Gosnells Quarry

Flora, Vegetation and Targeted Survey

Gosnells Quarry

Flora, Vegetation and Targeted Survey

Client: Holcim (Australia) Pty Ltd

ABN: 87 099 732 297

Prepared by

AECOM Australia Pty Ltd
3 Forrest Place, Perth WA 6000, GPO Box B59, Perth WA 6849, Australia
T +61 8 6208 0000 F +61 8 6208 0999 www.aecom.com
ABN 20 093 846 925

04-Aug-2017

Job No.: 60522332

AECOM in Australia and New Zealand is certified to ISO9001, ISO14001 AS/NZS4801 and OHSAS18001.

Quality Information

Document Gosnells Quarry

Ref 60522332

Date 04-Aug-2017

Prepared by Floora de Wit

Reviewed by Linda Kirchner

Revision History

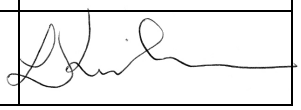
Rev	Revision Date	Details	Authorised	
			Name/Position	Signature
A	07-Dec-2016	Draft for internal review	Linda Kirchner Associate Director - Environment	
B	09-Dec-2016	Draft for client review	Linda Kirchner Associate Director - Environment	
0	19-Dec-2016	Final for submission	Linda Kirchner Associate Director - Environment	
1	04-Aug-2017	Final with Amendments	Linda Kirchner Associate Director - Environment	

Table of Contents

List of Plates

List of Tables

List of Figures

Executive Summary

Holcim (Australia) Pty Ltd (Holcim) is planning to further develop the Gosnells Quarry (the Project) within their approved maximum development area in accordance with the site's Development Approval. The study area is located on the Darling Scarp, approximately 19 km south-east of Perth. AECOM Australia Pty Ltd (AECOM) was commissioned to undertake a flora and vegetation assessment and targeted Threatened orchid and Priority flora surveys to support the environmental assessment process.

Historically, six flora and vegetation assessments have been undertaken at the study area. This report attempts to amalgamate data obtained for the study area, including the vegetation mapping and Priority flora population extent and size. A level 2 flora and vegetation assessment was undertaken in October 2016 for areas previously not surveyed within the study area. The entire study area was traversed on foot and Priority flora boundaries and individual counts obtained for four Priority species previously recorded in the study area.

A total of nine vegetation communities were described and mapped within the study area. This included four heath communities, considered locally significant due to their unique and highly diverse floristic composition of shrubs and forbs. These communities also support the majority of Priority flora species. No Threatened Ecological Communities or Priority Ecological Communities were identified within the study area.

Five species of conservation significance were recorded within the study area. These were all Priority flora species. No species listed under the *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) or the *Wildlife Conservation Act 1950* (WC Act) were recorded. The conservation significant flora species recorded comprised:

- *Acacia horridula* (Priority 3) – lacking recent count data this species may be locally significant. Known from multiple adjacent local government areas therefore not considered regionally significant.
- *Acacia oncinophylla* subsp. *patulifolia* (Priority 4) – locally common and not considered regionally significant
- *Asteridea gracilis* (Priority 3) – may be locally common but under-sampled, may be regionally significant as it represents western extent of range
- *Beaufortia purpurea* (Priority 3) – locally significant and potentially regionally significant due to population size and extent within study area
- *Lasiopetalum glutinosum* subsp. *glutinosum* (Priority 3) – locally and potentially regionally significant due to size and extent of populations within the study area.

Targeted surveys for the conservation significant orchid species *Thelymitra magnifica* (Priority 1) and *Thelymitra stellata* (Endangered under the WC Act and the EPBC Act) were conducted during ideal detection periods in 2014, 2015 and 2016. Neither species was recorded in the study area. All areas of potentially suitable habitat were surveyed within the study area.

There were no significant limitations associated with the surveys, with sufficient rainfall recorded in the three months preceding the field survey, and an additional 11 limitations considered and addressed. No additional flora and vegetation surveys are recommended.

1.0 Introduction

1.1 Project Background

Holcim (Australia) Pty Ltd (Holcim) owns and operates Gosnells Quarry (the Quarry), providing a major source of hard rock products for the construction industry in the Perth region since the 1930s. The Quarry operation includes material extraction, crushing and screening, stockpiling, and distribution of material.

