i> , <i>Austrostipa</i> spp., over mixed herbs of <i>*Sisymbrium irio</i> , <i>Roepera billardiarei</i> with scattered climbers of <i>Dioscorea hastifolia</i> , with open rushes of <i>Desmodcladus asper</i> .	LQ01, LQ03, LQ05, LQ13, LQ17, LQ18, LQ21

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Table 1: Vegetation types within the site (GMA 2020) (continued)

Complex	Description	Quadrat
<i>Melaleuca</i> thickets	Closed scrub of <i>Melaleuca cardiophylla</i> with mallee of <i>Eucalyptus</i> spp. over low shrubs of <i>Rhagodia latifolia</i> , <i>Lasiopetalum angustifolium</i> with scattered climbers of <i>Aphanopetalum clematideum</i> , <i>Dioscorea hastifolia</i> .	LQ02, LQ4, LQ14, LQ15, LQ16, LQ22

2.3 Weeds and pests

Flora that are regarded as having negative environmental or economic impacts are often referred to as weeds (DBCA 2023). Many non-native flora species and some native species are considered to be weeds. The likelihood of weeds occurring is higher in disturbed areas, especially areas that have been set aside for mining activities.

Particularly detrimental weed species may be listed as a 'declared pest' pursuant to the State *Biosecurity and Agriculture Management Act 2007* (BAM Act) or as a 'weed of national significance' (WoNS) (DAWE 2021).

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3 Methods

3.1 Field survey

Two botanists from Emerge undertook the rehabilitation monitoring within the site between 16 - 18 August 2023. Existing reference monitoring and rehabilitation monitoring quadrats were re-scored. Two new rehabilitation monitoring quadrats were established and two rehabilitation (LQ15) and reference (LQ16) quadrats were re-established that had previously been lost or damaged.

Plant specimens collected during the field survey were dried, pressed and named in accordance with requirements of the Western Australian Herbarium (2023). Identification of specimens occurred through comparison with named material and through the use of taxonomic keys. Flora species not native to Western Australia are denoted by an asterisk ('*') in text and raw data.

3.2 Sampling

Rehabilitation monitoring comprised the use of permanent 10 x 10 m quadrats. Where required to be established, each quadrat was marked with fence droppers bound by measuring tape and the four corners were located using a hand-held GPS receiver.

With each monitoring quadrat the following data was recorded:

- Site details (personnel/recorder, date, quadrat dimensions, GPS coordinates of all corners and photographs from each corner of the quadrat).
- Rehabilitation year and works.
- Environmental information (slope, drainage, bare-ground, rock outcropping, soil type and colour class, litter layer, topographical position, time since last fire event).
- biological information (vegetation structure and condition, 'foliage projective cover' (FPC), degree of disturbance and species present, including density of weeds and declared pests).

The quadrats sampled are detailed below in **Table 2**:

Table 2: Quadrat type, rehabilitation year and vegetation type

Rehabilitation year	Quadrat number	Quadrat type	Vegetation type	Quadrat status 2023
N/A	LQ04	Reference	<i>Melaleuca</i> thickets	Monitored
	LQ05	Reference	Mixed open heath on sandy limestone ridge	Monitored
	LQ07	Reference	<i>Acacia rostellifera</i> scrub	Monitored
	LQ08	Reference	<i>Acacia rostellifera</i> scrub	Monitored
	LQ09	Reference	<i>Acacia rostellifera</i> scrub	Monitored
	LQ16	Reference	<i>Melaleuca</i> thickets	Re-established
	LQ17	Reference	Mixed open heath on sandy limestone ridge	Monitored
	LQ18	Reference	Mixed open heath on sandy limestone ridge	Monitored
	LQ19	Reference	<i>Acacia rostellifera</i> scrub	Monitored

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Table 2: Quadrat type, rehabilitation year and vegetation type (continued)

Rehabilitation year	Quadrat number	Quadrat type	Vegetation type	Quadrat status 2023
2010	LQ12	Rehabilitation	<i>Acacia rostellifera</i> scrub	Monitored
	LQ20	Rehabilitation	<i>Acacia rostellifera</i> scrub	Monitored
2013	LQ10	Rehabilitation	<i>Acacia rostellifera</i> scrub	Monitored
	LQ11	Rehabilitation	<i>Acacia rostellifera</i> scrub	Monitored
2018	LQ13	Rehabilitation	Mixed open heath on sandy limestone ridge	Monitored
	LQ14	Rehabilitation	<i>Melaleuca</i> thickets	Monitored
	LQ15	Rehabilitation	<i>Melaleuca</i> thickets	Re-established
2021	LQ01	Rehabilitation	Mixed open heath on sandy limestone ridge	Monitored
	LQ02	Rehabilitation	<i>Melaleuca</i> thickets	Monitored
	LQ03	Rehabilitation	Mixed open heath on sandy limestone ridge	Monitored
	LQ06	Rehabilitation	<i>Acacia rostellifera</i> scrub	Monitored
2022	LQ21	Rehabilitation	Mixed open heath on sandy limestone ridge	Established
	LQ22	Rehabilitation	<i>Melaleuca</i> thickets	Established

3.3 Data analysis

Reference and rehabilitation quadrats were stratified by the vegetation types previously identified (refer **Section 2.2**):

- ‘*Acacia rostellifera* scrub’
- ‘Mixed open heath on sandy limestone ridges’
- ‘*Melaleuca* thickets’.

Vegetation stratum was classified in the RMP into three categories: upper stratum (tree), middle stratum (shrub) and lower stratum (grasses/herbs) (GMA 2020). Delineation of the three stratum is readily achievable based on observations made in the field for the majority of species present within the site. However, as there are multiple climbing and twining species that occur within the site, attribution of species into stratum has also been guided by the plant growth form descriptions provided in Florabase (Western Australian Herbarium 2023).

Alyogyne hakeifolia is referred to as a shrub on Florabase. However, based on the height and growth form observed on site, it has been attributed as an upper stratum species. Where upper stratum species were observed to be juvenile (<2 m tall), they were attributed in the middle stratum. Of the climbing and twining species, *Aphanopetalum clematideum*, *Commicarpus australis*, *Roepera apiculata*, *Roepera fruticulosa* and *Tetragonia implexicoma* have all been considered as middle stratum species as they are described as shrubs on Florabase, whilst *Clematis linearifolia*, *Convolvulus remotus*, *Dioscorea hastifolia*, *Glycine canescens* and *Thysanotus manglesianus* are all described as herbs and are therefore classified as ground stratum species. Where middle stratum species were observed to be juvenile (<0.5 m tall), they were attributed in the ground stratum.

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For species diversity and percentage cover, mean values were calculated for 2023 reference data and 2023 rehabilitation data (by vegetation type). The 2023 target mean species richness for each vegetation type was calculated from the reference data, as per the objectives (75% +/-5% for species diversity and 50% +/-5% for percentage cover). The 2023 rehabilitation data mean was compared to the target for each vegetation type, to determine whether each rehabilitation area is meeting the objective. The key upper stratum species recorded in rehabilitation quadrats was compared to those recorded in applicable reference quadrats.

As the monitoring has not been occurring for five continuous years it is not possible to assess the data against the completion criteria (refer **Section 1.4**). However, where rehabilitation is greater than one year old, the above analysis was used to assess trends and infer whether the vegetation is likely to meet the completion criteria.

3.4 Limitations

The field survey was undertaken by experienced personnel within the optimal flowering period for assessment of flora in Geraldton Sandplains (EPA 2016).

Only one quadrat was sampled for the 2021 *Acacia rostellifera* rehabilitation, 2018 and 2022 mixed open health on sandy limestone ridge rehabilitation, 2021 and 2022 *Melaleuca* thicket, which is not a large enough sample size to reliably indicate the outcomes of the rehabilitation within the site. At least two quadrats were sampled for all other ages of rehabilitation. Two samples was considered the minimum number to assess the outcomes of rehabilitation.

Assessment of quadrat data from a single point in time does not provide a basis to interpret trends within a particular rehabilitation area. However, the varying age of rehabilitation areas monitored offers some ability to interpret trends across rehabilitation areas.

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4 Results

4.1 General site conditions

The topography within the site varies between the quadrat locations. The quadrats located within the northern and southern portions of the site are located on flat ground, whilst quadrats within the central portion are located on a sloping landform.

Vegetation within the northern portion of the site appears to have been impacted by Tropical Cyclone Serjoea in 2021, with a number of fallen trees and shrubs present.

Soils across both reference and rehabilitation areas are brown sand. Litter loads were higher in the reference areas than rehabilitation areas.

4.1.1 Species inventory

A total of 54 native and 20 non-native (weed) species were recorded within the site during the field survey, representing 35 families and 59 genera. The dominant families containing native taxa were Chenopodiaceae (four native taxa) and Poaceae (five native taxa and five weed taxa). The most common genus was *Austrostipa* with four taxa.

A total of 40 native and 13 weed species were recorded with the reference quadrats, whilst 36 native and 19 weed species were recorded within the rehabilitation quadrats.

A species list is provided as **Appendix A**. Species presence and cover within each quadrat are provided as **Appendix B**.

4.2 Species diversity

4.2.1 *Acacia rostellifera* scrub

4.2.1.1 Reference

Comparison of the native and weed species diversity from the current and previous monitoring events for the *Acacia rostellifera* scrub reference quadrats is provided in **Table 3**.

Table 3: *Acacia rostellifera* scrub reference quadrats species diversity

Quadrat	No. native taxa			No. weed taxa		
	2019 [^]	2022 [#]	2023	2019 [^]	2022 [#]	2023
LQ07	8	7	7	4	7	5
LQ08	7	8	10	7	6	7
LQ09	5	5	6	2	4	6
LQ19	-	17	19	-	6	8
Average	7	9	11	4	6	7

[^]GHD (2019a), [#]Emerge Associates (2022)

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4.2.1.2 Rehabilitation

Comparison of the native and weed species diversity from the current and previous monitoring events for the *Acacia rostellifera* scrub rehabilitation quadrats is provided in **Table 4**.

Table 4: *Acacia rostellifera* scrub rehabilitation quadrats species diversity

Quadrat and rehabilitation year	No. native taxa			No. weed taxa		
	2019 [^]	2022 [#]	2023	2019 [^]	2022 [#]	2023
LQ06 (2021)	-	7	7	-	7	7
LQ12 (2010)	8	8	9	3	6	7
LQ20 (2010)	-	5	9	-	4	6
Average (2010)	8	7	9	3	5	7
LQ10 (2013)	3	8	10	2	7	9
LQ11 (2013)	3	7	9	3	5	9
Average (2013)	3	8	10	3	6	9

[^]GHD (2019a), [#]Emerge Associates (2022)

Species diversity from *Acacia rostellifera* scrub rehabilitation areas is compared against the completion criteria derived from the reference quadrats in **Plate 1**.

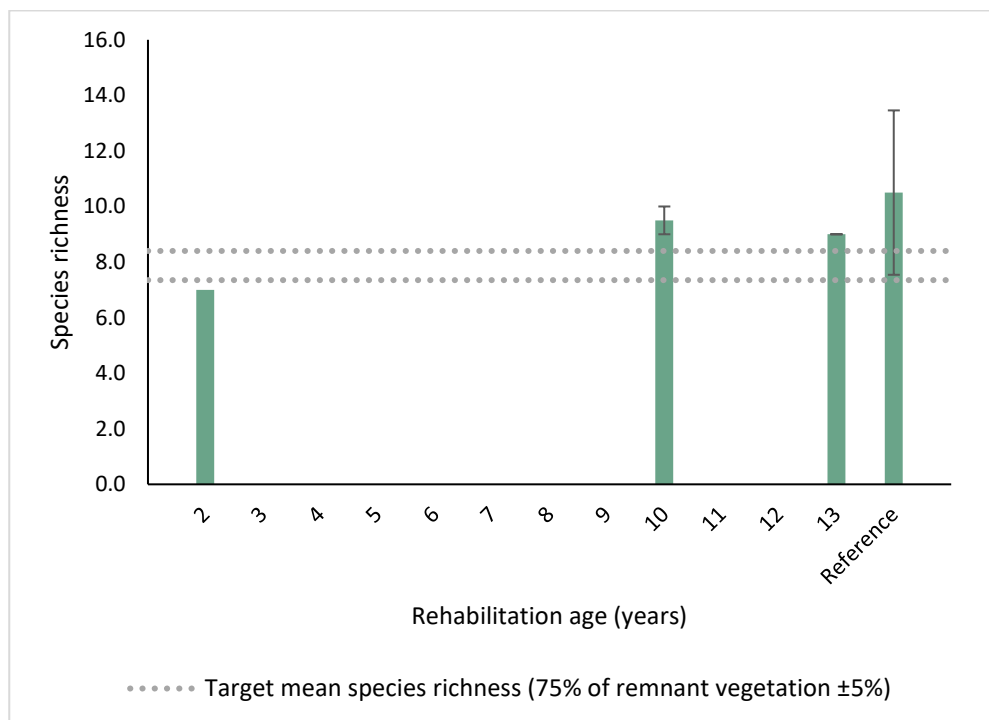


Plate 1: Mean species richness (\pm standard errors) for 2023 monitoring of quadrats in *Acacia rostellifera* rehabilitation areas and reference sites presented against completion criteria (native vegetation)

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4.2.2 Mixed open heath on sandy limestone ridge

4.2.2.1 Reference

Comparison of the native and weed species diversity from the current and previous monitoring events for the mixed open heath on sandy limestone ridge reference quadrats is provided in **Table 5**.

Table 5: Mixed open heath on sandy limestone ridge reference quadrats species diversity

Quadrat	No. native taxa			No. weed taxa		
	2019 [^]	2022	2023	2019 [^]	2022	2023
LQ05	-	17	20	-	9	6
LQ17	19	23	28	2	3	4
LQ18	21	18	25	4	6	5
Average	20	19	24	3	6	5

[^]GHD (2019a), [#]Emerge Associates (2022)

4.2.2.2 Rehabilitation

Comparison of the native and weed species diversity from the current and previous monitoring events for the mixed open heath on sandy limestone ridge rehabilitation quadrats is provided below in **Table 6**.

Table 6: Mixed open heath on sandy limestone ridge rehabilitation quadrats species diversity

Quadrat and rehabilitation year	No. native taxa			No. weed taxa		
	2019 [^]	2022 [#]	2023	2019 [^]	2022 [#]	2023
LQ01 (2021)	-	7	8	-	2	6
LQ03 (2021)	-	5	6	-	5	8
Average (2021)	-	6	7	-	4	7
LQ13 (2018)	2	6	5	5	7	7
LQ21 (2022)	-	-	9	-	-	5

[^]GHD (2019a), [#]Emerge Associates (2022)

Species diversity of the mixed open heath on sandy limestone ridge rehabilitation areas is compared against the completion criteria derived from the reference quadrats in **Plate 2**.

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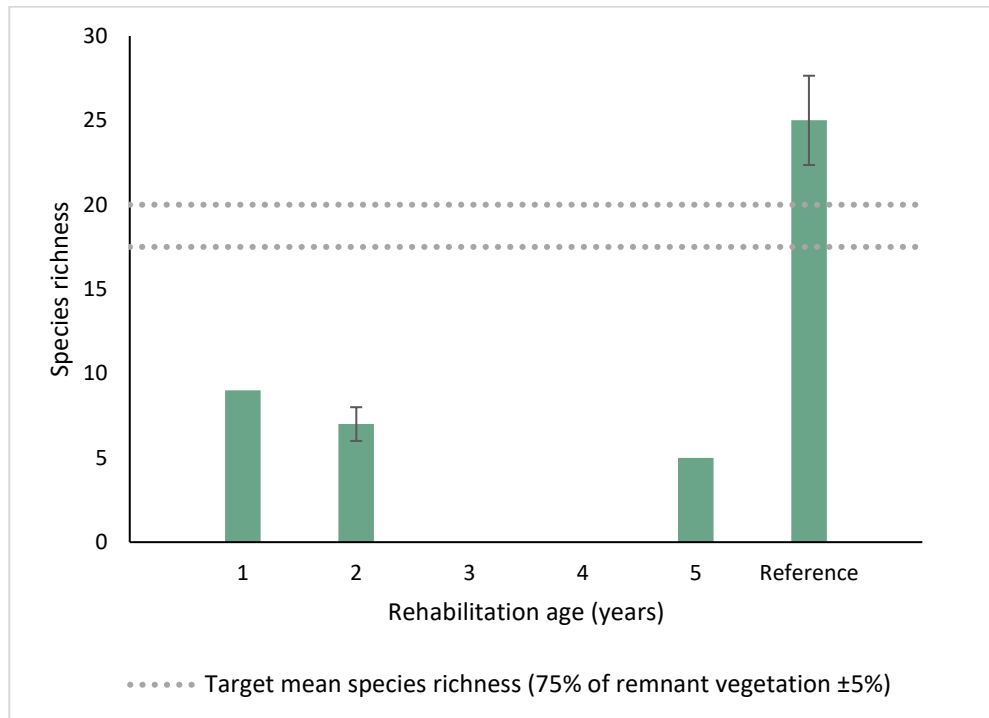


Plate 2: Mean species richness (\pm standard errors) for 2023 monitoring of quadrats in mixed open heath on sandy limestone ridge rehabilitation areas and reference sites presented against completion criteria (native vegetation)

4.2.3 Melaleuca thickets

4.2.3.1 Reference

Comparison of the native and weed species diversity from the current and previous monitoring events for the *Melaleuca* thickets reference quadrats is provided below in **Table 7**.

Table 7: *Melaleuca* thickets reference quadrat species diversity

Quadrat	No. native taxa		No. weed taxa	
	2022 [#]	2023	2022 [#]	2023
LQ04	14	18	5	5
LQ16	-	18	-	5
Average	14	18	5	5

[#]Emerge Associates (2022)

4.2.3.2 Rehabilitation

Comparison of the native and weed species diversity from the current and previous monitoring events for the *Melaleuca* thickets rehabilitation quadrats is provided below in **Table 8**. LQ15 had previously been monitored in 2019 and 2022 but was impacted during works on site between the 2022 and 2023 monitoring periods. LQ15 was therefore re-established from 2023 and the previous data has been removed from this monitoring report.

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Table 8: *Melaleuca* thickets rehabilitation quadrats species diversity

Quadrat and rehabilitation year	No. native taxa			No. weed taxa		
	2019 [^]	2022 [#]	2023	2019 [^]	2022 [#]	2023
LQ14 (2018)	2	4	6	6	7	7
LQ15 (2018)	-	-	4	-	-	10
Average (2018)	2	3	5	6	8	9
LQ02 (2021)	-	4	11	-	5	12
LQ22 (2022)	-	-	12	-	-	10

[^]GHD (2019a), [#]Emerge Associates (2022)

Species diversity from the *Melaleuca* thickets rehabilitation areas is compared against the completion criteria derived from the reference quadrats in **Plate 3**.