Holcim operates within an approved limit of extraction under their Extractive Industry Licence, granted by the City of Gosnells in 2007. Their maximum extraction limit has been defined within a Development Approval, granted by City of Gosnells in 1985.

Multiple biological investigations have been undertaken within the approved development approval area to define floristic and vegetation values. This has included flora and vegetation assessments and targeted Threatened and Priority flora surveys.

Holcim is planning to further develop its current operations at the Quarry within the approved development approval footprint. Additional flora and vegetation surveys were required to define the vegetation communities and condition, and map and quantify the presence of Threatened and Priority flora.

1.2 Project Location

The Quarry is located at Lot 3 Cockram Road in Martin, WA, situated on the Darling Scarp, approximately 19 km south-east of Perth. The Holcim tenement boundary (Figure 1) represents the development perimeter (project area), including 54.26 ha cleared areas for the existing quarry and associated infrastructure, 137.79 ha native vegetation and 7.85 ha of planted/rehabilitated vegetation.

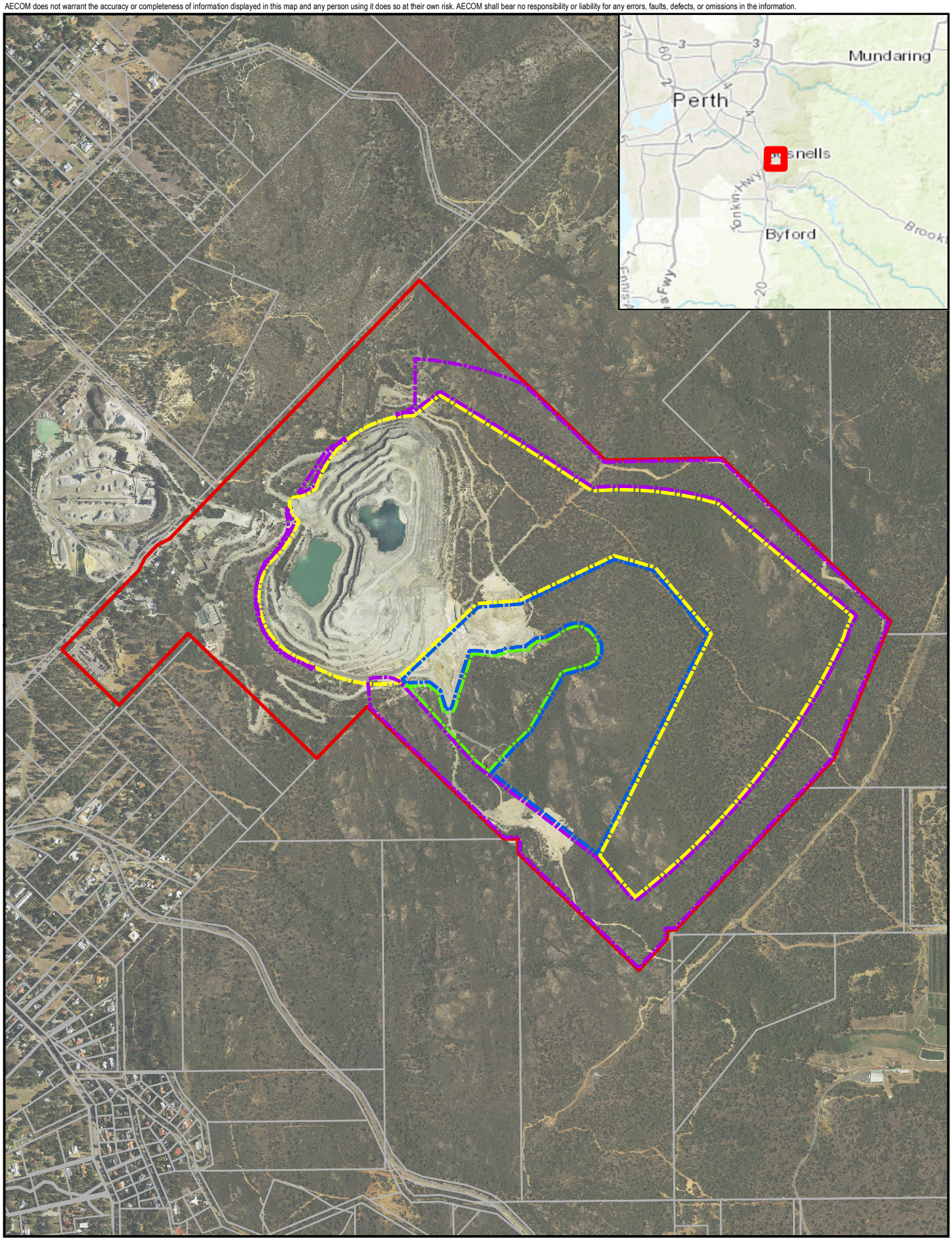
The study area refers to the area surveyed in 2016 and includes a buffer perimeter of additional vegetation mapping undertaken to supplement 2015 mapping, and Threatened and Priority flora mapping within the larger area previously surveyed in 2014, 2015 and 2016.