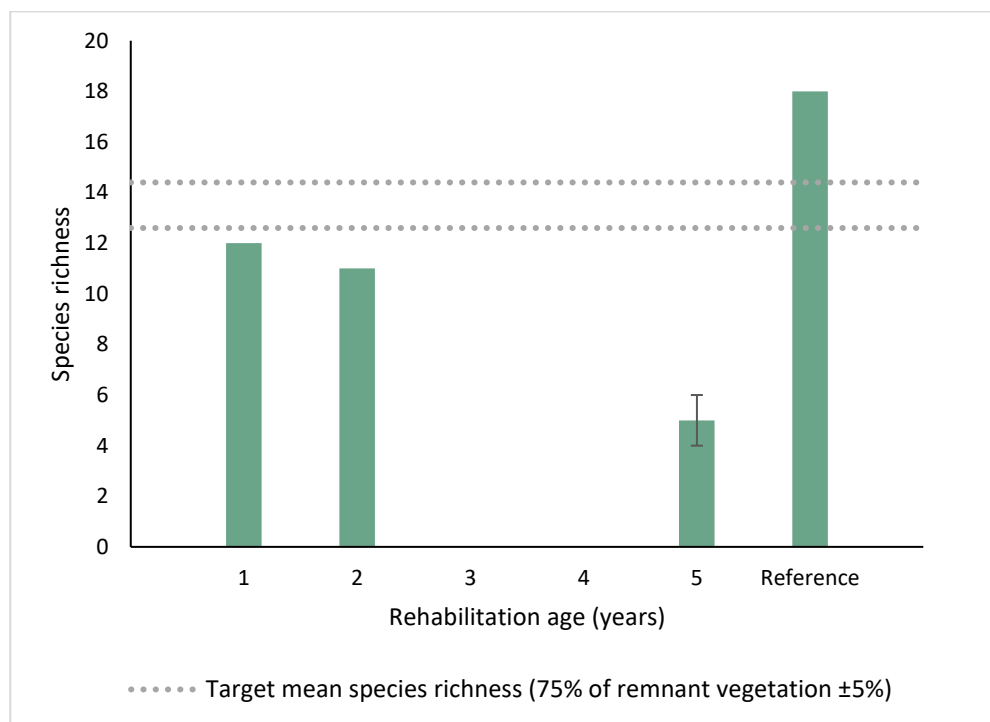


Plate 3: Mean species richness (\pm standard errors) for 2023 monitoring of quadrats in *Melaleuca* thicket rehabilitation areas and reference sites presented against completion criteria (native vegetation)

4.3 Percentage cover

4.3.1 *Acacia rostellifera* scrub

4.3.1.1 Reference

Comparison of the stratum cover from the current and previous monitoring events for the *Acacia rostellifera* scrub reference quadrats is provided in **Table 9**.

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Table 9: *Acacia rostellifera* reference quadrats percentage cover of native flora

Quadrat	Upper stratum			Middle stratum			Ground stratum		
	2019 [^]	2022 [#]	2023	2019 [^]	2022 [#]	2023	2019 [^]	2022 [#]	2023
LQ07	70%	2%	20%	41%	1%	32%	2%	15%	0.2%
LQ08	20%	10%	0%	29%	27%	49%	2%	10%	6%
LQ09	0%	0%	5%	65%	24%	28%	0%	28%	15%
LQ19	-	35%	47%	-	17%	19%	-	8%	5%
Average	45%	12%	18%	23%	17%	32%	2%	15%	6%

[^]GHD (2019a), [#]Emerge Associates (2022)

4.3.1.2 Rehabilitation

Comparison of the stratum cover from the current and previous monitoring events for the *Acacia rostellifera* scrub rehabilitation quadrats is provided in **Table 10**.

Table 10: *Acacia rostellifera* rehabilitation quadrats percentage cover of native flora

Quadrat and rehabilitation year	Upper stratum			Middle stratum			Ground stratum		
	2019 [^]	2022 [#]	2023	2019 [^]	2022 [#]	2023	2019 [^]	2022 [#]	2023
LQ06 (2021)	-	0%	0%	-	40%	50%	-	1%	0.4%
LQ12 (2010)	0%	67%	60%	76%	6%	5%	2%	0.1%	0.2%
LQ20 (2010)	-	60%	75%	-	0%	0.5%	-	0.2%	0.9%
Average (2010)	0%	64%	68%	76%	3%	3%	2%	0.2%	0.5%
LQ10 (2013)	0%	65%	65%	18%	0%	0%	2%	1%	2%
LQ11 (2013)	0%	70%	70%	54%	0%	0%	5%	5%	2%
Average (2013)	0%	68%	68%	36%	0%	0%	3.5%	3%	2%

[^]GHD (2019a), [#]Emerge Associates (2022)

Percentage cover from the *Acacia rostellifera* scrub rehabilitation areas is compared against the completion criteria derived from the reference quadrats in **Plate 4** and **Plate 5**.

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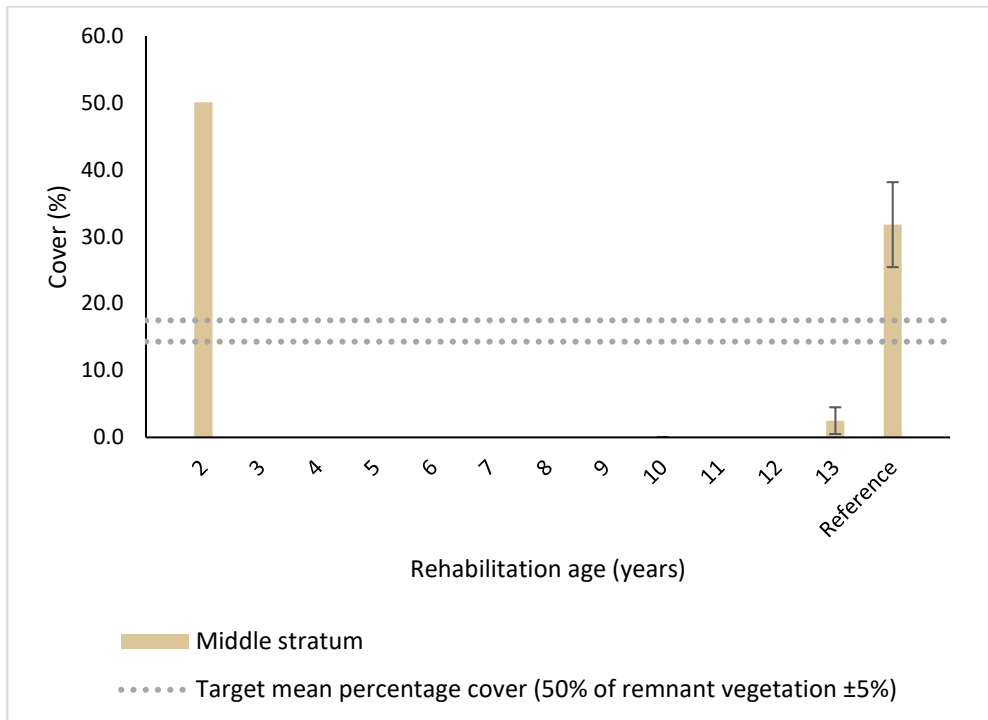


Plate 4: Mean percentage cover (\pm standard errors) for 2023 monitoring of *Acacia rostellifera* scrub quadrats in rehabilitation areas and reference sites presented against completion criteria for middle stratum (native vegetation)

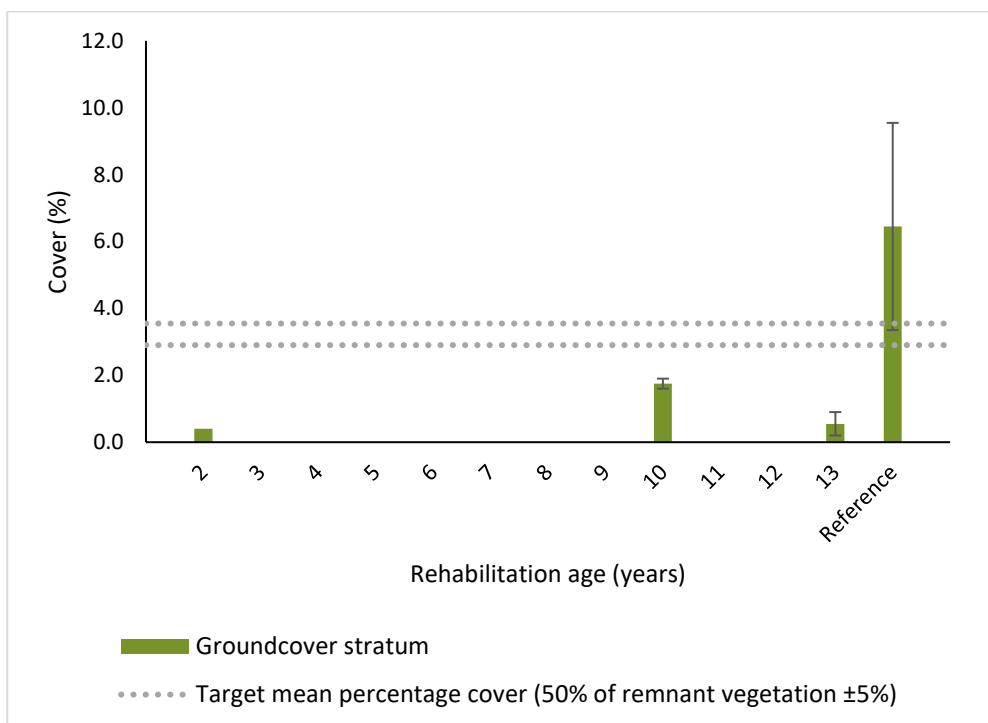


Plate 5: Mean percentage cover (\pm standard errors) for 2023 monitoring of *Acacia rostellifera* scrub quadrats in rehabilitation areas and reference sites presented against completion criteria for ground stratum (native vegetation)

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4.3.2 Mixed open heath on sandy limestone ridge

4.3.2.1 Reference

Comparison of the stratum cover from the current and previous monitoring events for the mixed open heath on sandy limestone ridge reference quadrats is provided in **Table 11**.

Table 11: Mixed open heath on sandy limestone ridge reference quadrats percentage cover of native flora

Quadrat	Upper stratum			Middle stratum			Ground stratum		
	2019 [^]	2022 [#]	2023	2019 [^]	2022 [#]	2023	2019 [^]	2022 [#]	2023
LQ05	-	7%	7%	-	18%	30%	-	12%	13%
LQ17	0%	15%	22%	87%	30%	45%	9%	31%	14%
LQ18	0%	16%	21%	83%	17%	36%	11%	20%	11%
Average	0%	13%	17%	85%	22%	37%	10%	21%	13%

[^]GHD (2019a), [#]Emerge Associates (2022)

4.3.2.2 Rehabilitation

Comparison of the stratum cover from the current and previous monitoring events for the mixed open heath reference rehabilitation quadrats is provided in **Table 12**.

Table 12: Mixed open heath on sandy limestone ridge quadrats percentage cover of native flora

Quadrat and rehabilitation year	Upper stratum			Middle stratum			Ground stratum		
	2019 [^]	2022 [#]		2019 [^]	2022 [#]		2019 [^]	2022 [#]	
LQ01 (2021)	-	0%	0%	-	4%	7%	-	1%	2%
LQ03 (2021)	-	0%	0%	-	4%	16%	-	10%	5%
Average (2021)	-	0%	0%	-	4%	11%	-	5.5%	4%
LQ13 (2018)	0%	5%	10%	1%	21%	25%	1%	1%	0.3%
LQ21 (2022)	-	-	0%	-	-	35%	-	-	2%

[^]GHD (2019a), [#]Emerge Associates (2022)

Percentage cover from the mixed open heath on sandy limestone ridge rehabilitation areas is compared against the completion criteria derived from the reference quadrats in **Plate 6** and **Plate 7**.

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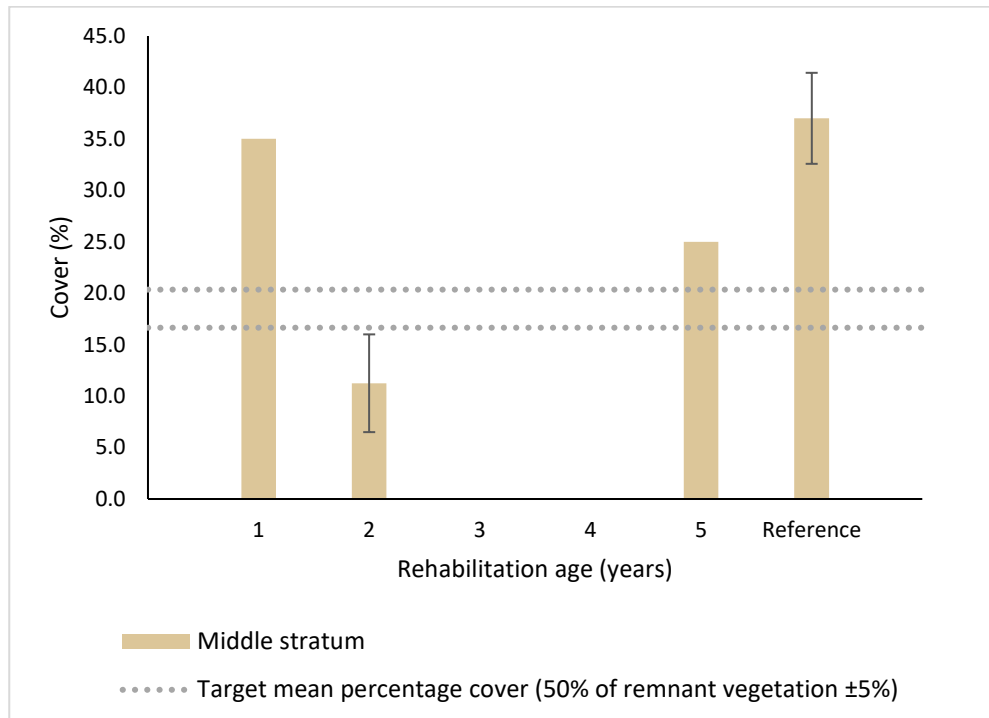


Plate 6: Mean percentage cover (\pm standard errors) for 2023 monitoring of mixed open heath on sandy limestone ridge quadrats in rehabilitation areas and reference sites presented against completion criteria for middle stratum (native vegetation)

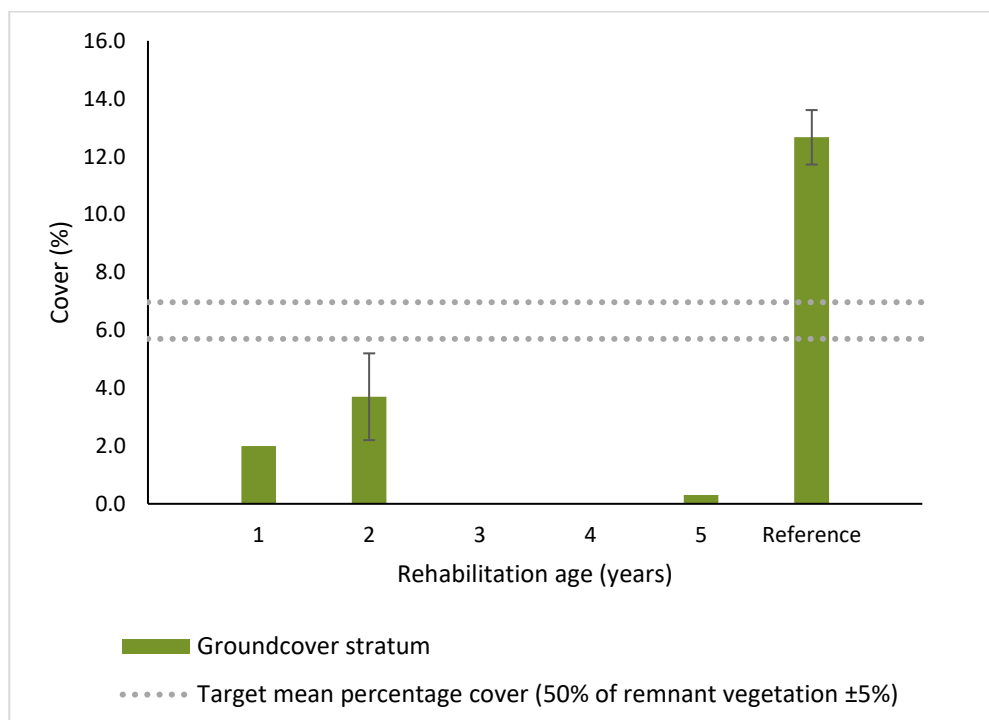


Plate 7: Mean percentage cover (\pm standard errors) for 2023 monitoring of mixed open heath on sandy limestone ridge in rehabilitation areas and reference sites presented against completion criteria for groundcover stratum (native vegetation)

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4.3.3 Melaleuca thickets

4.3.3.1 Reference

Comparison of the stratum cover from the current and previous monitoring events for the *Melaleuca* thickets reference quadrats is provided **Table 13**.

Table 13: *Melaleuca* thickets reference quadrat percentage cover of native flora

Quadrat	Upper stratum		Middle stratum		Ground stratum	
	2022 [#]	2023	2022 [#]	2023	2022 [#]	2023
LQ04	40%	7%	12%	52%	4%	13%
LQ16	-	30%	-	39%	-	12%
Average	40%	19%	12%	46%	4%	13%

[#]Emerge Associates (2022)

4.3.3.2 Rehabilitation

Comparison of the stratum cover from the current and previous monitoring events for the *Melaleuca* thickets rehabilitation quadrats is provided **Table 14**.

Table 14: *Melaleuca* thickets rehabilitation quadrats percentage cover of native flora

Quadrat and rehabilitation year	Upper stratum			Middle stratum			Ground stratum		
	2019 [^]	2022 [#]	2023	2019 [^]	2022 [#]	2023	2019 [^]	2022 [#]	2023
LQ14 (2018)	0%	25%	40%	2%	2%	1%	2%	4%	0.6%
LQ15 (2018)	0%	5%	10%	1%	5%	10%	2%	0%	0.1%
Average (2018)	0%	15%	25%	2%	4%	6%	2%	2%	0.4%
LQ02 (2021)	-	0%	0%	-	0.2%	13%	-	10%	11%
LQ22 (2022)	-	-	0%	-	-	36%	-	-	2%

[^]GHD (2019a), [#]Emerge Associates (2022)

Percentage cover from the *Melaleuca* thickets rehabilitation areas is compared against the completion criteria derived from the reference quadrats in **Plate 8** and **Plate 9**.