1.3 Objectives

The objective of this assessment was to collate the previous studies undertaken at the Quarry and undertake a flora and vegetation assessment for areas not previously assessed. Specifically, the scope included:

- A review and summary of existing information available including flora and vegetation assessments previously undertaken at the Quarry and Department of Parks and Wildlife (DPaW) and Protected Matters database results
- Undertake a flora and vegetation assessment compliant with current Environmental Protection Authority (EPA) and Department of Parks and Wildlife (DPaW) guidelines within areas not previously subject to these investigations, including:
  - vegetation community and condition mapping
  - Threatened and Priority targeted flora searches
- Complete targeted Threatened and Priority flora searches within the development approval area to ascertain the presence and locations of all significant flora species.

This report presents a collation of the results of all previous studies and the 2016 field survey results.



PROJECT ID 60522332
CREATED BY DGF/RNM
APPROVED BY FDW
LAST MODIFIED 29 AUG 2017

AECOM
www.aecom.com

N

DATUM GDA 1994, PROJECTION MGA ZONE 50

0 110 220 330 440
metres

1:15,000 when printed at A4

LEGEND

- Astron 2012 and Bennett 2014 Survey Area
- AECOM 2014 Survey Area
- AECOM 2015 Survey Area
- AECOM 2016 Survey Area
- Holcim Tenement
- Cadastre Boundaries

Data sources: Sources: Esri, HERE, DeLorme, Intermap, increment P Corp., GEBCO, USGS, FAO, NPS, NRCAN, GeoBase, IGN, Kadaster NL, Ordnance Survey, Esri Japan, METI, Esri China (Hong Kong), swisstopo, MapmyIndia, © OpenStreetMap contributors, and the GIS User Community

Base Data: (c) Based on information provided by and with the permission of the Western Australian Land Information Authority trading as Landgate (2010).

Site Location

HOLCIM QUARRY

Figure

1

Map Document: P:\605X\60522332\4. Tech Work Area\4.99 GIS\02_MXDs\Figures\G60522332_Fig1_DevFootprint_RNM_v03_20170829.mxd (rob.mcgregor)

A4 size

2.0 Legal Framework

2.1 Overview

Key legislation governing the protection and management of Western Australia's conservation significant flora and vegetation are summarised in Table 1 and further discussed below.

Table 1 Relevant legislation, regulations and guidance

Legislation	Purpose
Commonwealth of Australia	
Environment Protection and Biodiversity Conservation Act 1999 (EPBC Act)	Provides for the protection of the environment and the conservation of biodiversity. Gosnells Quarry is exempt from the assessment and approval provisions of the EPBC Act in accordance with Section 43B of the EPBC Act.
Western Australia	
Wildlife Conservation Act 1950 (WC Act)	Provides for the conservation and protection of Western Australia's wildlife.
Environmental Protection Act 1986 (EP Act)	Preventing, controlling and abating environmental harm and conserving, preserving, protecting, enhancing and managing the environment.
Biosecurity and Agriculture Management Act 2007 (BAM Act)	Provides for the management, control and prevention of certain plants and animals, and for the protection of agriculture and related resources generally.