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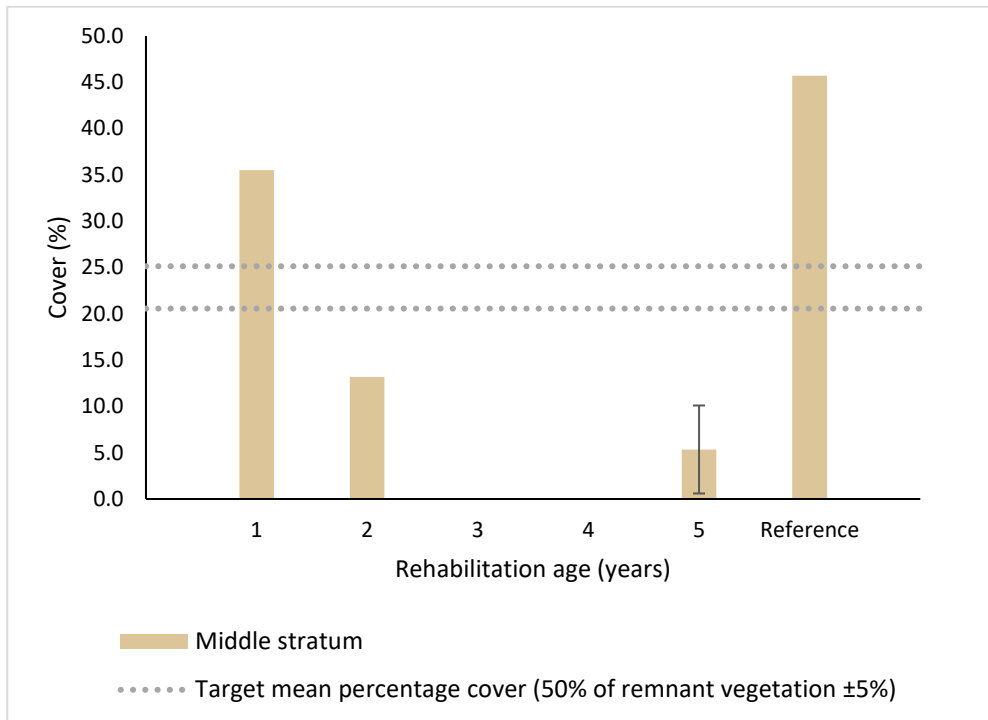


Plate 8: Mean percentage cover (\pm standard errors) for 2023 monitoring of *Melaleuca* thickets quadrats in rehabilitation areas and reference sites presented against completion criteria for middle stratum (native vegetation)

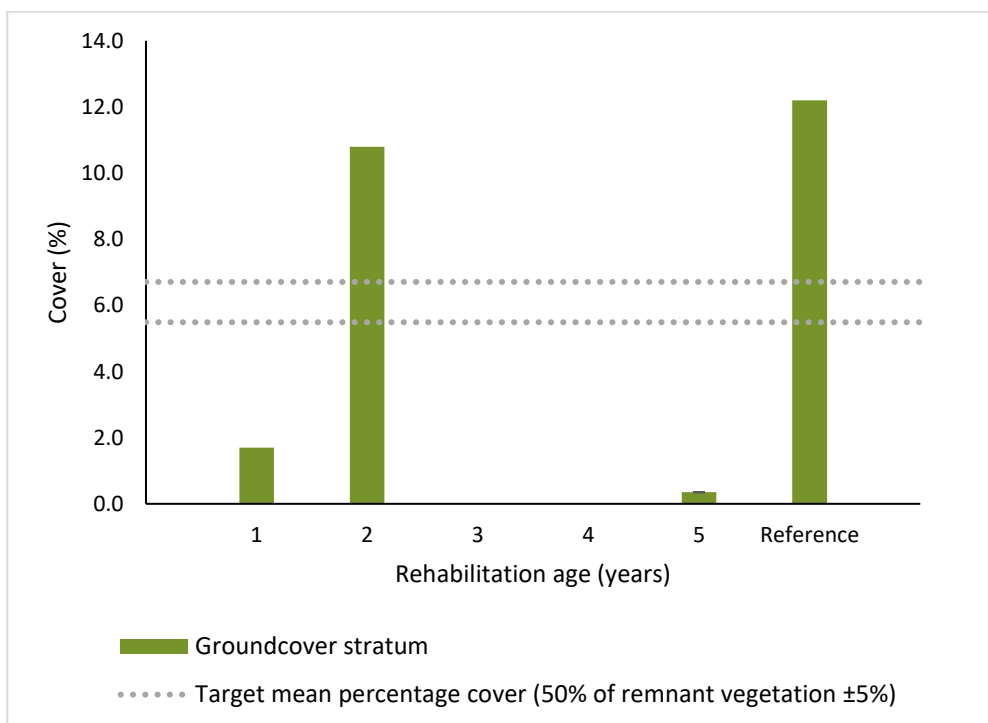


Plate 9: Mean percentage cover (\pm standard errors) for 2023 monitoring of *Melaleuca* thickets quadrats in rehabilitation areas and reference sites presented against completion criteria for ground stratum (native vegetation)

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4.4 Key upper stratum species

4.4.1 *Acacia rostellifera* scrub

4.4.1.1 Reference

The key upper stratum species recorded within the *Acacia rostellifera* scrub reference quadrats are provided in **Table 15**. Individuals of *Acacia rostellifera* within LQ08 are currently juvenile and therefore classified as ground cover stratum.

Table 15: *Acacia rostellifera* reference quadrats key upper stratum species from 2023 monitoring

Quadrat	Key upper stratum species
LQ07	<i>Acacia rostellifera</i>
LQ08	<i>Acacia rostellifera</i>
LQ09	<i>Acacia rostellifera</i>
LQ19	<i>Acacia rostellifera</i> , <i>Alyogyne hakeifolia</i> , <i>Pittosporum angustifolium</i>

4.4.1.2 Rehabilitation

The key upper stratum species recorded within the *Acacia rostellifera* scrub rehabilitation quadrats are provided in **Table 16**. Individuals of *Acacia rostellifera* and *Alyogyne hakeifolia* within LQ06 are currently juvenile and therefore classified as middle stratum.

Table 16: *Acacia rostellifera* rehabilitation quadrats key upper stratum species from 2023 monitoring

Quadrat and rehabilitation year	Key upper stratum species
LQ06 (2021)	<i>Acacia rostellifera</i> , <i>Alyogyne hakeifolia</i>
LQ12 (2010)	<i>Acacia rostellifera</i> , <i>Alyogyne hakeifolia</i> , <i>Grevillea argyrophylla</i>
LQ20 (2010)	<i>Acacia rostellifera</i> , <i>Alyogyne hakeifolia</i> , <i>Grevillea argyrophylla</i>
LQ10 (2013)	<i>Acacia rostellifera</i> , <i>Alyogyne hakeifolia</i>
LQ11 (2013)	<i>Acacia rostellifera</i> , <i>Alyogyne hakeifolia</i>

4.4.2 Mixed open heath on sandy limestone ridge

4.4.2.1 Reference

The key upper stratum species recorded within the mixed open heath on sandy limestone ridge reference quadrats are provided in **Table 17**.

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Table 17: Mixed open heath on sandy limestone ridge reference quadrats key upper stratum species from 2023 monitoring

Quadrat	Key upper stratum species
LQ05	<i>Acacia rostellifera</i> , <i>Grevillea argyrophylla</i>
LQ17	<i>Acacia rostellifera</i> , <i>Alyogyne hakeifolia</i> , <i>Grevillea argyrophylla</i> , <i>Pittosporum angustifolium</i>
LQ18	<i>Acacia rostellifera</i> , <i>Alyogyne hakeifolia</i> , <i>Pittosporum angustifolium</i>

4.4.2.2 Rehabilitation

The key upper stratum species recorded within the mixed open heath on sandy limestone ridge rehabilitation quadrats are provided in **Table 18**. Individuals of *Acacia rostellifera* and *Alyogyne hakeifolia* within LQ01, LQ03 and LQ21 are currently juvenile and therefore classified as middle stratum.

Table 18: Mixed open heath on sandy limestone ridge rehabilitation quadrats key upper stratum species from 2023 monitoring

Quadrat and rehabilitation year	Key upper stratum species
LQ01 (2021)	<i>Acacia rostellifera</i> , <i>Alyogyne hakeifolia</i>
LQ03 (2021)	<i>Acacia rostellifera</i>
LQ13 (2018)	<i>Acacia rostellifera</i>
LQ21 (2022)	<i>Acacia rostellifera</i> , <i>Alyogyne hakeifolia</i>

4.4.3 *Melaleuca* thickets

4.4.3.1 Reference

The key upper stratum species recorded within the *Melaleuca* thickets reference quadrats are provided in **Table 19**.

Table 19: *Melaleuca* thickets reference quadrats key upper stratum species from 2023 monitoring

Quadrat	Key upper stratum species
LQ04	<i>Grevillea argyrophylla</i>
LQ16	<i>Eucalyptus fruticosa</i> , <i>Pittosporum angustifolium</i>

4.4.3.2 Rehabilitation

The key upper stratum species recorded within the *Melaleuca* thickets rehabilitation quadrats are provided in **Table 20**. Individuals of *Eucalyptus fruticosa* within LQ02 are currently juvenile and therefore classified as ground cover stratum.

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Table 20: *Melaleuca thickets rehabilitation quadrats key upper stratum species from 2023 monitoring*

Quadrat and rehabilitation year	Key upper stratum species
LQ14 (2018)	None
LQ15 (2018)	None
LQ02 (2021)	<i>Eucalyptus fruticosa</i>
LQ22 (2022)	None

4.5 Weeds

No declared pests or WoNS were recorded within the site.

Common weeds recorded across both rehabilitation and remnant quadrats included **Ehrharta longiflora*, **Lysimachia arvensis* and **Sonchus oleraceus*.

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5 Discussion

The rehabilitation areas need to have been established for at least five years before they can be considered to have met the targets specified in the RMP. The rehabilitation areas subject to monitoring ranges from one to 13 years old and hence it is too early to expect that most would have matured sufficiently to achieve all criteria and targets.

The vegetation within the younger rehabilitation areas is too immature to meet either species diversity or cover targets, which is not unexpected at this stage. The need for time to mature is further indicated by the lack of upper stratum cover in the 2021 and 2022 rehabilitation areas. As discussed below, several of the rehabilitation quadrats contain upper stratum species that are juveniles and currently classified as ground cover or middle stratum, but as individuals grow they will eventually be identified as upper stratum species.

Several weed species occurred within all three vegetation types across the rehabilitation quadrats consisting of three grass species, **Avena barbata*, **Ehrharta longiflora* and **Rostraria pumila* and five herb species **Lysimachia arvensis*, **Mesembryanthemum crystallinum*, **Reichardia tingitana*, **Sonchus oleraceus* and **Urospermum picroides*.

Weed cover in the rehabilitation areas was variable across the three vegetation types. Weed species and cover within rehabilitation areas was similar to that within reference sites. The completion criteria does not include reference to weeds but there was no indication that weeds are negatively impacting rehabilitation success. Observations made during the monitoring within rehabilitation areas showed evidence of weed control, which appeared to have reduced the grass cover of weeds.

This years' monitoring results provides the first or second year's data for the rehabilitation areas established in 2021 and 2022. A minimum of two years of monitoring is worthwhile to evaluate whether a rehabilitation area is on a trajectory to meet the completion criteria. Accordingly, ongoing monitoring will be crucial to provide evaluation of the progress and performance of rehabilitation areas against the practical completion criteria and targets from the RMP. Monitoring also indicates whether additional infill planting is required to assist in meeting the requirements of the RMP for areas of revegetation older than five years that are not currently meeting the completion criteria.

5.1 *Acacia rostellifera* scrub

The older *Acacia rostellifera* scrub rehabilitation areas (2010 and 2013) are currently meeting practical completion criteria for native species diversity, whilst the most recent rehabilitation area (2021) is only slightly lower than the minimum completion criteria. Whilst there is another three years until this rehabilitation can be assessed the completion criteria, the 2023 monitoring indicates that the rehabilitation is trending in the appropriate direction.

The key upper stratum species in the reference quadrats is *Acacia rostellifera*, which is present in all rehabilitation quadrats. Therefore, the rehabilitation is meeting the requirements of the RMP for the presence of key upper stratum species. In the 2010 and 2013 rehabilitation areas, the upper stratum percentage cover ranges between 60 – 75% cover, whereas in the reference quadrats the cover ranges from 0 – 47%.

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The dense cover of the upper stratum *A. rostellifera* may be reducing sunlight penetration to the middle and lower stratum, limiting the ability of mid and lower strata species present in the reference quadrats to establish in the rehabilitation quadrats, which is why the rehabilitation quadrats are not trending towards meeting the completion criteria, except for the middle stratum within the 2021 rehabilitation quadrats. However, it is likely that the cover of *A. rostellifera* within rehabilitation quadrats will reduce over time as it is known to be a coloniser species (RIRDC 2004).

5.2 Mixed open heath on sandy limestone ridge

None of the mixed open heath on sandy limestone ridge rehabilitation sites are meeting the minimum completion criteria for species diversity. Given that the reference sites for this vegetation type contain an average of 24 native species, it is likely that it will take several years for these areas of rehabilitation to appropriately mature and develop suitable habitat for the annuals recorded in the reference quadrats such as *Clematis linearifolia*, *Parietaria cardiostegia*, *Thysanotus manglesianus* and *Trachymene ceratocarpa*.

The key upper stratum species present in the reference quadrats are *Acacia rostellifera*, *Alyogyne hakeifolia*, *Grevillea argyrophylla* and *Pittosporum angustifolium*, with only *A. rostellifera* and *A. hakeifolia* recorded in all three reference quadrats. All rehabilitation quadrats contain *Acacia rostellifera*, with varied occurrences of the other upper stratum species present. Given the varied nature of the upper stratum species within the reference quadrats, since the dominant *A. rostellifera* occurs in all rehabilitation quadrats, the applicable completion criteria is considered to have been met.

5.3 *Melaleuca* thickets

None of the *Melaleuca* thickets rehabilitation sites are meeting the minimum completion criteria for native species diversity. As per the mixed open heath on sandy limestone ridge, the reference sites for *Melaleuca* thickets contained a high average number of native species (18) and it is likely that it will take several years for these areas of rehabilitation to appropriately mature and develop suitable habitat for the annual species recorded in the reference sites.

The 2022 rehabilitation area is meeting the completion criteria for the middle stratum cover, whilst the 2018 and 2021 rehabilitation is not. When measured against the completion criteria for the groundcover stratum, only the 2021 rehabilitation is meeting the completion criteria. It should be noted that only one monitoring quadrat has been established for both the 2021 and 2022 rehabilitation, and so the quadrats whilst intended to be representative of the rehabilitation area provide a limited sample of the rehabilitation efforts.

Between the two reference quadrats there were three species recorded in the upper stratum: *Eucalyptus fruticosa*, *Grevillea argyrophylla* and *Pittosporum angustifolium*, none of which occurred in both quadrats. LQ02 (2021 rehabilitation) contains one of these species (*E. fruticosa*) and is considered to meet the completion criteria. None of the other rehabilitation quadrats contain any of the key upper stratum species.

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6 Conclusion

Rehabilitation monitoring was undertaken by Emerge in August 2023.

Outcomes of the 2023 rehabilitation monitoring indicate the following:

- The older *Acacia rostellifera* scrub rehabilitation quadrats (2010 and 2013) meet the minimum completion criteria for native species diversity.
- The newer *Acacia rostellifera* scrub rehabilitation quadrat (2021) and all of the mixed open heath on sandy limestone ridge and *Melaleuca* thickets rehabilitation quadrats are not trending towards meeting the minimum completion criteria for native species diversity.
- Rehabilitation is generally not trending towards meeting the completion criteria for the middle and ground cover stratum percentage cover completion criteria across all three vegetation types.
- The percentage cover is trending towards meeting the completion criteria for the 2021 *Acacia rostellifera* scrub rehabilitation (middle stratum), the 2018 and 2022 mixed open heath on sandy limestone ridge rehabilitation (middle stratum), the 2022 *Melaleuca* thickets rehabilitation (middle stratum) and the 2021 *Melaleuca* thickets rehabilitation (groundcover stratum).
- Older *Acacia rostellifera* scrub rehabilitation quadrats contain key upper stratum species, whilst newer *Acacia rostellifera* scrub (2021) and mixed open heath on sandy limestone ridge rehabilitation quadrats (2018, 2021 and 2022) all contain the key upper stratum species as juveniles.
- The *Melaleuca* thickets rehabilitation quadrats do not contain the key upper stratum species and are therefore not meeting the requirements of the RMP.

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7 References

7.1 General references

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<<http://www.bom.gov.au/climate/data/>>.

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7.2 Online references

The online resources that have been utilised in the preparation of this report are referenced in **Section 7.1**, with access date information provided in **Table R 1**.

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Table R 1 Access dates for online references

Reference	Date accessed	Website or dataset name
BoM (2023)	6 November 2023	Climate Data Online
BoM (2022)	6 November 2023	Severe Tropical Cyclone Seroja
DAWE (2022)	6 November 2023	Weeds of National Significance (WoNS)
DBCA (2023)	15 November 2023	Florabase

Figures



Figure 1: Site Location

Figure 2: Quadrat Locations

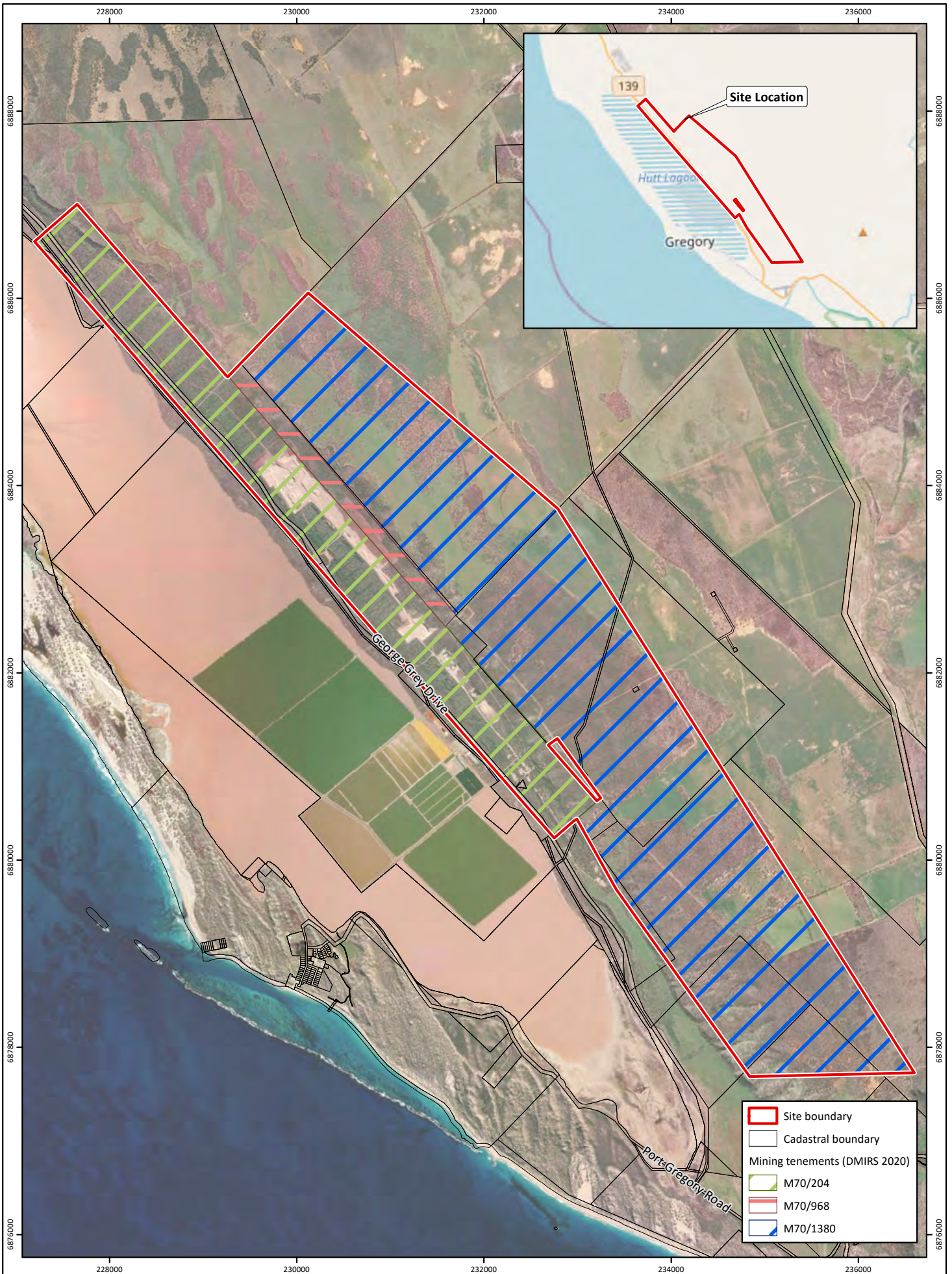


Figure 1: Site Location

Project: 2023 Rehabilitation Monitoring
Lynton Mine

Client: GMA Garnet Pty Ltd

Plan Number: EP22-057(02)--F11
Drawn: GAR
Date: 02/11/2023
Checked: SCM
Approved: RAW
Date: 17/11/2023



0 500 1,000
Metres
Scale: 1:52,500@A4
GDA 1994 MGA Zone 50



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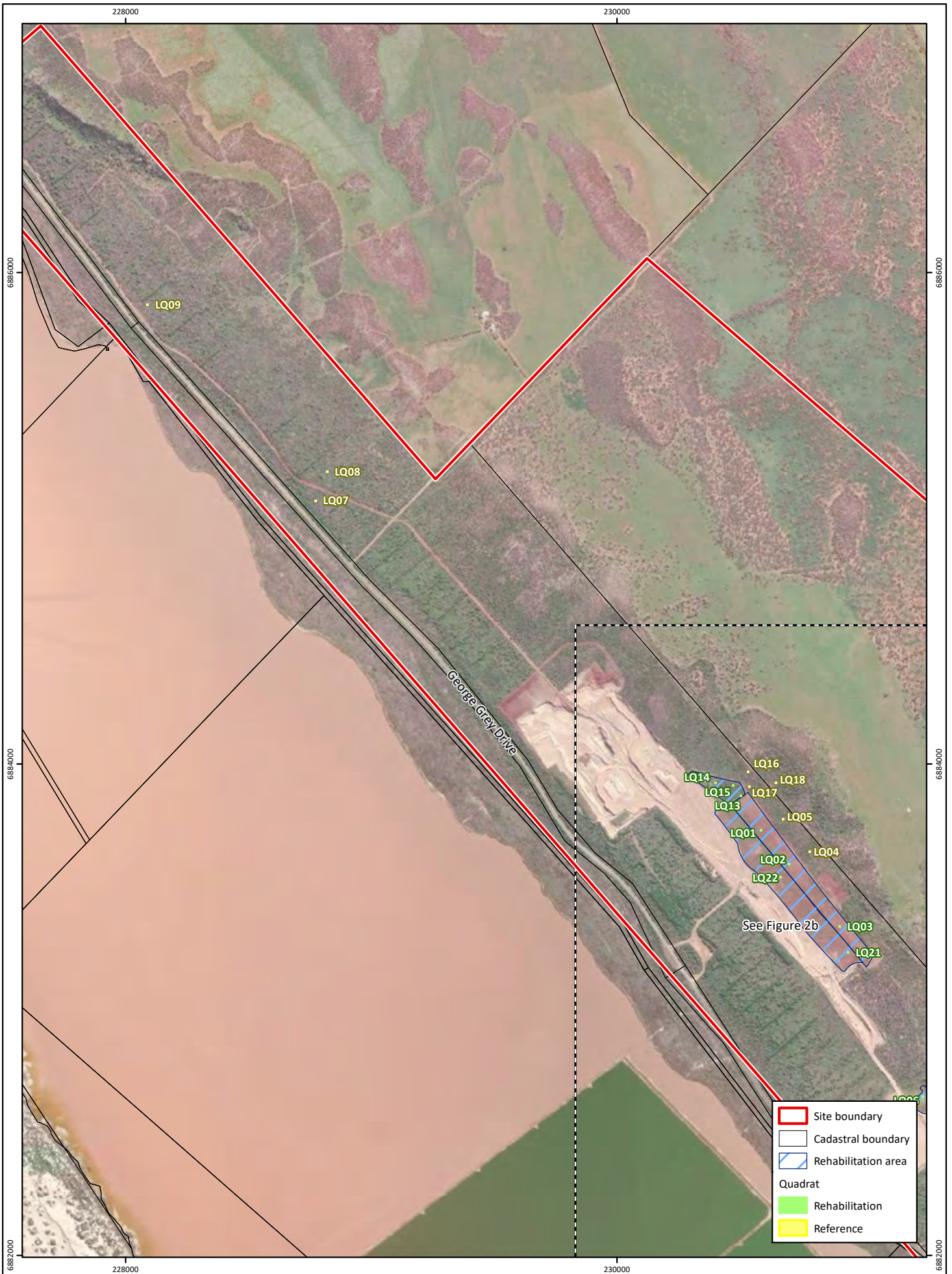
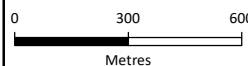


Figure 2a: Quadrat Locations

Project: 2023 Rehabilitation Monitoring
Lynton Mine
Client: GMA Garnet Pty Ltd

Plan Number: EP22-057(02)--F12
Drawn: GAR
Date: 02/11/2023
Checked: SCM
Approved: RAW
Date: 17/11/2023



Scale: 1:20,000@A4
GDA 1994 MGA Zone 50



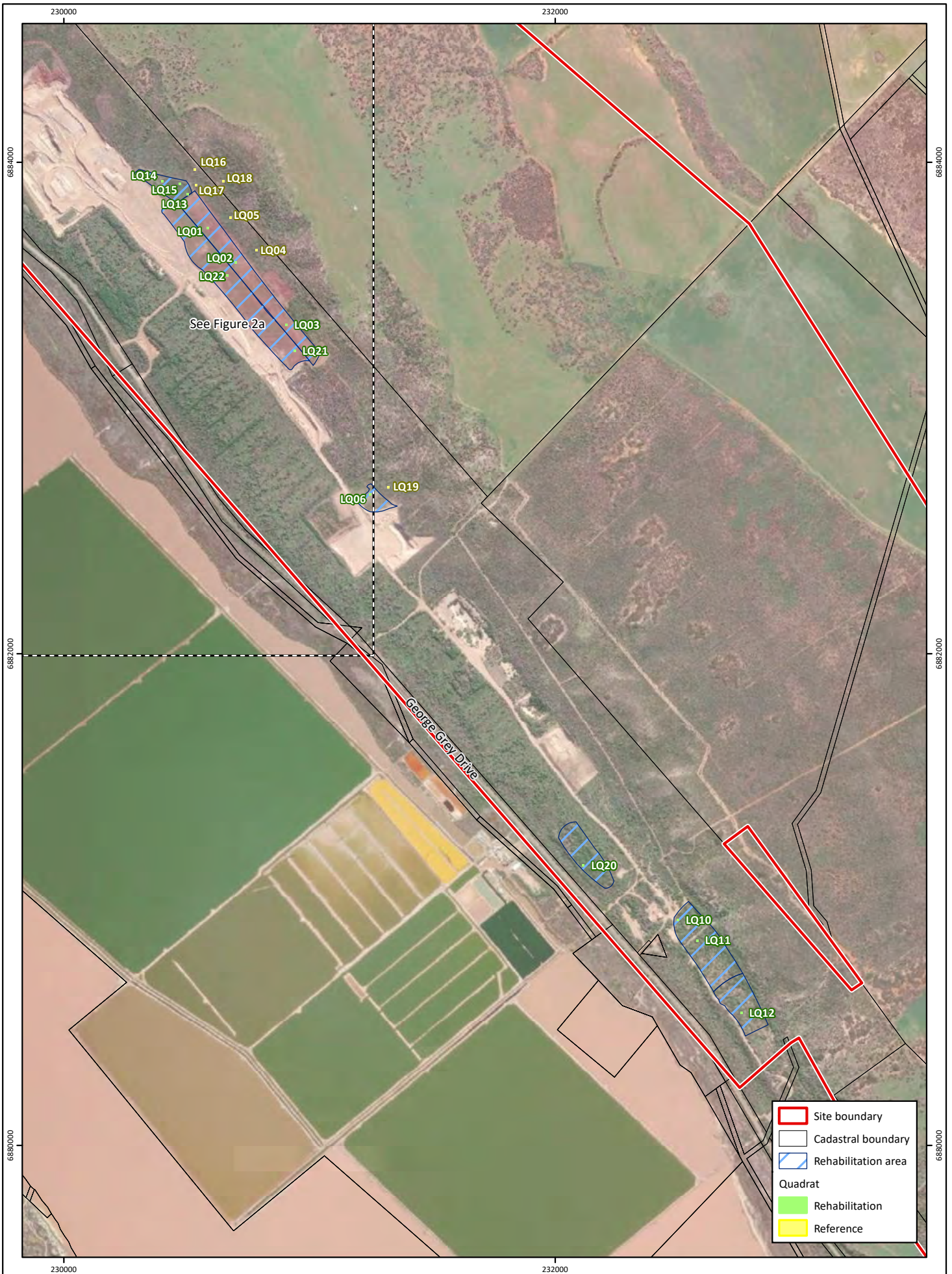


Figure 2b: Quadrat Locations

Project: 2023 Rehabilitation Monitoring
Lynton Mine
Client: GMA Garnet Pty Ltd

Plan Number: EP22-057(02)--F12
Drawn: GAR
Date: 02/11/2023
Checked: SCM
Approved: RAW
Date: 17/11/2023



0 300 600
Metres
Scale: 1:20,000@A4
GDA 1994 MGA Zone 50



Appendix A

Species List



Family	Status	Species
Aizoaceae	*	<i>Mesembryanthemum crystallinum</i> <i>Tetragonia implexicoma</i>
Amaranthaceae		<i>Ptilotus divaricatus</i> <i>Ptilotus villosiflorus</i>
Aphanopetalaceae		<i>Aphanopetalum clematideum</i>
Araliaceae		<i>Trachymene ceratocarpa</i>
Asparagaceae		<i>Acanthocarpus preissii</i> <i>Thysanotus manglesianus</i> <i>Thysanotus sp.</i>
Asteraceae	*	<i>Centaurea melitensis</i>
	*	<i>Helianthus annuus</i>
	*	<i>Hypochaeris glabra</i>
		<i>Olearia sp. Kennedy Range (G. Byrne 66)</i>
	*	<i>Reichardia tingitana</i>
		<i>Senecio pinnatifolius</i>
	*	<i>Sonchus oleraceus</i>
	*	<i>Urospermum picroides</i>
Brassicaceae	*	<i>Brassica tournefortii</i>
	*	<i>Raphanus raphanistrum</i>
	*	<i>Sisymbrium ?erysimoides</i>
Chenopodiaceae		<i>Enchylaena tomentosa</i> <i>Rhagodia latifolia subsp. latifolia</i> <i>Rhagodia preissii</i> <i>Rhagodia preissii subsp. obovata</i>
Convolvulaceae		<i>Convolvulus remotus</i>
Crassulaceae		<i>Crassula colorata</i>
Dioscoreaceae		<i>Dioscorea hastifolia</i>
Euphorbiaceae		<i>Euphorbia ?boophthona</i>
Fabaceae		<i>Acacia rostelifera</i> <i>Glycine canescens</i>
	*	<i>Lupinus cosentinii</i>
	*	<i>Melilotus indicus</i>
Geraniaceae		<i>Erodium cygnorum</i>

Family	Status	Species
Goodeniaceae		<i>Goodenia berardiana</i> <i>Scaevola crassifolia</i>
Malvaceae		<i>Alyogyne hakeifolia</i> <i>Hannafordia quadrivalvis</i>
Montiaceae		<i>Calandrinia liniflora</i> <i>Calandrinia remota</i>
Myrtaceae		<i>Eucalyptus fruticosa</i> <i>Melaleuca cardiophylla</i> <i>Melaleuca sp.</i>
Nyctaginaceae		<i>Commicarpus australis</i>
Orchidaceae		<i>Eriochilus sp.</i>
Phyllanthaceae		<i>Lysiandra calycina</i>
Pittosporaceae		<i>Pittosporum angustifolium</i>
Poaceae		<i>Austrostipa compressa</i> <i>Austrostipa elegantissima</i> <i>Austrostipa flavescens</i> <i>Austrostipa sp.</i>
	*	<i>Avena barbata</i>
	*	<i>Bromus diandrus</i>
	*	<i>Ehrharta longiflora</i>
		Poaceae sp.
	*	<i>Rostraria pumila</i>
	*	<i>Schismus barbatus</i>
Polygonaceae	*	? <i>Rumex sp.</i>
Primulaceae	*	<i>Lysimachia arvensis</i>
Proteaceae		<i>Grevillea argyrophylla</i>
Ranunculaceae		<i>Clematis linearifolia</i>
Santalaceae		<i>Anthobolus foveolatus</i>
Sapindaceae		<i>Diplopeltis petiolaris</i>
Scrophulariaceae		<i>Eremophila glabra subsp. camosa</i>
Solanaceae		<i>Anthocercis ilicifolia</i>

Family	Status	Species
	*	<i>Solanum nigrum</i>
		<i>Solanum oldfieldii</i>
Surianaceae		
		<i>Stylobasium spathulatum</i>
Thymelaeaceae		
		<i>Pimelea angustifolia</i>
		<i>Pimelea gilgiana</i>
		<i>Pimelea microcephala</i>
Urticaceae		
		<i>Parietaria cardiostegia</i>
		<i>Parietaria debilis</i>
Zygophyllaceae		
		<i>Roepera apiculata</i>
		<i>Roepera fruticulosa</i>

*=non-native

Appendix B

Quadrat Data



Sample Name:

LQ01

Project no.: EP22-057

Rehabilitation year: 2021

Date: 16/08/2023

Status Permanent

Author: SCM,ASF

LQ01: Page 1 of 2

Quadrat and landform details

Sample type: Quadrat

Size: 10 m x 10 m

Altitude (m): 62

Geographic datum/zone: GDA94/Zone 50

Soil water content: slightly damp

Landform: mid-slope

Time since fire: no evidence

Disturbance: high - rehab

Soil type/texture sand/

Bare ground (%): 80

Rocks (%) and type: 2%, limestone

Soil colour: brown/

Litter: 2% (twigs,leaves,)

Vegetation condition: completely degraded

Erosion: None

Drainage: Good

NW corner

230580 mE/6883738 mN



NE corner

230591 mE/ 6883736 mN



SW corner

230581 mE/ 6883726 mN



SE corner

230592 mE/ 6883726 mN



Sample Name:

LQ01

Project no.: EP22-057

Date: 16/08/2023

Status Permanent

Author: SCM,ASF

LQ01: Page 2 of 2

Species Data

* denotes non-native species

Cover (%)	Confirmed name	Height (cm)	Stratum
5	<i>Acacia rostellifera</i>	190	Upper
0.5	<i>Alyogyne hakeifolia</i>	105	Middle
0.1	* <i>Avena barbata</i>	50	Groundcover
20	* <i>Brassica tournefortii</i>	75	Groundcover
0.1	<i>Calandrinia ?liniflora</i>	prostrate	Groundcover
0.1	* <i>Ehrharta longiflora</i>	15	Groundcover
0.5	* <i>Lysimachia arvensis</i>	prostrate	Groundcover
1	<i>Melaleuca cardiophylla</i>	60	Groundcover
1	* <i>Mesembryanthemum crystallinum</i>	prostrate	Groundcover
2	<i>Ptilotus villosiflorus</i>	15	Groundcover
0.5	<i>Rhagodia preissii subsp. obovata</i>	70	Middle
0.1	* <i>Schismus barbatus</i>	prostrate	Groundcover
0.1	<i>Senecio pinnatifolius</i>	20	Groundcover
0.5	<i>Stylobasium spathulatum</i>	85	Middle

Sample Name:

LQ02

Project no.: EP22-057

Rehabilitation year: 2021

Date: 17/08/2023

Status Permanent

Author: SCM,ASF

LQ02: Page 1 of 2

Quadrat and landform details

Sample type: Quadrat

Size: 10 m x 10 m

Altitude (m): 62

Geographic datum/zone: GDA94/Zone 50

Soil water content: slightly damp

Landform: mid-slope

Time since fire: no evidence

Disturbance: high - rehab

Soil type/texture sand/

Bare ground (%): 40

Rocks (%) and type: 2%, limestone

Soil colour: brown/

Litter: 30% (twigs,branches,)

Vegetation condition: completely degraded

Erosion: None

Drainage: Good

NW corner

230695 mE/ 6883595 mN



NE corner

230705 mE/ 6883597 mN



SW corner

230704 mE/6883586 mN



SE corner

230694 mE/6883588 mN



Sample Name:

LQ02

Project no.: EP22-057

Date: 17/08/2023

Status Permanent

Author: SCM,ASF

LQ02: Page 2 of 2

Species Data

* denotes non-native species

Cover (%)	Confirmed name	Height (cm)	Stratum
10	<i>Acacia rostellifera</i>	120	Middle
1	<i>Alyogyne hakeifolia</i>	110	Middle
1	<i>Anthocercis ilicifolia</i>	120	Middle
0.1	* <i>Avena barbata</i>	30	Groundcover
15	* <i>Brassica tournefortii</i>	110	Groundcover
0.1	* <i>Bromus diandrus</i>	35	Groundcover
0.5	<i>Calandrinia ?liniflora</i>	prostrate	Groundcover
5	* <i>Ehrharta longiflora</i>	50	Groundcover
0.1	<i>Eucalyptus fruticosa</i>	55	Middle
0.1	<i>Goodenia berardiana</i>	25	Groundcover
0.5	* <i>Lysimachia arvensis</i>	prostrate	Groundcover
0.1	<i>Melaleuca cardiophylla</i>	35	Groundcover
10	* <i>Mesembryanthemum crystallinum</i>	prostrate	Groundcover
0.1	<i>Olearia sp. Kennedy Range (G. Byrr</i>	20	Groundcover
10	<i>Ptilotus villosiflorus</i>	prostrate	Groundcover
1	* <i>Raphanus raphanistrum</i>	65	Groundcover
0.1	* <i>Reichardia tingitana</i>	20	Groundcover
1	<i>Rhagodia preissii subsp. obovata</i>	70	Middle
0.5	* <i>Rostraria pumila</i>	20	Groundcover
1	*? <i>Rumex sp.</i>	prostrate	Groundcover
0.1	* <i>Schismus barbatus</i>	prostrate	Groundcover
0.1	* <i>Sonchus oleraceus</i>	20	Groundcover
0.1	<i>Stylobasium spathulatum</i>	100	Middle

Sample Name:

LQ03

Project no.: EP22-057

Rehabilitation year: 2021

Date: 17/08/2023

Status Permanent

Author: SCM,ASF

LQ03: Page 1 of 2

Quadrat and landform details

Sample type: Quadrat

Size: 10 m x 10 m

Altitude (m): 48

Geographic datum/zone: GDA94/Zone 50

Soil water content: dry

Landform: mid-slope

Time since fire: no evidence

Disturbance: high - rehab

Soil type/texture sand/

Bare ground (%): 70

Rocks (%) and type: 2%, limestone

Soil colour: brown/

Litter: 15% (leaves,twigs,branches)

Vegetation condition: completely degraded

Erosion: None

Drainage: Good

NW corner

230900 mE/6883342 mN



NE corner

230911 mE/ 6883344 mN



SW corner

230900 mE/ 6883331 mN



SE corner

230910 mE/ 6883332 mN



Sample Name:

LQ03

Project no.: EP22-057

Date: 17/08/2023

Status Permanent

Author: SCM,ASF

LQ03: Page 2 of 2

Species Data

* denotes non-native species

Cover (%)	Confirmed name	Height (cm)	Stratum
10	<i>Acacia rostellifera</i>	180	Middle
0.5	* <i>Avena barbata</i>	50	Groundcover
1	* <i>Brassica tournefortii</i>	45	Groundcover
0.1	<i>Calandrinia ?liniflora</i>	prostrate	Groundcover
1	* <i>Ehrharta longiflora</i>	30	Groundcover
0.1	* <i>Helianthus annuus</i>	10	Groundcover
0.5	* <i>Lysimachia arvensis</i>	prostrate	Groundcover
1	<i>Melaleuca sp.</i>	80	Middle
0.1	<i>Pittosporum angustifolium</i>	40	Middle
5	<i>Ptilotus villosiflorus</i>	prostrate	Groundcover
0.5	* <i>Raphanus raphanistrum</i>	40	Groundcover
5	<i>Rhagodia ?preissii</i>	150	Middle
0.1	* <i>Rostraria pumila</i>	10	Groundcover
1	*? <i>Rumex sp.</i>	prostrate	Groundcover

Sample Name:

LQ04

Project no.: EP22-057

Rehabilitation year: Remnant vegetation

Date: 17/08/2023

Status Permanent

Author: SCM,ASF

LQ04: Page 1 of 2

Quadrat and landform details

Sample type: Quadrat

Size: 10 m x 10 m

Altitude (m): 58

Geographic datum/zone: GDA94/Zone 50

Soil water content: slightly damp

Landform: mid-slope

Time since fire: no evidence

Disturbance: low - weeds

Soil type/texture sand/

Bare ground (%): 1

Rocks (%) and type: 1%, limestone

Soil colour: brown/

Litter: 25% (twigs,bark,branches)