2.2 Commonwealth Legislation

The EPBC Act is the main piece of federal legislation protecting biodiversity in Australia. If an action or project is likely to have a significant impact on a matter of national environmental significance this action must be referred to the Minister for the Environment for a decision on whether assessment and approval is required under the EPBC Act.

2.2.1 Matters of National Environmental Significance

Matters of national environmental significance include:

- listed threatened species and ecological communities
- migratory species protected under international agreements
- Ramsar wetlands of international importance
- the Commonwealth marine environment
- world Heritage properties
- national Heritage places
- Great Barrier Reef Marine Park
- a water resource, in relation to coal seam gas development and large coal mining development
- nuclear actions.

2.2.2 Flora

Species at risk of extinction are recognised at a Commonwealth level and are categorised in one of six categories as outlined in Table 2.

Table 2 Categories of species listed under Schedule 179 of the EPBC Act

Conservation code	Category
Ex	Extinct Taxa
ExW	Extinct in the Wild
CE	Critically Endangered
E	Endangered
V	Vulnerable
CD	Conservation Dependent

2.2.3 Communities

Communities can be classified as Threatened Ecological Communities (TECs) under the EPBC Act. The EPBC Act protects Australia's ecological communities by providing for:

- identification and listing of ecological communities as threatened
- development of conservation advice and recovery plans for listed ecological communities
- recognition of key threatening processes
- reduction of impacts of these processes through threat abatement plans.

Categories of federally listed TECs are described in Table 3.

Table 3 Categories of TECs that are listed under the EPBC Act

Conservation Code	Category
CE	Critically Endangered - is facing an extremely high risk of extinction in the wild in the immediate future
E	Endangered - not critically endangered and is facing a very high risk of extinction in the wild in the near future
V	Vulnerable - not critically endangered or endangered, but is facing a high risk of extinction in the wild in the medium-term future

2.3 Western Australian Legislation

2.3.1 Flora

Plants that are considered threatened and need to be specially protected because they are under identifiable threat of extinction are listed under the WC Act. These categories are defined in Table 4.

Table 4 Conservation codes for WA flora listed under the WA Act

Conservation Code	Category
CR	Critically endangered species
EN	Endangered species
VU	Vulnerable species
EX	Presumed extinct species

Species that have not yet been adequately surveyed to warrant being listed under the WA Act are added to the Priority flora List by the State Minister of Environment.

Table 5 Conservation codes for WA flora as endorsed by the Minister for Environment

Conservation Code	Category
Priority One	Poorly known species
Priority Two	Poorly known species
Priority Three	Poorly known species
Priority Four	Rare, Near Threatened and other species in need of monitoring
Priority Five	Conservation Dependent species

2.3.2 Communities

State listed TECs are not protected under any legislation, rather they are endorsed by the Minister for Environment. Categories of TECs are defined in Table 6. Priority Ecological Communities (PECs) are endorsed by the Minister for Environment as having insufficient information available to be considered as a TEC, or which are rare but not currently threatened. These categories are described in Table 7.

Table 6 Conservation codes for State-listed Threatened Ecological Communities

Conservation Code	Category
PD	Presumed Totally Destroyed
CR	Critically Endangered
EN	Endangered
VU	Vulnerable

Table 7 Conservation codes for Priority Ecological Communities

Conservation	Code Category
P1	Priority One - poorly-known ecological communities
P2	Priority Two - poorly-known ecological communities
P3	Priority Three - poorly known ecological communities
P4	Priority Four - ecological communities that are adequately known, rare but not threatened or meet criteria for Near Threatened, or that have been recently removed from the threatened list.
P5	Priority Five - Conservation Dependent ecological communities

3.0 Methodology

3.1 Desktop Assessment

The desktop assessment included a comprehensive literature review of all studies previously conducted at the quarry and government database searches. Documents and sources incorporated in this report include:

- Vegetation and Flora Readymix Quarry Gosnells (Bennett Environmental Consulting [Bennett], 2005)
- Vegetation survey of two sites at Readymix quarry at Gosnells (Bennett, 2006)
- Desktop flora and vegetation assessment undertaken for the Holcim development area (Astron, 2012a)
- Field survey of flora, vegetation and fauna (Astron, 2012b)
- Gosnells Quarry Clearing Permit CPS 5543/2 Amendment Application Supporting Information (URS Australia Pty Ltd [URS], 2013)
- Review of habitat and targeted searches for *Thelymitra stellata* and *Thelymitra magnifica* (Bennett, 2014)
- Flora, Vegetation and Targeted Orchid Assessment (AECOM, 2014)
- Flora, Vegetation and Targeted Orchid Assessment (AECOM, 2015)
- DPaW database searches (requested February 2016).