Vegetation condition: very good/excellent

Erosion: None

Drainage: Good

NW corner

230779 mE/ 6883651 mN



NE corner

230788 mE/ 6883648 mN



SW corner

230778 mE/ 6883641 mN



SE corner

230787 mE/ 6883638 mN



Sample Name:

LQ04

Project no.: EP22-057

Date: 17/08/2023

Status Permanent

Author: SCM,ASF

LQ04: Page 2 of 2

Species Data

* denotes non-native species

Cover (%)	Confirmed name	Height (cm)	Stratum
1	<i>Acacia rostellifera</i>	190	Middle
0.1	<i>Austrostipa compressa</i>	35	Groundcover
0.1	* <i>Brassica tournefortii</i>	prostrate	Groundcover
2	<i>Dioscorea hastifolia</i>	prostrate	Groundcover
10	<i>Dioscorea hastifolia</i>	270	Upper
15	* <i>Ehrharta longiflora</i>	25	Groundcover
5	<i>Grevillea argyrophylla</i>	350	Upper
0.5	* <i>Lysimachia arvensis</i>	prostrate	Groundcover
40	<i>Melaleuca cardiophylla</i>	350	Upper
1	<i>Olearia sp. Kennedy Range (G. Byrr.</i>	130	Middle
0.1	<i>Parietaria cardiostegia</i>	20	Groundcover
0.5	<i>Pimelea ?angustifolia</i>	100	Middle
2	<i>Pimelea microcephala</i>	240	Upper
0.1	<i>Pittosporum angustifolium</i>	190	Middle
0.1	<i>Ptilotus divaricatus</i>	100	Middle
5	<i>Rhagodia latifolia subsp. latifolia</i>	160	Middle
0.5	<i>Roepera apiculata</i>	60	Groundcover
0.1	<i>Roepera fruticulosa</i>	30	Groundcover
0.1	<i>Solanum oldfieldii</i>	25	Groundcover
1	* <i>Sonchus oleraceus</i>	25	Groundcover
2	<i>Tetragonia implexicoma</i>	170	Groundcover
0.1	<i>Thysanotus manglesianus</i>	200	Groundcover
20	* <i>Urospermum picroides</i>	10	Groundcover

Sample Name:

LQ05

Project no.: EP22-057

Rehabilitation year: Remnant vegetation

Date: 17/08/2023

Status Permanent

Author: SCM,ASF

LQ05: Page 1 of 2

Quadrat and landform details

Sample type: Quadrat

Size: 10 m x 10 m

Altitude (m): 0

Geographic datum/zone: GDA94/Zone 50

Soil water content: dry

Landform: 0

Time since fire: no evidence

Disturbance: low - weeds

Soil type/texture sand/

Bare ground (%): 1

Rocks (%) and type: 1%, limestone

Soil colour: brown/grey

Litter: 25% (logs,branches,twigs)

Vegetation condition: very good/excellent

Erosion: None

Drainage: Good

NW corner

230675 mE/ 6883781 mN



NE corner

230682 mE/ 6883780 mN



SW corner

230675 mE/ 6883771 mN



SE corner

230685 mE/ 6883769 mN



Sample Name:

LQ05

Project no.: EP22-057

Date: 17/08/2023

Status Permanent

Author: SCM,ASF

LQ05: Page 2 of 2

Species Data

* denotes non-native species

Cover (%)	Confirmed name	Height (cm)	Stratum
2	<i>Acacia rostellifera</i>	230	Upper
0.1	<i>Alyogyne hakeifolia</i>	30	Groundcover
0.1	<i>Austrostipa compressa</i>	75	Groundcover
0.1	<i>Austrostipa elegantissima</i>	170	Groundcover
0.1	* <i>Avena barbata</i>	40	Groundcover
0.1	<i>Commicarpus australis</i>	70	Middle
0.5	<i>Convolvulus remotus</i>	50	Groundcover
10	<i>Dioscorea hastifolia</i>	170	Groundcover
45	* <i>Ehrharta longiflora</i>	30	Groundcover
1	<i>Euphorbia ?boophthona</i>	65	Groundcover
5	<i>Grevillea argyrophylla</i>	350	Upper
2	* <i>Lysimachia arvensis</i>	prostrate	Groundcover
15	<i>Melaleuca cardiophylla</i>	190	Middle
2	<i>Olearia sp. Kennedy Range (G. Byrr</i>	140	Middle
0.5	<i>Pimelea gilgiana</i>	90	Middle
5	<i>Pimelea microcephala</i>	210	Upper
1	<i>Ptilotus divaricatus</i>	120	Upper
2	* <i>Reichardia tingitana</i>	20	Groundcover
0.1	<i>Rhagodia latifolia subsp. latifolia</i>	60	Middle
0.1	<i>Roepera apiculata</i>	30	Groundcover
2	<i>Roepera fruticulosa</i>	90	Groundcover
0.1	* <i>Solanum nigrum</i>	40	Groundcover
0.5	<i>Solanum oldfieldii</i>	50	Groundcover
0.5	* <i>Sonchus oleraceus</i>	20	Groundcover
0.5	? <i>Stylobasium spathulatum</i>	120	Middle
5	<i>Tetragonia implexicoma</i>	160	Groundcover

Sample Name:

LQ06

Project no.: EP22-057

Rehabilitation year: 2021

Date: 17/08/2023

Status Permanent

Author: SCM,ASF

LQ06: Page 1 of 2

Quadrat and landform details

Sample type: Quadrat

Size: 10 m x 10 m

Altitude (m): 32

Geographic datum/zone: GDA94/Zone 50

Soil water content: dry

Landform: flat

Time since fire: no evidence

Disturbance: high - rehab

Soil type/texture sand/

Bare ground (%): 2

Rocks (%) and type: 1%, limestone

Soil colour: brown/

Litter: 80% (leaves,twigs,)

Vegetation condition: completely degraded

Erosion: None

Drainage: Good

NW corner

231239 mE/ 6882653 mN



NE corner

231250 mE/ 6882652 mN



SW corner

231241 mE/ 6882640 mN



SE corner

231250 mE/ 6882642 mN



Sample Name:

LQ06

Project no.: EP22-057

Date: 17/08/2023

Status Permanent

Author: SCM,ASF

LQ06: Page 2 of 2

Species Data

* denotes non-native species

Cover (%)	Confirmed name	Height (cm)	Stratum
20	<i>Acacia rostellifera</i>	180	Middle
0.1	<i>Alyogyne hakeifolia</i>	110	Middle
0.1	* <i>Brassica tournefortii</i>	25	Groundcover
0.1	<i>Calandrinia ?liniflora</i>	prostrate	Groundcover
2	* <i>Ehrharta longiflora</i>	20	Groundcover
0.1	<i>Euphorbia ?boophthona</i>	15	Groundcover
0.1	* <i>Lysimachia arvensis</i>	prostrate	Groundcover
2	* <i>Mesembryanthemum crystallinum</i>	prostrate	Groundcover
0.5	* <i>Reichardia tingitana</i>	25	Groundcover
30	<i>Rhagodia ?preissii</i>	125	Middle
0.1	<i>Roepera fruticulosa</i>	15	Groundcover
0.1	* <i>Rostraria pumila</i>	15	Groundcover
0.5	* <i>Sonchus oleraceus</i>	prostrate	Groundcover
0.1	<i>Stylobasium spathulatum</i>	35	Groundcover

Sample Name:

LQ07

Project no.: EP22-057

Rehabilitation year: Remnant vegetation

Date: 16/08/2023

Status Permanent

Author: SCM,ASF

LQ07: Page 1 of 2

Quadrat and landform details

Sample type: Quadrat

Size: 10 m x 10 m

Altitude (m): 17

Geographic datum/zone: GDA94/Zone 50

Soil water content: dry

Landform: flat

Time since fire: no evidence

Disturbance: moderate - cyclone damage, weed

Soil type/texture sand/ with organic layer

Bare ground (%): 0

Rocks (%) and type: No rocks

Soil colour: brown/

Litter: 80% (logs,branches,twigs)

Vegetation condition: good

Erosion: None

Drainage: Good

NW corner

228767 mE/ 6885079 mN



NE corner

228778 mE/ 6885077 mN



SW corner

228774 mE/ 6885067 mN



SE corner

228765 mE/ 6885068 mN



Sample Name:

LQ07

Project no.: EP22-057

Date: 16/08/2023

Status Permanent

Author: SCM,ASF

LQ07: Page 2 of 2

Species Data

* denotes non-native species

Cover (%)	Confirmed name	Height (cm)	Stratum
20	<i>Acacia rostellifera</i>	500	Upper
0.1	<i>Austrostipa elegantissima</i>	80	Groundcover
0.1	* <i>Brassica tournefortii</i>	35	Groundcover
0.5	<i>Commicarpus australis</i>	90	Middle
15	* <i>Ehrharta longiflora</i>	60	Groundcover
0.1	<i>Parietaria cardiostegia</i>	35	Groundcover
5	<i>Pimelea microcephala</i>	220	Upper
1	<i>Rhagodia preissii subsp. obovata</i>	150	Middle
0.5	* <i>Solanum nigrum</i>	50	Groundcover
0.5	* <i>Sonchus oleraceus</i>	35	Groundcover
25	<i>Tetragonia implexicoma</i>	150	Groundcover
10	* <i>Urospermum picroides</i>	10	Groundcover

Sample Name:

LQ08

Project no.: EP22-057

Rehabilitation year: Remnant vegetation

Date: 16/08/2023

Status Permanent

Author: SCM,ASF

LQ08: Page 1 of 2

Quadrat and landform details

Sample type: Quadrat

Size: 10 m x 10 m

Altitude (m): 18

Geographic datum/zone: GDA94/Zone 50

Soil water content: slightly damp

Landform: flat

Time since fire: no evidence

Disturbance: moderate - cyclone damage, weed

Soil type/texture sand/

Bare ground (%): 15

Rocks (%) and type: No rocks

Soil colour: brown/

Litter: 50% (logs,branches,leaves)

Vegetation condition: good

Erosion: None

Drainage: Good

NW corner

228812 mE/ 6885192 mN



NE corner

228825 mE/6885194 mN



SW corner

228812 mE/ 6885185 mN



SE corner

228822 mE/ 6885182 mN



Sample Name:

LQ08

Project no.: EP22-057

Date: 16/08/2023

Status Permanent

Author: SCM,ASF

LQ08: Page 2 of 2

Species Data

* denotes non-native species

Cover (%)	Confirmed name	Height (cm)	Stratum
0.1	<i>Acacia rostellifera</i>	25	Groundcover
1	<i>Anthobolus foveolatus</i>	90	Middle
5	<i>Austrostipa elegantissima</i>	120	Middle
10	* <i>Brassica tournefortii</i>	65	Groundcover
2	<i>Commicarpus australis</i>	160	Middle
2	* <i>Ehrharta longiflora</i>	30	Groundcover
0.1	* <i>Hypochaeris glabra</i>	prostrate	Groundcover
0.1	* <i>Lysimachia arvensis</i>	prostrate	Groundcover
0.1	* <i>Melilotus indicus</i>	prostrate	Groundcover
1	<i>Olearia sp. Kennedy Range (G. Byrr.</i>	80	Middle
0.5	<i>Parietaria debilis</i>	25	Groundcover
5	<i>Pimelea microcephala</i>	240	Upper
0.1	<i>Poaceae sp. 2</i>	prostrate	Groundcover
20	<i>Rhagodia preissii subsp. obovata</i>	150	Middle
0.1	* <i>Sonchus oleraceus</i>	prostrate	Groundcover
20	<i>Tetragonia implexicoma</i>	130	Groundcover
2	* <i>Urospermum picroides</i>	prostrate	Groundcover

Sample Name:

LQ09

Project no.: EP22-057

Rehabilitation year: Remnant vegetation

Date: 16/08/2023

Status Permanent

Author: SCM,ASF

LQ09: Page 1 of 2

Quadrat and landform details

Sample type: Quadrat

Size: 10 m x 10 m

Altitude (m): 16

Geographic datum/zone: GDA94/Zone 50

Soil water content: dry

Landform: flat

Time since fire: no evidence

Disturbance: moderate - cyclone damage, weed

Soil type/texture sand/ with organic layer

Bare ground (%): 0

Rocks (%) and type: No rocks

Soil colour: brown/

Litter: 80% (logs,branches,twigs)

Vegetation condition: good

Erosion: None

Drainage: Good

NW corner

228086 mE/ 6885876 mN



NE corner

228095 mE/ 6885873 mN



SW corner

228094 mE/ 6885863 mN



SE corner

228086 mE/ 6885866 mN



Sample Name:

LQ09

Project no.: EP22-057

Date: 16/08/2023

Status Permanent

Author: SCM,ASF

LQ09: Page 2 of 2

Species Data

* denotes non-native species

Cover (%)	Confirmed name	Height (cm)	Stratum
5	<i>Acacia rostellifera</i>	230	Upper
25	* <i>Brassica tournefortii</i>	60	Groundcover
15	<i>Clematis linearifolia</i>	190	Middle
0.1	<i>Commicarpus australis</i>	120	Middle
1	* <i>Ehrharta longiflora</i>	40	Groundcover
1	<i>Enchylaena tomentosa</i>	50	Groundcover
0.1	* <i>Reichardia tingitana</i>	30	Groundcover
25	<i>Rhagodia preissii subsp. obovata</i>	190	Middle
0.1	* <i>Solanum nigrum</i>	35	Groundcover
0.5	* <i>Sonchus oleraceus</i>	35	Groundcover
2	<i>Tetragonia implexicoma</i>	140	Groundcover
2	* <i>Urospermum picroides</i>	10	Groundcover

Sample Name:

LQ10

Project no.: EP22-057

Rehabilitation year: 2013

Date: 18/08/2023

Status Permanent

Author: SCM,ASF

LQ10: Page 1 of 2

Quadrat and landform details

Sample type: Quadrat

Size: 10 m x 10 m

Altitude (m): 17

Geographic datum/zone: GDA94/Zone 50

Soil water content: dry

Landform: flat

Time since fire: no evidence

Disturbance: moderate - old rehab, weeds

Soil type/texture sand/

Bare ground (%): 5

Rocks (%) and type: 1%, limestone

Soil colour: brown/grey

Litter: 70% (leaves,branches,twigs)

Vegetation condition: degraded

Erosion: None

Drainage: Good

NW corner

232500 mE/ 6880931 mN



NE corner

232505 mE/ 6880922 mN



SW corner

232492 mE/ 6880925 mN



SE corner

232497 mE/ 6880916 mN



Sample Name:

LQ10

Project no.: EP22-057

Date: 18/08/2023

Status Permanent

Author: SCM,ASF

LQ10: Page 2 of 2

Species Data

* denotes non-native species

Cover (%)	Confirmed name	Height (cm)	Stratum
40	<i>Acacia rostellifera</i>	500	Upper
25	<i>Alyogyne hakeifolia</i>	350	Upper
0.1	* <i>Avena barbata</i>	30	Groundcover
0.1	* <i>Brassica tournefortii</i>	40	Groundcover
0.1	<i>Calandrinia liniflora</i>	prostrate	Groundcover
0.1	<i>Commicarpus australis</i>	10	Groundcover
0.5	<i>Crassula colorata</i>	prostrate	Groundcover
0.1	<i>Dioscorea hastifolia</i>	prostrate	Groundcover
1	* <i>Ehrharta longiflora</i>	25	Groundcover
10	* <i>Hypochaeris glabra</i>	20	Groundcover
0.5	* <i>Lysimachia arvensis</i>	prostrate	Groundcover
0.1	<i>Pimelea microcephala</i>	40	Groundcover
0.5	* <i>Reichardia tingitana</i>	10	Groundcover
0.1	<i>Rhagodia preissii subsp. obovata</i>	30	Groundcover
10	* <i>Rostraria pumila</i>	15	Groundcover
0.5	* <i>Sonchus oleraceus</i>	40	Groundcover
0.5	<i>Thysanotus sp.</i>	300	Groundcover
0.1	<i>Trachymene ceratocarpa</i>	prostrate	Groundcover
10	* <i>Urospermum picroides</i>	25	Groundcover

Sample Name:

LQ11

Project no.: EP22-057

Rehabilitation year: 2013

Date: 18/08/2023

Status Permanent

Author: SCM,ASF

LQ11: Page 1 of 2

Quadrat and landform details

Sample type: Quadrat

Size: 10 m x 10 m

Altitude (m): 19

Geographic datum/zone: GDA94/Zone 50

Soil water content: dry

Landform: flat

Time since fire: no evidence

Disturbance: moderate - old rehab, weeds

Soil type/texture sand/

Bare ground (%): 2

Rocks (%) and type: 2%, limestone

Soil colour: brown/grey

Litter: 95% (leaves,branches,twigs)

Vegetation condition: degraded

Erosion: None

Drainage: Good

NW corner

232568 mE/ 6880843 mN



NE corner

232575 mE/ 6880845 mN



SW corner

232583 mE/ 6880838 mN



SE corner

232573 mE/ 6880834 mN



Sample Name:

LQ11

Project no.: EP22-057

Date: 18/08/2023

Status Permanent

Author: SCM,ASF

LQ11: Page 2 of 2

Species Data

* denotes non-native species

Cover (%)	Confirmed name	Height (cm)	Stratum
60	<i>Acacia rostellifera</i>	500	Upper
10	<i>Alyogyne hakeifolia</i>	350	Upper
0.1	<i>Calandrinia remota</i>	prostrate	Groundcover
0.1	<i>Crassula colorata</i>	prostrate	Groundcover
10	* <i>Ehrharta longiflora</i>	40	Groundcover
0.1	* <i>Hypochaeris glabra</i>	prostrate	Groundcover
0.1	* <i>Lysimachia arvensis</i>	prostrate	Groundcover
0.1	<i>Pimelea microcephala</i>	10	Groundcover
5	* <i>Reichardia tingitana</i>	15	Groundcover
0.1	<i>Rhagodia preissii subsp. obovata</i>	40	Groundcover
0.5	<i>Roepera fruticulosa</i>	30	Groundcover
0.5	* <i>Rostraria pumila</i>	10	Groundcover
0.1	* <i>Sisymbrium ?erysimoides</i>	30	Groundcover
0.1	* <i>Solanum nigrum</i>	10	Groundcover
0.5	* <i>Sonchus oleraceus</i>	20	Groundcover
0.5	<i>Thysanotus sp.</i>	230	Groundcover
0.5	<i>Trachymene ceratocarpa</i>	prostrate	Groundcover
10	* <i>Urospermum picroides</i>	15	Groundcover

Sample Name:

LQ12

Project no.: EP22-057

Rehabilitation year: 2013

Date: 17/08/2023

Status Permanent

Author: SCM,ASF

LQ12: Page 1 of 2

Quadrat and landform details

Sample type: Quadrat

Size: 10 m x 10 m

Altitude (m): 25

Geographic datum/zone: GDA94/Zone 50

Soil water content: dry

Landform: flat

Time since fire: no evidence

Disturbance: moderate - old rehab, weeds

Soil type/texture sand/

Bare ground (%): 2

Rocks (%) and type: 1%, limestone

Soil colour: brown/grey

Litter: 70% (logs,branches,leaves)

Vegetation condition: degraded

Erosion: None

Drainage: Good

NW corner

232754 mE/ 6880534 mN



NE corner

232755 mE/ 6880529 mN



SW corner

232763 mE/ 6880543 mN



SE corner

232765 mE/ 6880532 mN



Sample Name:

LQ12

Project no.: EP22-057

Date: 17/08/2023

Status Permanent

Author: SCM,ASF

LQ12: Page 2 of 2

Species Data

* denotes non-native species

Cover (%)	Confirmed name	Height (cm)	Stratum
50	<i>Acacia rostellifera</i>	500	Upper
5	<i>Alyogyne hakeifolia</i>	270	Upper
0.1	* <i>Brassica tournefortii</i>	15	Groundcover
0.1	<i>Calandrinia remota</i>	prostrate	Groundcover
40	* <i>Ehrharta longiflora</i>	35	Groundcover
5	<i>Grevillea argyrophylla</i>	300	Upper
0.1	* <i>Lysimachia arvensis</i>	prostrate	Groundcover
0.1	* <i>Melilotus indicus</i>	prostrate	Groundcover
2	<i>Olearia sp. Kennedy Range (G. Byrr</i>	170	Middle
0.5	* <i>Reichardia tingitana</i>	35	Groundcover
1	<i>Rhagodia latifolia subsp. latifolia</i>	100	Middle
0.5	* <i>Rostraria pumila</i>	10	Groundcover
1	<i>Scaevola crassifolia</i>	120	Middle
0.5	* <i>Sonchus oleraceus</i>	prostrate	Groundcover
0.5	<i>Stylobasium spathulatum</i>	140	Middle
0.1	<i>Thysanotus sp.</i>	climber	Groundcover

Sample Name:

LQ13

Project no.: EP22-057

Rehabilitation year: 2018

Date: 16/08/2023

Status Permanent

Author: SCM,ASF

LQ13: Page 1 of 2

Quadrat and landform details

Sample type: Quadrat

Size: 10 m x 10 m

Altitude (m): 49

Geographic datum/zone: GDA94/Zone 50

Soil water content: dry

Landform: upper slope

Time since fire: no evidence

Disturbance: high - rehab

Soil type/texture sand/

Bare ground (%): 2

Rocks (%) and type: 2%, limestone

Soil colour: brown/

Litter: 40% (twigs,leaves,)

Vegetation condition: degraded

Erosion: None

Drainage: Good

NW corner

230501 mE/ 6883881 mN



NE corner

230509 mE/ 6883875 mN



SW corner

230505 mE/ 6883867 mN



SE corner

230498 mE/ 6883872 mN



Sample Name:

LQ13

Project no.: EP22-057

Date: 16/08/2023

Status Permanent

Author: SCM,ASF

LQ13: Page 2 of 2

Species Data

* denotes non-native species

Cover (%)	Confirmed name	Height (cm)	Stratum
10	<i>Acacia rostellifera</i>	300	Upper
0.1	* <i>Avena barbata</i>	60	Groundcover
0.1	<i>Calandrinia remota</i>	prostrate	Groundcover
5	* <i>Ehrharta longiflora</i>	30	Groundcover
0.1	<i>Euphorbia ?boophthona</i>	30	Groundcover
0.1	* <i>Lysimachia arvensis</i>	prostrate	Groundcover
10	* <i>Raphanus raphanistrum</i>	70	Groundcover
1	* <i>Reichardia tingitana</i>	30	Groundcover
25	<i>Rhagodia preissii</i>	120	Middle
0.1	<i>Roepera apiculata</i>	40	Groundcover
15	* <i>Sonchus oleraceus</i>	25	Groundcover
15	* <i>Urospermum picroides</i>	10	Groundcover

Sample Name:

LQ14

Project no.: EP22-057

Rehabilitation year: 2018

Date: 16/08/2023

Status Permanent

Author: SCM,ASF

LQ14: Page 1 of 2

Quadrat and landform details

Sample type: Quadrat

Size: 10 m x 10 m

Altitude (m): 56

Geographic datum/zone: GDA94/Zone 50

Soil water content: slightly damp

Landform: upper slope

Time since fire: no evidence

Disturbance: high - rehab

Soil type/texture sand/

Bare ground (%): 10

Rocks (%) and type: 1%, limestone

Soil colour: brown/

Litter: 40% (leaves,twigs,branches)

Vegetation condition: degraded

Erosion: None

Drainage: Good

NW corner

230470 mE/ 6883919 mN



NE corner

230477 mE/ 6883917 mN



SW corner

230474 mE/ 6883909 mN



SE corner

230474 mE/ 6883906 mN



Sample Name:

LQ14

Project no.: EP22-057

Date: 16/08/2023

Status Permanent

Author: SCM,ASF

LQ14: Page 2 of 2

Species Data

* denotes non-native species

Cover (%)	Confirmed name	Height (cm)	Stratum
40	<i>Acacia rostellifera</i>	350	Upper
0.5	<i>Alyogyne hakeifolia</i>	140	Middle
0.1	* <i>Avena barbata</i>	50	Groundcover
0.5	<i>Calandrinia remota</i>	prostrate	Groundcover
20	* <i>Ehrharta longiflora</i>	25	Groundcover
0.1	<i>Euphorbia ?boophthona</i>	30	Groundcover
0.1	* <i>Lysimachia arvensis</i>	prostrate	Groundcover
1	* <i>Raphanus raphanistrum</i>	50	Groundcover
0.1	* <i>Reichardia tingitana</i>	25	Groundcover
5	<i>Rhagodia preissii</i>	120	Midde
2	* <i>Sonchus oleraceus</i>	25	Groundcover
0.1	<i>Stylobasium spathulatum</i>	75	Middle
15	* <i>Urospermum picroides</i>	prostrate	Groundcover

Sample Name:

LQ15

Project no.: EP22-057

Rehabilitation year: 2018

Date: 16/08/2023

Status Permanent

Author: SCM,ASF

LQ15: Page 1 of 2

Quadrat and landform details

Sample type: Quadrat

Size: 10 m x 10 m

Altitude (m): 57

Geographic datum/zone: GDA94/Zone 50

Soil water content: damp

Landform: mid-slope

Time since fire: no evidence

Disturbance: high - rehab

Soil type/texture sand/

Bare ground (%): 2

Rocks (%) and type: No rocks

Soil colour: brown/

Litter: 15% (twigs,leaves,)

Vegetation condition: completely degraded

Erosion: None

Drainage: Good

NW corner

230396 mE/ 6883928 mN



NE corner

230405 mE/ 6883928 mN



SW corner

230405 mE/ 6883928 mN



SE corner

230465 mE/ 6883928 mN



Sample Name:

LQ15

Project no.: EP22-057

Date: 16/08/2023

Status Permanent

Author: SCM,ASF

LQ15: Page 2 of 2

Species Data

* denotes non-native species

Cover (%)	Confirmed name	Height (cm)	Stratum
10	<i>Acacia rostellifera</i>	200	Upper
0.1	* <i>Avena barbata</i>	70	Groundcover
0.5	* <i>Bromus diandrus</i>	40	Groundcover
0.1	<i>Calandrinia ?liniflora</i>	prostrate	Groundcover
50	* <i>Ehrharta longiflora</i>	65	Groundcover
0.1	* <i>Lysimachia arvensis</i>	prostrate	Groundcover
5	* <i>Mesembryanthemum crystallinum</i>	prostrate	Groundcover
5	* <i>Raphanus raphanistrum</i>	60	Groundcover
2	* <i>Reichardia tingitana</i>	35	Groundcover
10	<i>Rhagodia preissii</i>	110	Middle
0.1	* <i>Rostraria pumila</i>	15	Groundcover
2	* <i>Sonchus oleraceus</i>	60	Groundcover
0.1	<i>Stylobasium spathulatum</i>	70	Middle
0.1	* <i>Urospermum picroides</i>	20	Groundcover

Sample Name:

LQ16

Project no.: EP22-057

Rehabilitation year: Remnant vegetation

Date: 17/08/2023

Status Permanent

Author: SCM,ASF

LQ16: Page 1 of 2

Quadrat and landform details

Sample type: Quadrat

Size: 10 m x 10 m

Altitude (m): 69

Geographic datum/zone: GDA94/Zone 50

Soil water content: dry

Landform: top

Time since fire: no evidence

Disturbance: low - weeds

Soil type/texture sand/

Bare ground (%): 2

Rocks (%) and type: 1%, limestone

Soil colour: brown/

Litter: 60% (logs,branches,leaves)

Vegetation condition: very good/excellent

Erosion: None

Drainage: Good

NW corner

230527 mE/ 6883974 mN



NE corner

230536 mE/ 6883974 mN



SW corner

230524 mE/ 6883967 mN



SE corner

230535 mE/ 6883966 mN



Sample Name:

LQ16

Project no.: EP22-057

Date: 17/08/2023

Status Permanent

Author: SCM,ASF

LQ16: Page 2 of 2

Species Data

* denotes non-native species

Cover (%)	Confirmed name	Height (cm)	Stratum
0.1	<i>Aphanopetalum clematideum</i>	180	Middle
0.1	<i>Austrostipa elegantissima</i>	70	Groundcover
0.1	<i>Austrostipa flavescens</i>	60	Groundcover
0.5	<i>Calandrinia remota</i>	prostrate	Groundcover
10	<i>Clematis linearifolia</i>	200	Groundcover
0.5	<i>Crassula colorata</i>	5	Groundcover
5	* <i>Ehrharta longiflora</i>	20	Groundcover
15	<i>Eucalyptus fruticosa</i>	400	Upper
0.1	<i>Euphorbia ?boophthona</i>	30	Groundcover
0.1	* <i>Lysimachia arvensis</i>	prostrate	Groundcover
1	<i>Melaleuca cardiophylla</i>	160	Middle
5	<i>Olearia sp. Kennedy Range (G. Byrr.</i>	100	Middle
0.5	<i>Parietaria cardiostegia</i>	15	Groundcover
1	<i>Pimelea microcephala</i>	170	Middle
15	<i>Pittosporum angustifolium</i>	400	Upper
0.1	<i>Ptilotus divaricatus</i>	70	Middle
0.1	* <i>Raphanus raphanistrum</i>	25	Groundcover
15	<i>Rhagodia latifolia subsp. latifolia</i>	100	Middle
2	<i>Rhagodia preissii subsp. obovata</i>	90	Middle
0.1	<i>Roepera fruticulosa</i>	80	Groundcover
0.1	* <i>Rostraria pumila</i>	10	Groundcover
0.5	* <i>Sonchus oleraceus</i>	15	Groundcover
15	<i>Tetragonia implexicoma</i>	110	Groundcover

Sample Name:

LQ17

Project no.: EP22-057

Rehabilitation year: Remnant vegetation

Date: 16/08/2023

Status Permanent

Author: SCM,ASF

LQ17: Page 1 of 2

Quadrat and landform details

Sample type: Quadrat

Size: 10 m x 10 m

Altitude (m): 61

Geographic datum/zone: GDA94/Zone 50

Soil water content: dry

Landform: mid-slope

Time since fire: no evidence

Disturbance: low - weeds

Soil type/texture sand/

Bare ground (%): 5

Rocks (%) and type: 1%, limestone

Soil colour: brown/grey

Litter: 40% (logs,branches,leaves)

Vegetation condition: very good/excellent

Erosion: None

Drainage: Good

NW corner

230534 mE/ 6883919 mN



NE corner

230543 mE/ 6883951 mN



SW corner

230361 mE/ 6883942 mN



SE corner

230352 mE/ 6883946 mN



Sample Name:

LQ17

Project no.: EP22-057

Date: 16/08/2023

Status Permanent

Author: SCM,ASF

LQ17: Page 2 of 2

Species Data

* denotes non-native species

Cover (%)	Confirmed name	Height (cm)	Stratum
5	<i>Acacia rostellifera</i>	400	Upper
1	<i>Acanthocarpus preissii</i>	70	Middle
2	<i>Alyogyne hakeifolia</i>	300	Upper
2	<i>Austrostipa elegantissima</i>	120	Groundcover
0.1	<i>Austrostipa flavescens</i>	80	Groundcover
0.1	<i>Calandrinia remota</i>	prostrate	Groundcover
0.5	<i>Clematis linearifolia</i>	165	Groundcover
0.5	<i>Commicarpus australis</i>	120	Middle
10	<i>Dioscorea hastifolia</i>	200	Groundcover
0.1	<i>Diplopeltis petiolaris</i>	50	Middle
5	* <i>Ehrharta longiflora</i>	30	Groundcover
0.5	<i>Eremophila glabra subsp. camosa</i>	90	Middle
0.1	<i>Goodenia berardiana</i>	10	Groundcover
10	<i>Grevillea argyrophylla</i>	300	Upper
0.1	<i>Lysiandra calycina</i>	70	Middle
0.1	* <i>Lysimachia arvensis</i>	prostrate	Groundcover
1	<i>Melaleuca cardiophylla</i>	70	Middle
15	<i>Olearia sp. Kennedy Range (G. Byrr.</i>	170	Middle
0.1	<i>Parietaria cardiostegia</i>	20	Groundcover
5	<i>Pimelea microcephala</i>	180	Middle
5	<i>Pittosporum angustifolium</i>	240	Upper
0.1	<i>Ptilotus divaricatus</i>	40	Groundcover
0.1	* <i>Raphanus raphanistrum</i>	25	Groundcover
2	<i>Rhagodia latifolia subsp. latifolia</i>	90	Middle
0.5	<i>Roepera apiculata</i>	45	Groundcover
0.1	<i>Roepera fruticulosa</i>	110	Middle
0.1	<i>Solanum oldfieldii</i>	30	Groundcover
0.1	* <i>Sonchus oleraceus</i>	prostrate	Groundcover
10	? <i>Stylobasium spathulatum</i>	180	Middle
10	<i>Tetragonia implexicoma</i>	60	Groundcover
0.1	<i>Thysanotus manglesianus</i>	190	Groundcover
0.1	<i>Trachymene ceratocarpa</i>	prostrate	Groundcover

Sample Name:

LQ18

Project no.: EP22-057

Rehabilitation year: Remnant vegetation

Date: 17/08/2023

Status Permanent

Author: SCM,ASF

LQ18: Page 1 of 2

Quadrat and landform details

Sample type: Quadrat

Size: 10 m x 10 m

Altitude (m): 67

Geographic datum/zone: GDA94/Zone 50

Soil water content: slightly damp

Landform: mid-slope

Time since fire: no evidence

Disturbance: low - weeds

Soil type/texture sand/

Bare ground (%): 2

Rocks (%) and type: 1%, limestone

Soil colour: brown/

Litter: 40% (branches,logs,twigs)

Vegetation condition: very good/excellent

Erosion: None

Drainage: Good

NW corner

230647 mE/ 6883936 mN



NE corner

230653 mE/ 6883928 mN



SW corner

230641 mE/ 6883929 mN



SE corner

230646 mE/ 6883922 mN



Sample Name:

LQ18

Project no.: EP22-057

Date: 17/08/2023

Status Permanent

Author: SCM,ASF

LQ18: Page 2 of 2

Species Data

* denotes non-native species

Cover (%)	Confirmed name	Height (cm)	Stratum
15	<i>Acacia rostellifera</i>	400	Upper
5	<i>Alyogyne hakeifolia</i>	400	Upper
0.5	<i>Austrostipa elegantissima</i>	140	Middle
0.1	<i>Austrostipa flavescens</i>	50	Groundcover
2	<i>Clematis linearifolia</i>	180	Middle
0.5	<i>Commicarpus australis</i>	60	Groundcover
0.1	<i>Convolvulus remotus</i>	climber	Groundcover
5	<i>Dioscorea hastifolia</i>	180	Middle
1	<i>Dioscorea hastifolia</i>	prostrate	Groundcover
0.1	? <i>Diplopeltis petiolaris</i>	30	Groundcover
40	* <i>Ehrharta longiflora</i>	40	Groundcover
0.5	<i>Euphorbia ?boophthona</i>	40	Groundcover
0.1	<i>Glycine canescens</i>	130	Middle
0.1	<i>Goodenia berardiana</i>	15	Groundcover
0.1	* <i>Lupinus cosentinii</i>	25	Groundcover
2	<i>Lysiandra calycina</i>	110	Middle
0.1	* <i>Lysimachia arvensis</i>	prostrate	Groundcover
5	<i>Olearia sp. Kennedy Range (G. Byrr.</i>	180	Middle
1	<i>Pimelea angustifolia</i>	60	Groundcover
5	<i>Pimelea microcephala</i>	210	Upper
1	<i>Pittosporum angustifolium</i>	210	Upper
0.1	* <i>Raphanus raphanistrum</i>	30	Groundcover
2	<i>Rhagodia latifolia subsp. latifolia</i>	110	Middle
0.1	<i>Roepera apiculata</i>	20	Groundcover
5	<i>Roepera fruticulosa</i>	70	Middle
2	<i>Solanum oldfieldii</i>	55	Groundcover
0.1	* <i>Sonchus oleraceus</i>	prostrate	Groundcover
5	? <i>Stylobasium spathulatum</i>	210	Upper
10	<i>Tetragonia implexicoma</i>	70	Middle
0.1	<i>Thysanotus sp.</i>	135	Groundcover
0.1	<i>Trachymene ceratocarpa</i>	prostrate	Groundcover

Sample Name:

LQ19

Project no.: EP22-057

Rehabilitation year: Remnant vegetation

Date: 17/08/2023

Status Permanent

Author: SCM,ASF

LQ19: Page 1 of 2

Quadrat and landform details

Sample type: Quadrat

Size: 10 m x 10 m

Altitude (m): 33

Geographic datum/zone: GDA94/Zone 50

Soil water content: dry

Landform: lower slope

Time since fire: no evidence

Disturbance: moderate - cyclone damage

Soil type/texture sand/

Bare ground (%): 1

Rocks (%) and type: 1%, limestone

Soil colour: brown/

Litter: 80% (leaves,branches,logs)

Vegetation condition: very good

Erosion: None

Drainage: Good

NW corner

231317 mE/ 6882685 mN



NE corner

231326 mE/ 6882684 mN



SW corner

231327 mE/ 6882673 mN



SE corner

231317 mE/ 6883673 mN



Sample Name:

LQ19

Project no.: EP22-057

Date: 17/08/2023

Status Permanent

Author: SCM,ASF

LQ19: Page 2 of 2

Species Data

* denotes non-native species

Cover (%)	Confirmed name	Height (cm)	Stratum
40	<i>Acacia rostellifera</i>	500	Upper
5	<i>Alyogyne hakeifolia</i>	270	Upper
0.1	<i>Austrostipa compressa</i>	20	Groundcover
0.5	<i>Austrostipa elegantissima</i>	100	Groundcover
0.1	* <i>Avena barbata</i>	30	Groundcover
0.1	* <i>Brassica tournefortii</i>	15	Groundcover
0.1	<i>Calandrinia remota</i>	prostrate	Groundcover
0.1	<i>Clematis linearifolia</i>	240	Groundcover
0.1	<i>Commicarpus australis</i>	80	Middle
10	* <i>Ehrharta longiflora</i>	25	Groundcover
1	<i>Euphorbia ?boophthona</i>	50	Groundcover
0.1	* <i>Lysimachia arvensis</i>	prostrate	Groundcover
2	<i>Olearia sp. Kennedy Range (G. Byrr.</i>	200	Upper
2	<i>Phyllanthus calycinus</i>	100	Middle
0.5	<i>Pimelea gilgiana</i>	110	Middle
2	<i>Pimelea microcephala</i>	240	Middle
2	<i>Pittosporum angustifolium</i>	240	Upper
0.1	* <i>Reichardia tingitana</i>	10	Groundcover
5	<i>Rhagodia latifolia subsp. latifolia</i>	85	Middle
2	<i>Rhagodia ?preissii</i>	160	Middle
2	<i>Roepera apiculata</i>	50	Groundcover
0.1	<i>Roepera fruticulosa</i>	40	Groundcover
0.1	* <i>Solanum nigrum</i>	20	Groundcover
1	<i>Solanum oldfieldii</i>	50	Groundcover
0.1	* <i>Sonchus oleraceus</i>	prostrate	Groundcover
5	<i>Tetragonia implexicoma</i>	150	Groundcover
0.1	* <i>Urospermum picroides</i>	10	Groundcover

Sample Name:

LQ20

Project no.: EP22-057

Rehabilitation year: 2010

Date: 17/08/2023

Status Permanent

Author: SCM,ASF

LQ20: Page 1 of 2

Quadrat and landform details

Sample type: Quadrat

Size: 10 m x 10 m

Altitude (m): 10

Geographic datum/zone: GDA94/Zone 50

Soil water content: dry

Landform: flat

Time since fire: no evidence

Disturbance: low - weeds

Soil type/texture sand/

Bare ground (%): 1

Rocks (%) and type: 5%, limestone

Soil colour: brown/grey

Litter: 95% (leaves,twigs,branches)

Vegetation condition: very good

Erosion: None

Drainage: Good

NW corner

232110 mE/ 6881146 mN



NE corner

232119 mE/ 6881143 mN



SW corner

232122 mE/ 6881136 mN



SE corner

232107 mE/ 6881138 mN



Sample Name:

LQ20

Project no.: EP22-057

Date: 17/08/2023

Status Permanent

Author: SCM,ASF

LQ20: Page 2 of 2

Species Data

* denotes non-native species

Cover (%)	Confirmed name	Height (cm)	Stratum
30	<i>Acacia rostellifera</i>	500	Upper
40	<i>Alyogyne hakeifolia</i>	500	Upper
0.1	<i>Austrostipa elegantissima</i>	70	Groundcover
0.1	<i>Eriochilus sp.</i>	10	Groundcover
5	<i>Grevillea argyrophylla</i>	500	Upper
0.1	* <i>Hypochaeris glabra</i>	prostrate	Groundcover
0.1	* <i>Lysimachia arvensis</i>	prostrate	Groundcover
0.5	<i>Pimelea microcephala</i>	80	Middle
0.1	* <i>Reichardia tingitana</i>	prostrate	Groundcover
0.5	<i>Roepera apiculata</i>	35	Groundcover
1	* <i>Rostraria pumila</i>	15	Groundcover
0.1	* <i>Sonchus oleraceus</i>	30	Groundcover
0.1	<i>Tetragonia implexicoma</i>	10	Groundcover
0.1	<i>Thysanotus sp.</i>	climber	Groundcover
5	* <i>Urospermum picroides</i>	10	Groundcover

Sample Name:

LQ21

Project no.: EP22-057

Rehabilitation year: 2022

Date: 18/08/2023

Status: Permanent

Author: SCM,ASF

LQ21: Page 1 of 2

Quadrat and landform details

Sample type: Quadrat

Size: 10 m x 10 m

Altitude (m): 49

Geographic datum/zone: GDA94/Zone 50

Soil water content: dry

Landform: upper slope

Time since fire: no evidence

Disturbance: high - rehab

Soil type/texture: sand/

Bare ground (%): 15

Rocks (%) and type: 5%, limestone

Soil colour: brown/cream

Litter: 70% (logs, branches, twigs)

Vegetation condition: completely degraded

Erosion: None

Drainage: Good

NW corner

230935 mE, 6883237 mN



NE corner

230945 mE, 6883240 mN



SW corner

230936 mE, 6883230 mN



SE corner

230945 mE, 6883230 mN



Sample Name:

LQ21

Project no.: EP22-057

Date: 18/08/2023

Status Permanent

Author: SCM,ASF

LQ21: Page 2 of 2

Species Data

* denotes non-native species

Cover (%)	Confirmed name	Height (cm)	Stratum
30	<i>Acacia rostellifera</i>	80	Middle
5	<i>Alyogyne hakeifolia</i>	100	Middle
0.1	* <i>Avena barbata</i>	45	Groundcover
0.1	<i>Convolvulus remotus</i>	climber	Groundcover
0.1	* <i>Ehrharta longiflora</i>	15	Groundcover
0.1	<i>Goodenia berardiana</i>	15	Groundcover
0.1	<i>Hannafordia quadrivalvis</i>	20	Groundcover
0.1	* <i>Lysimachia arvensis</i>	prostrate	Groundcover
0.1	<i>Olearia sp. Kennedy Range (G. Byrr</i>	15	Groundcover
0.5	<i>Ptilotus villosiflorus</i>	prostrate	Groundcover
0.1	<i>Roepera fruticulosa</i>	prostrate	Groundcover
0.1	*? <i>Rumex sp.</i>	prostrate	Groundcover
0.1	* <i>Sonchus oleraceus</i>	prostrate	Groundcover
1	<i>Stylobasium spathulatum</i>	40	Groundcover

Sample Name:

LQ22

Project no.: EP22-057

Rehabilitation year: 2022

Date: 18/08/2023

Status: Permanent

Author: SCM,ASF

LQ22: Page 1 of 2

Quadrat and landform details

Sample type: Quadrat

Size: 10 m x 10 m

Altitude (m): 54

Geographic datum/zone: GDA94/Zone 50

Soil water content: dry

Landform: mid-slope

Time since fire: no evidence

Disturbance: high - rehab

Soil type/texture sand/

Bare ground (%): 35

Rocks (%) and type: 10%, limestone

Soil colour: brown/cream

Litter: 5% (twigs,leaves,)

Vegetation condition: completely degraded

Erosion: None

Drainage: Good

NW corner

230660 mE, 6883544 mN



NE corner

230673 mE, 6883544 mN



SW corner

230660 mE, 6883531 mN



SE corner

230670 mE, 6883534 mN



Sample Name:

LQ22

Project no.: EP22-057

Date: 18/08/2023

Status Permanent

Author: SCM,ASF

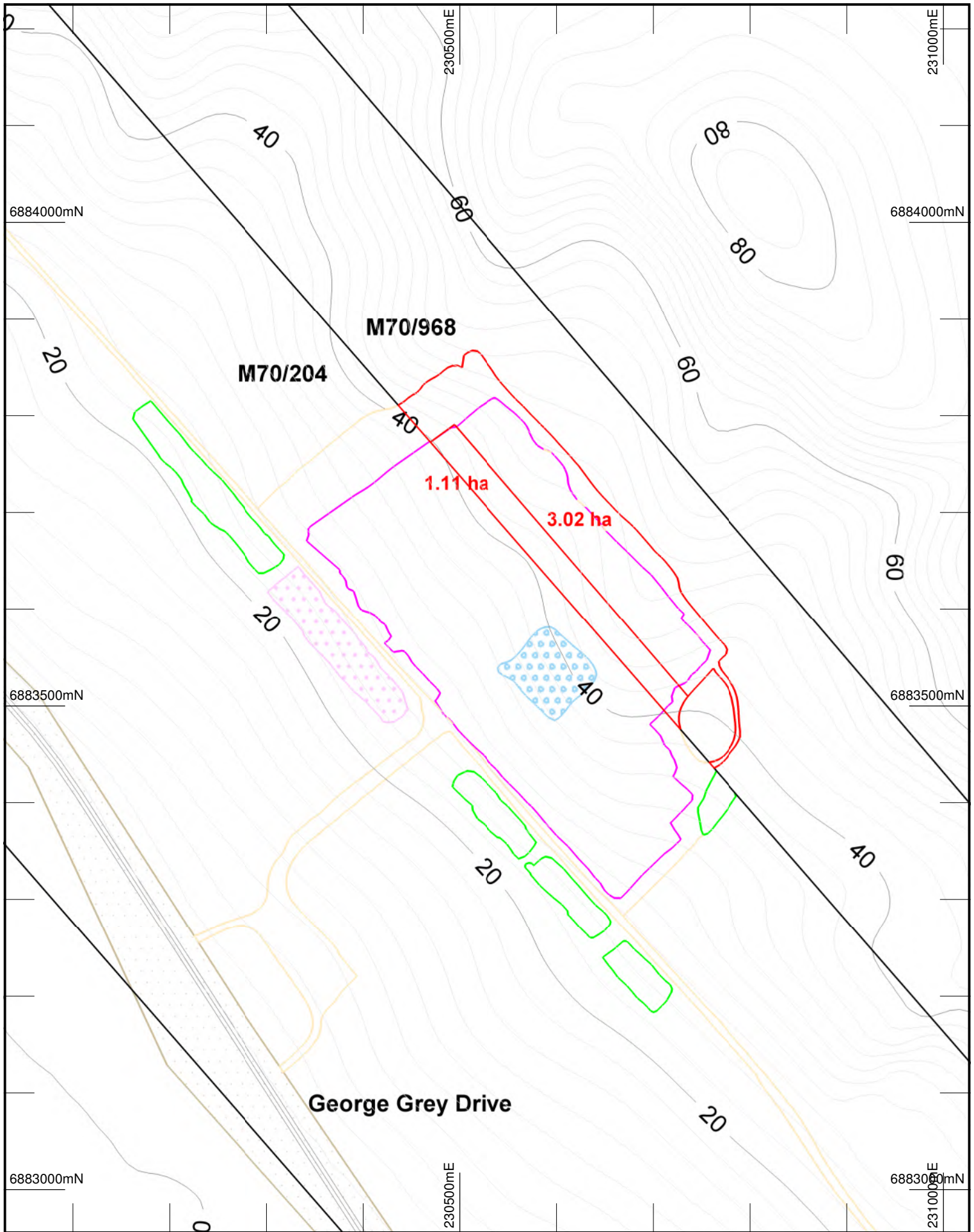
LQ22: Page 2 of 2

Species Data

* denotes non-native species

Cover (%)	Confirmed name	Height (cm)	Stratum
30	<i>Acacia rostellifera</i>	150	Middle
5	<i>Alyogyne hakeifolia</i>	180	Middle
0.1	<i>Austrostipa sp.</i>	50	Groundcover
5	* <i>Avena barbata</i>	70	Groundcover
0.1	* <i>Bromus diandrus</i>	35	Groundcover
0.1	* <i>Centaurea melitensis</i>	30	Groundcover
2	* <i>Ehrharta longiflora</i>	30	Groundcover
0.1	<i>Erodium cygnorum</i>	15	Groundcover
0.5	<i>Euphorbia ?boophthona</i>	45	Groundcover
0.1	<i>Goodenia berardiana</i>	20	Groundcover
0.1	<i>Hannafordia quadrivalvis</i>	10	Groundcover
0.5	* <i>Lysimachia arvensis</i>	prostrate	Groundcover
0.1	<i>Olearia sp. Kennedy Range (G. Byrr.</i>	25	Groundcover
0.1	<i>Pimelea microcephala</i>	20	Groundcover
0.5	<i>Ptilotus villosiflorus</i>	10	Groundcover
0.1	* <i>Raphanus raphanistrum</i>	50	Groundcover
0.5	* <i>Reichardia tingitana</i>	40	Groundcover
0.1	* <i>Rostraria pumila</i>	10	Groundcover
0.5	<i>Scaevola crassifolia</i>	70	Middle
0.1	* <i>Schismus barbatus</i>	prostrate	Groundcover
0.1	* <i>Sonchus oleraceus</i>	30	Groundcover
0.1	<i>Stylobasium spathulatum</i>	40	Middle

Attachment 4 Clearing Activities between 2014 and 2023



LEGEND

- GMA Tenement
- Cleared Area 2014-2015
- Lynton 3300 Mine Pit (15/06/2015)
- Topsoil Stockpile
- Pit Backfill
- Pit Rehab/Reveg
- Road Reserve
- Stockpile

Scale
1 : 5000

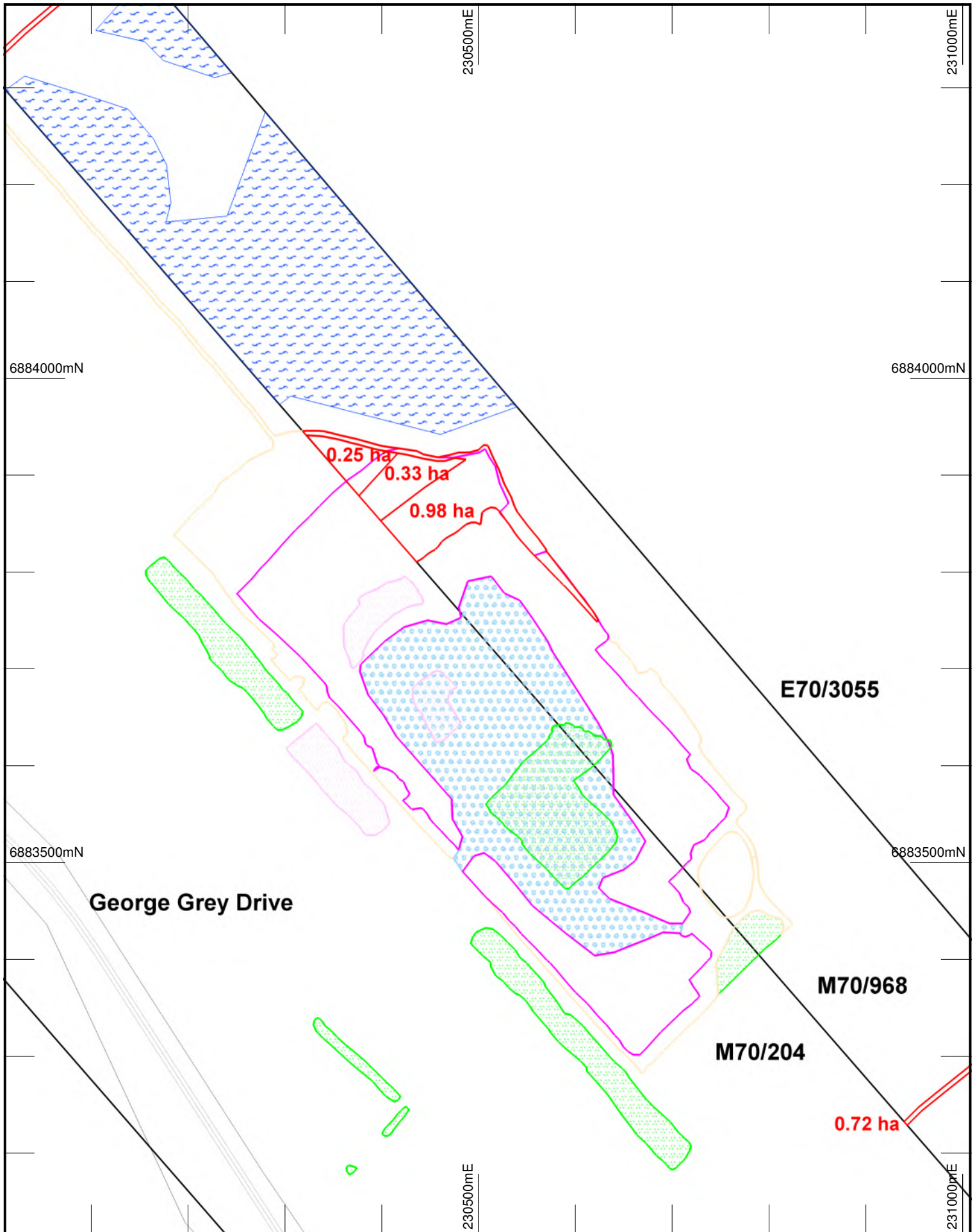
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Figure 1:

**Cleared Areas
under Permit 5947/2
2014-2015**

Date Plotted 10-Jul-2015



LEGEND

- GMA Tenement
- Cleared Area 2015-2016
- Lynton Mine Pit (30/06/2016)
- Track / Cleared Area
- Exclusion Zone
- Topsoil Stockpile
- Stockpile
- Pit Backfill
- Pit Rehab/Reveg
- Road Reserve

Scale
1 : 5000

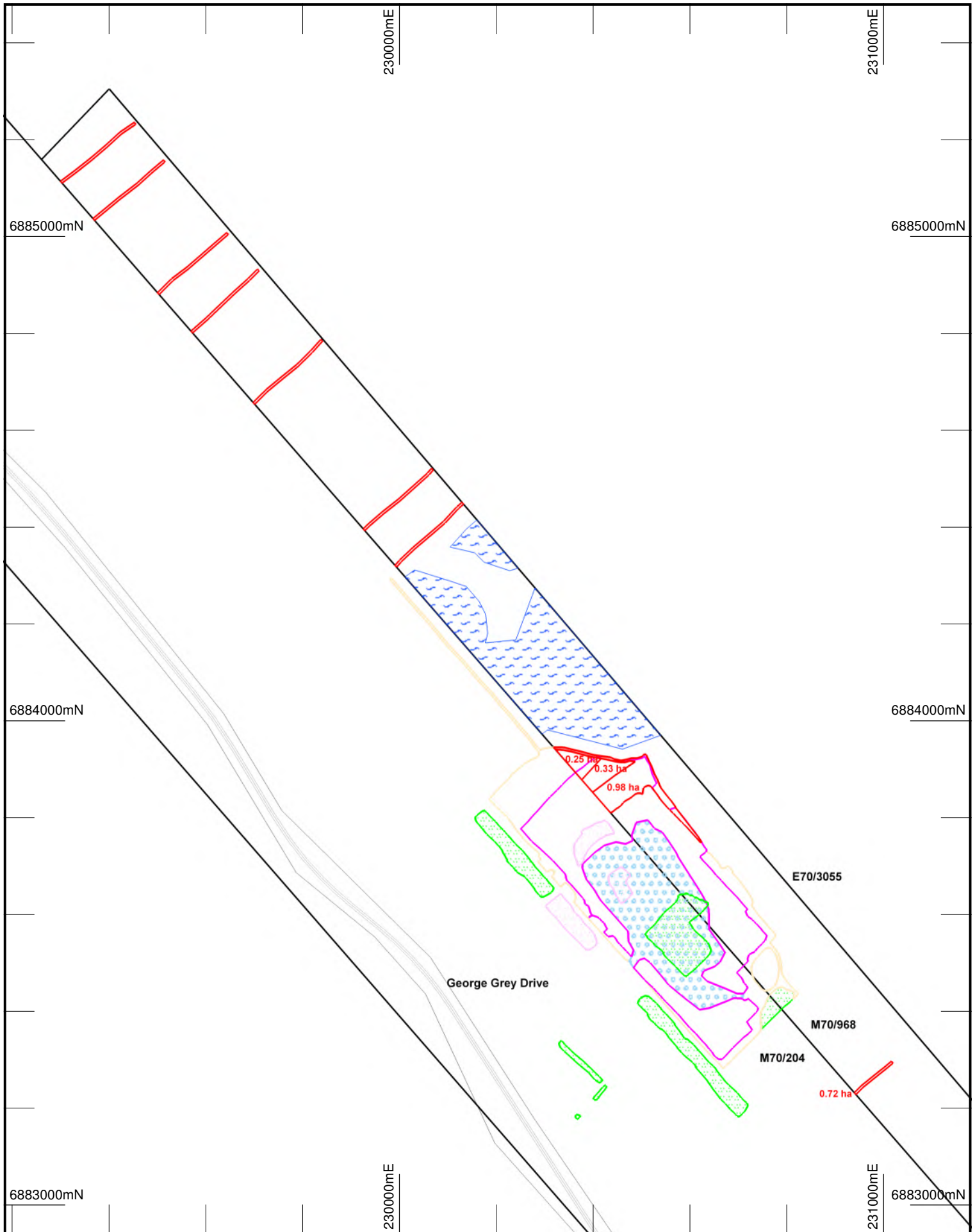
0 50 100m



Figure 1:

**Clearing Permit
CPS 5947/2
2015-2016 Report**

Date Plotted 27-Jul-2016



LEGEND

- GMA Tenement
- Cleared Area 2015-2016
- Lynton Mine Pit (30/06/2016)
- Track / Cleared Area
- Exclusion Zone
- Topsoil Stockpile
- Stockpile
- Pit Backfill
- Pit Rehab/Reveg
- Road Reserve