Studies undertaken prior to the AECOM surveys were used to inform the sample plan and targeted searches undertaken in 2014, 2015 and 2016. Significant vegetation communities and species identified in the desktop assessment were reviewed to determine the likelihood of their presence within the study area. The likelihood of occurrence was based on locations of known records/locations of significant values, and the presence of suitable habitat within the study area.

Context of the survey results, including their local and regional significance, was based on current published knowledge of species, and informed by publicly available information including:

- Geological Survey of Western Australia and Geoscience (2008)
- WA Atlas (Landgate, 2016)
- Climate statistics (BOM, 2016)
- Vegetation complexes (Heddle *et al.*, 1980)
- Pre-European vegetation complexes (Beard, 1981).

3.2 Field Survey

Six flora and vegetation assessments of various intensity and extent have been undertaken at the Quarry since 2005. The survey methodology can be reviewed in each of the detailed flora and vegetation assessment reports. Field survey methodology detailed in this section applies only to the field survey undertaken by AECOM in 2016.

3.2.1 Bennett 2005 Survey

The field assessment was undertaken on 7th and 8th October 2004. An aerial photograph of the area to be surveyed was provided prior to undertaking the field work. Transects were walked through the bush, ensuring that all variations in vegetation noted in the aerial were included. During the survey any Declared Rare or Priority Flora located were recorded with a GPS reading in WGS84, a photograph, and an estimate of the number.

Prior to undertaking the field work all listed Declared Rare and Priority Flora had been checked against specimens housed at the Western Australian Herbarium

Where plants were unknown in the field they were collected, pressed and later identified using appropriate keys and by comparison with collections housed at the Western Australian Herbarium. A pressed collection of each species of Declared Rare and Priority Flora was submitted to the Western Australian Herbarium for incorporation in their collection and all data was forwarded to the Rare Flora Section of the Department of Conservation and Land Management.

3.2.2 Astron 2012b Field Survey

The field survey was conducted by Astron personnel on 8 October 2012. The team consisted of Alice Bott (Botanist) and Dr Jessica Oates (Senior Zoologist).

The vegetation and flora field survey was undertaken in accordance with the requirements for a Level 1 assessment outlined in the EPAs *Position Statement 3: Terrestrial Biologica*l *Surveys as an Element of Biodiversity Protection* (2002) and *Guidance Statement 51: Terrestrial Flora and Vegetation Surveys for Environmental Impact Assessment in Western Australia* (2004a). Information acquired during the desktop study assisted in the design of the field survey. Pre- survey planning involved the examination of 1:10,000 scale aerial photography, landforms, surrounding vegetation mapping and vegetation community descriptions.

The number and location of sampling sites were determined based on the following criteria:

- the inclusion of at least one sample site in each vegetation association, distinguishable on aerial photographs
- sampling in homogenous vegetation and the avoidance of ecotone (transition) areas between associations
- the inclusion of target areas that are prospective for listed ecological communities and flora species identified during the desktop study
- the inclusion of target areas that are prospective for ecosystems identified as being at risk orof high priority for reservation (Williams and Mitchell 2001)
- the availability of safe access to the site.