Scale
1 : 10000

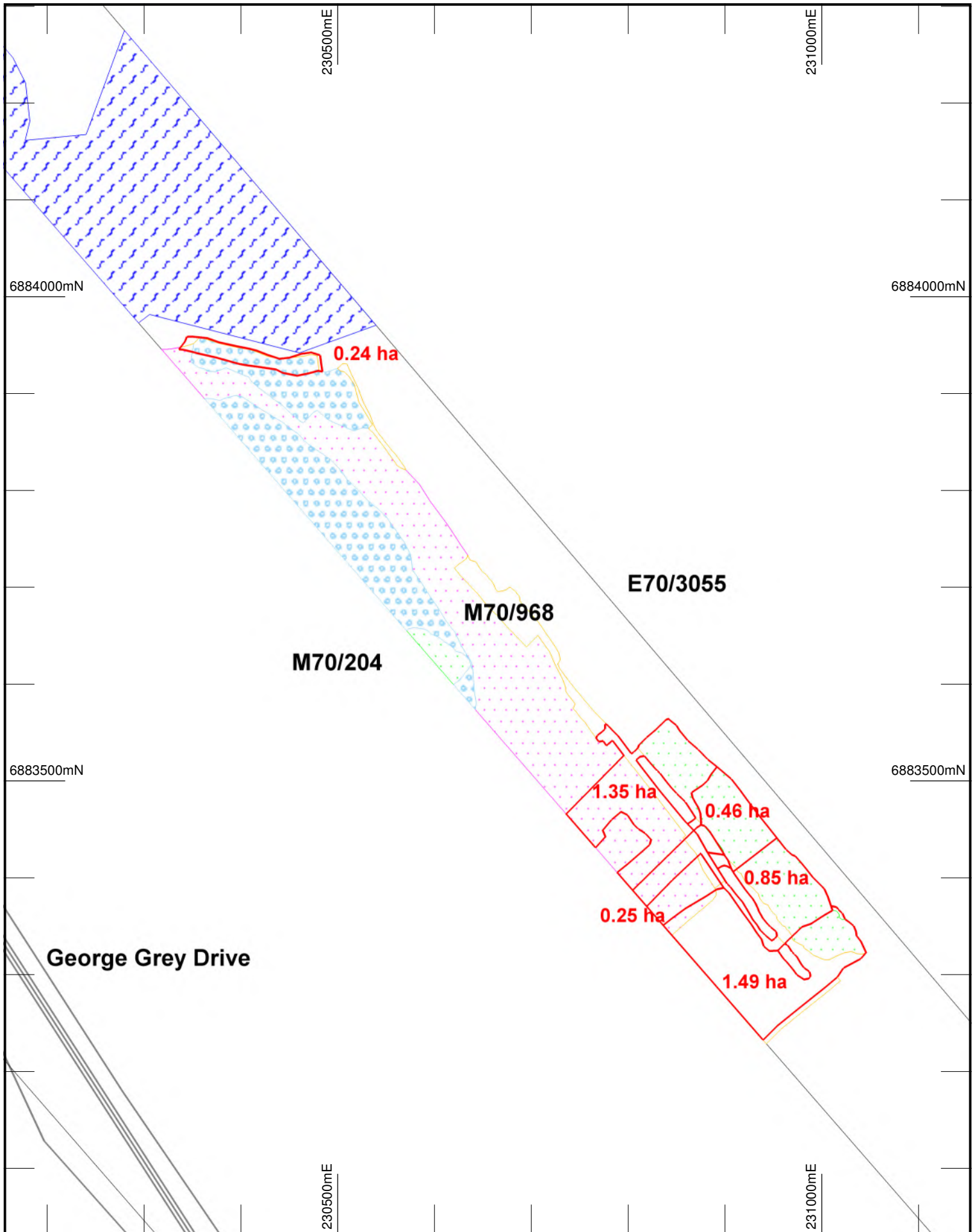
0 100 200m



Figure 2:

**Clearing Permit
CPS 5947/2
2015-2016 Report**

Date Plotted 27-Jul-2016



LEGEND

- | | |
|------------------------------|-------------------|
| GMA Tenement | Topsoil Stockpile |
| Cleared Area 2015-2016 | Stockpile |
| Lynton Mine Pit (30/06/2016) | Pit Backfill |
| Track / Cleared Area | Pit Rehab/Reveg |
| Exclusion Zone | Road Reserve |

Scale
1 : 5000

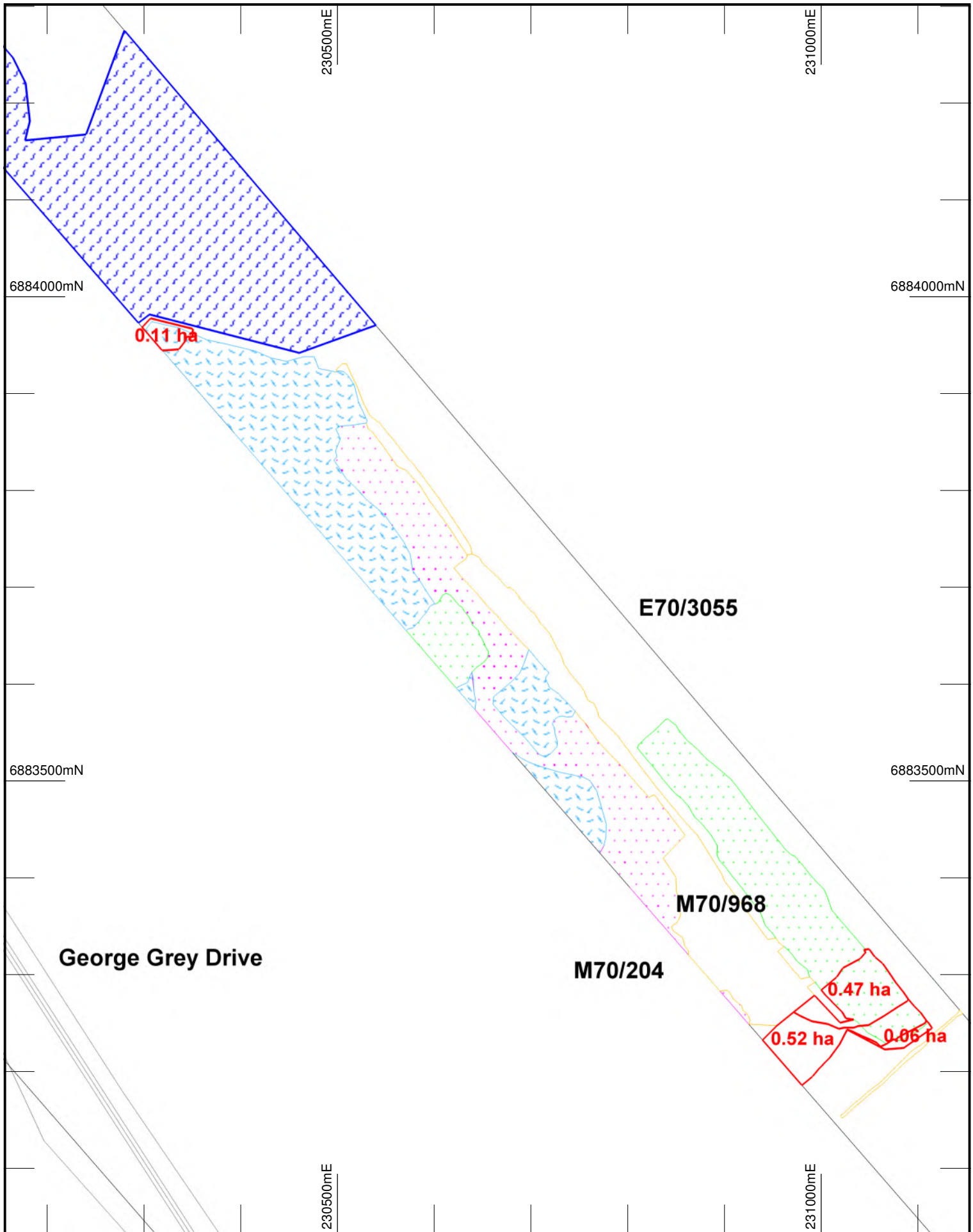
0 50 100m



Figure 1:

**Clearing Permit
CPS 5947/2
2016-2017 Report**

Date Plotted 21-Jul-2017



LEGEND

- | | |
|------------------------------|-------------------|
| GMA Tenement | Topsoil Stockpile |
| Cleared Area 2017-2018 | Stockpile |
| Lynton Mine Pit (30/06/2018) | Pit Backfill |
| Track / Cleared Area | Pit Rehab/Reveg |
| Exclusion Zone | Road Reserve |

Scale
1 : 5000

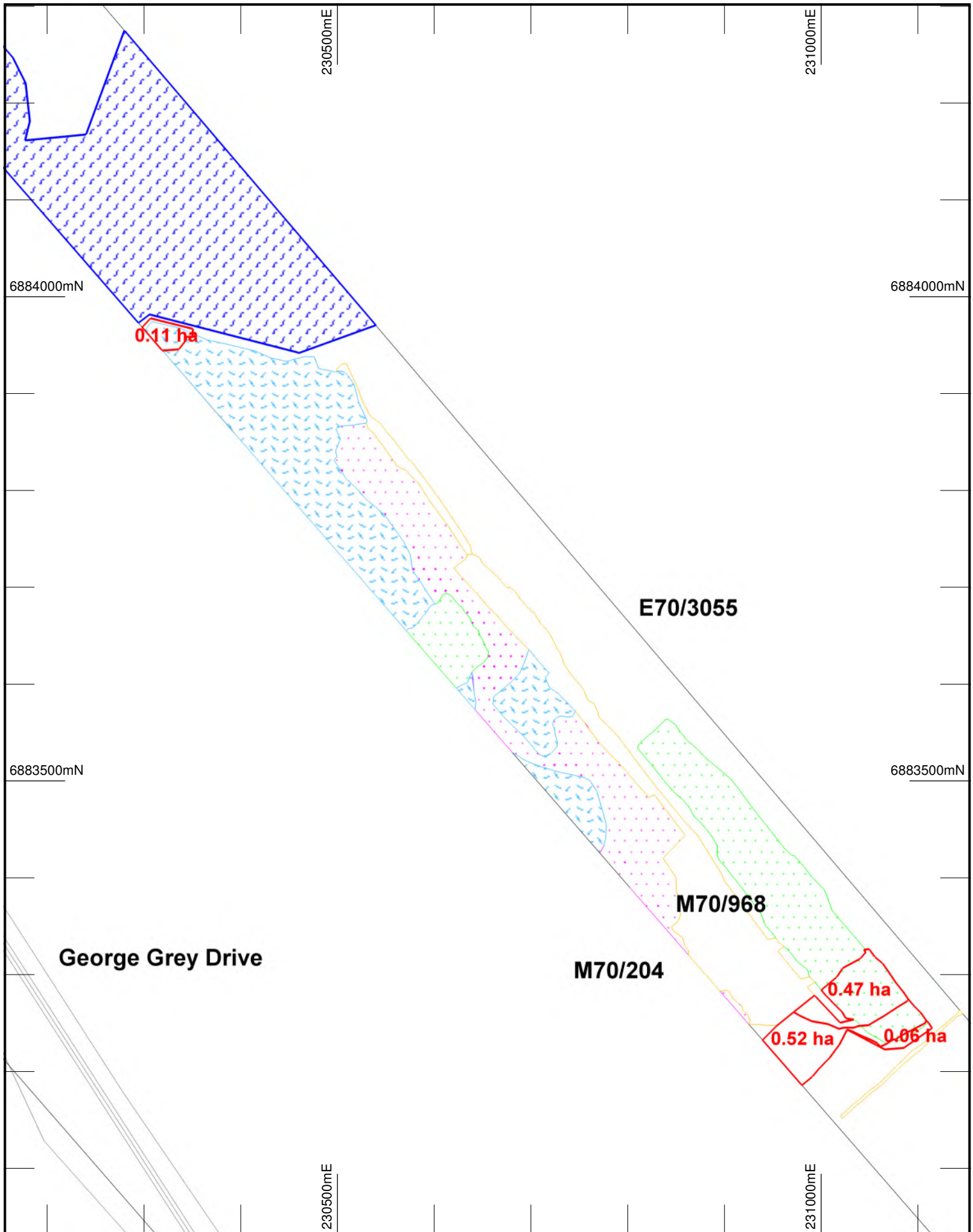
0 50 100m



Figure 1:

**Clearing Permit
CPS 5947/2
2017-2018 Report**

Date Plotted 17-Jul-2018



LEGEND

- | | |
|------------------------------|-------------------|
| GMA Tenement | Topsoil Stockpile |
| Cleared Area 2017-2018 | Stockpile |
| Lynton Mine Pit (30/06/2018) | Pit Backfill |
| Track / Cleared Area | Pit Rehab/Reveg |
| Exclusion Zone | Road Reserve |

Scale
1 : 5000

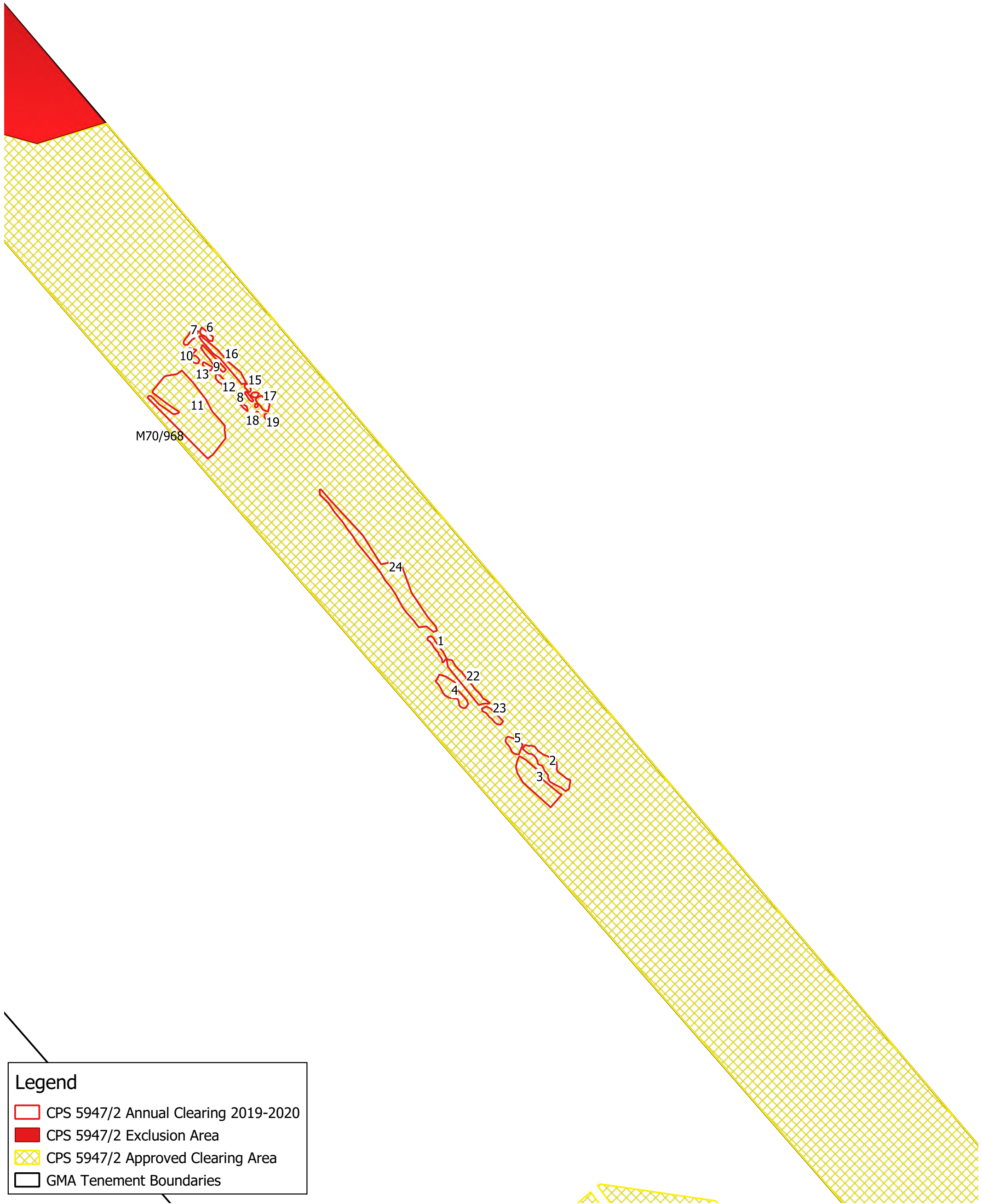
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Figure 1:

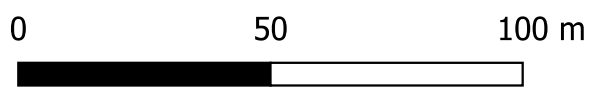
**Clearing Permit
CPS 5947/2
2017-2018 Report**

Date Plotted 17-Jul-2018



Legend

-  CPS 5947/2 Annual Clearing 2019-2020
-  CPS 5947/2 Exclusion Area
-  CPS 5947/2 Approved Clearing Area
-  GMA Tenement Boundaries



Map Project: Transverse Mercator
 Horizontal Datum: GDA 1994
 Grid: GDA 1994 MGA Zone 50
 Survey: 30 June 2020

Figure 1B
GMA Garnet Pty Ltd
CPS 5947/2
Annual Clearing Report
2019 - 2020

230000

Legend

-  CPS 5497 Clearing 2021- 2022
-  CPS 5947
-  DMIRS Mining Tenements

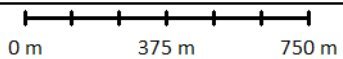
6885000

6885000

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 229946.72 6884421 229951.22 6884367.4
 230011.17 6884299.3 230024.81 6884352.3

230512.71 6883732.1 230509.75 6883738.3
 230513.74 6883735.9 230515.87 6883741.1

Rehabilitation



Map Projection: Transverse Mercator
Horizontal Datum: GDA 1994
Grid: GDA 1994 MGA Zone 50



Figure 1B
GMA Garnet
Port Gregory Garnet
CPS 5947/2
Annual Clearing Report
2021 - 2022

230000

6885000

2300000

6885000

Legend

- CPS 5497 Clearing 2021- 2022
- CPS 5947
- DMIRS Mining Tenements

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229862.91 6884484.2 229909.51 6884482.9

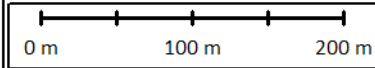
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Pit Expansion

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230024.81 6884352.3

230011.17 6884299.3



Map Projection: Transverse Mercator
Horizontal Datum: GDA 1994
Grid: GDA 1994 MGA Zone 50



Figure 1B
GMA Garnet
Port Gregory Garnet
CPS 5947/2
Annual Clearing Report
2021 - 2022

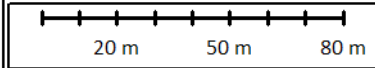
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Legend

- CPS 5497 Clearing 2021- 2022
- CPS 5947
- DMIRS Mining Tenements

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 230501.43 6883741.1 230509.75 6883738.3
 230513.74 6883735.9 230519.09 6883738.1
 230513.19 6883726.4 230516.39 6883722.2
 230522.93 6883718.1 230527.75 6883720.9
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 230537.42 6883694.8 230541 6883694.2
 230550.65 6883684.2

Rehabilitation
 Rehabilitation



Map Projection: Transverse Mercator
 Horizontal Datum: GDA 1994
 Grid: GDA 1994 MGA Zone 50



Figure 1B
 GMA Garnet
 Port Gregory Garnet
 CPS 5947/2
 Annual Clearing Report
 2021 - 2022

230000

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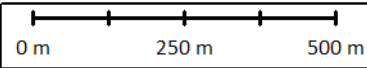
Legend

- CPS 5947 Clearing 2022- 2023
- CPS 5947-1
- DMIRS Mining Tenements

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 230351.15 6883966.9
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 230481.18 6883855.7

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 230941.29 6883407.9
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 230991.77 6883291.2



Map Projection: Transverse Mercator
Horizontal Datum: GDA 1994
Grid: GDA 1994 MGA Zone 50



Figure 1A
GMA Garnet
Port Gregory Garnet
CPS 5947/1
Annual Clearing Report
2022 - 2023

230000