A total of seven relevé quadrats (unmarked and unbounded sample areas) were surveyed in representative vegetation associations within the survey area. The following information was collected at each relevé:

- Location – coordinates measured using a handheld GPS (MGA50, GDA94). One set of coordinates taken from a central location of each relevé.
- Recorder and date–a list of the personnel involved in sampling that location and the survey date.
- Species – dominant vascular plant species present including introduced species. Species that could not be identified in the field were collected for later identification at the Astron herbarium or WA Herbarium.
- Weeds – the coordinates and density of any introduced flora.
- Vegetation description – Vegetation was described according to Keighery 1994, as adapted from Muir 1977 and Aplin 1979,and the National Vegetation Inventory System (NVIS), level 5. At this level, vegetation is described to ‘association’ where up to three dominant genera for each of the upper, mid and ground strata are categorised based on dominant growth form, cover and height.
- Vegetation condition – assessed according to the Vegetation Condition Scale modified from Trudgen 1991 by Keighery 1994.
- Habitat – a broad description of the surrounding landscape based on landform, topography and soil.
- Disturbances – records of any obvious disturbances such as fire, tracks or grazing.
- Photographs – a photograph was taken of each relevé.

A hard copy colour aerial photograph on an A3 map at a scale of 1: 10,000 was used to locate the survey area and to assist in navigation as well as delineating vegetation boundaries.

3.2.3 2014 Level 1 Flora Survey

The flora and vegetation survey was conducted in accordance with EPA Guidance Statement 51: *Terrestrial Surveys for Environmental Impact Assessment in Western Australia* (2004).

The Level 1 flora and vegetation survey was conducted by Catherine Krens (AECOM Senior Botanist) with assistance from Priscilla Fleming (Holcim personnel). The survey involved identifying and spatially mapping the vegetation communities present within the project area.

Flora and vegetation was sampled following DEC's (now DPaW) Standard Operating Procedure SOP No. 6.1 - Establishing Vegetation Quadrats, which recommends establishing 10 x 10m quadrats within the Jarrah Forest bioregion. A minimum of two quadrats were established within each vegetation community (DEC, 2009). Within each quadrat the following parameters were recorded:

- site number
- date
- GPS location
- photograph of the vegetation
- soil type
- topography
- vegetation type
- vegetation condition using the Keighery (1994) scale
- disturbance notes
- fire history
- species present
    - stratum
    - dominant species
    - estimated height
    - estimated percentage cover.

Characterisation of the vegetation communities involved describing the vegetation type using the National Vegetation Information System (NVIS) vegetation attribute standards. Vegetation communities were spatially mapped based on changes in landform and dominant species structure and composition. Where marked changes in species composition and floristic structure are observed a new vegetation community was described documenting all species observed (taking note of dominants) and structure.

Vegetation condition was determined in relation to the (perceived) ability of the bushland to maintain itself (Keighery, 1994). This is commonly interpreted primarily on the ratio of visible introduced species to native species; however, disturbance (e.g. grazing, erosion), degree of alteration to community and habitat structure, site ecology and other factors are also considered. The condition of the project area was determined at a range of detailed recording sites and in between as necessary, where condition was observed to change. The categories of vegetation condition used were consistent with a combination of methods developed by Keighery (1994) Table 8.

Table 8 Bushland condition ratings (Keighery 1994)

Condition category	Description
Pristine	Pristine or nearly so, no obvious signs of disturbance. *0% weed cover*
Excellent	Vegetation structure intact, disturbance affecting individual species and weeds are non-aggressive species. *1 – 5% weed cover*
Very Good	Vegetation structure altered obvious signs of disturbance. For example, disturbance to vegetation structure caused by repeated fires, the presence of some more aggressive weeds, dieback, logging and grazing. *5 – 25% weed cover*
Good	Vegetation structure significantly altered by very obvious signs of multiple disturbances. Retains basic vegetation structure or ability to regenerate it. For example, disturbance to vegetation structure caused by very frequent fires, the presence of some very aggressive weeds at high density, partial clearing, dieback and grazing. *25 – 50% weed cover*
Degraded	Basic vegetation structure severely impacted by disturbance. Scope for regeneration but not to a state approaching good condition without intensive management. For example, disturbance of vegetation structure caused by very frequent fires, the presence of very aggressive weeds, partial clearing, dieback and grazing. *50 – 75% weed cover*
Completely Degraded	The structure of the vegetation is no longer intact and the area is completely or almost completely without native species. These areas are often described as “parkland cleared” with the flora comprising weed or crop species with isolated native trees or shrubs. *75 – 100% weed cover*

An inventory of species including weed species was recorded within the project area. Areas of weed infestation were mapped with particular attention paid to Declared Pests (i.e. weeds listed under the BAM Act). If Declared Pests were observed their location and extent were mapped and recorded with a GPS.

Plants unable to be identified in the field were collected and processed in accordance with the Western Australian Herbarium (WAH) Standards. To aid in recognising individuals during the survey a field herbarium was maintained. To verify identification the collected specimens were compared to specimens held at the WAH with reference to taxonomic keys. Where appropriate, expertise from DPaW taxonomists were sought out to ensure accurate identification of specimens.

3.2.4 2015 Level 2 Flora Survey

A single-phase Level 2 Flora and Vegetation Assessment was conducted within the Project area (Figure 1) in accordance with EPA Guidance Statement 51: *Terrestrial Surveys for Environmental Impact Assessment in Western Australia* (2004). The survey was led by Senior Botanist Floora de Wit with Lyn Van Gorp as field assistant.

Floristic data was collected at sample point locations using a combination of 10 m x 10 m non-permanent quadrats and relevés to document the floristics, community composition, condition, and other identifying features of the Project area. Sample point locations were selected to ensure accurate representation of native vegetation within the Project area. Changes in floristic composition and structure were recorded and mapped as the Project area was traversed.

Flora and vegetation sampling followed methodology used in 2014, described in Section 3.2.1.

Quantitative flora data were used to define the vegetation communities. Vegetation communities were described and mapped based on changes in dominant species composition and landform. Vegetation community descriptions were based on the National Vegetation Information System (NVIS) framework (Commonwealth of Australia, 2003).

Vegetation condition was determined using the Keighery (1994) condition scale.

3.2.5 2016 Level 2 Flora Survey

A level 2 flora and vegetation assessment was undertaken within a corridor surrounding areas previously surveyed by AECOM in 2015 (the study area, Figure 2). This included quadrat-based sampling of floristic and vegetation community data and targeted threatened species searches following methodology outlined in EPA Guidance Statement 51 (GS51; 2004) and the EPA & DPaW technical guide (2015).

Floristic data was sampled from a combination of non-permanent quadrats and relevès following DPaW's Standard Operating Procedure (SOP) No. 6.1 - Establishing Vegetation Quadrats (DEC, 2009). Quadrats were 10x10 metres (m) defined by a measuring tape. Data collected from quadrats included the presence of plant species, their cover abundance, structural composition of vegetation, physical environment, and presence/absence of disturbance. Each sample point location was given a unique site number, and the following parameters recorded:

- date
- location using hand-held GPS (accuracy of 5 m)
- photograph
- soil details (type, colour, moisture)
- topography
- vegetation condition using the Keighery (1994) scale
- disturbance notes
- fire history
- species present
  - estimated height
  - estimated percentage cover.

Changes in floristic composition and structure were recorded and mapped as the study area was traversed. The AECOM survey effort including track logs for targeted surveys and all quadrats completed is shown in Figure 2.

Preliminary mapping of vegetation communities was undertaken prior to conducting the field survey to ensure that a minimum of three quadrats were sampled. Information gaps identified in previous surveys allowed for additional quadrats to be sampled in vegetation communities considered under-represented. The floristically diverse heath community mosaics were subject to additional sampling endeavouring to capture all vascular flora species present. This also ensures compliance with the regulator standards.

Flora species unable to be identified in the field were collected and processed in accordance with the Western Australian Herbarium (WAH) standards. A field herbarium was maintained to aid in recognising individuals during the survey. To verify identification the collected specimens were compared with reference to taxonomic keys to specimens held at the WAH. Where appropriate, expertise from DPaW taxonomists were sought out to ensure accurate identification of specimens.

3.2.6 Threatened Orchids

Previous biological assessments at the Gosnells Quarry concluded that there is the potential for the two conservation significant orchid species *Thelymitra stellata* (Endangered under the WC Act and EPBC Act) and *Thelymitra magnifica* (Priority 1) to occur at the Quarry. The project area has been comprehensively searched for both orchid species by Bennett and AECOM. A summary of survey effort and factors critical to the detectability of orchids is addressed in Table 9. These factors were derived from the Threatened orchid survey guidelines, published by Commonwealth of Australia (2013a).

Threatened orchid surveys were undertaken by AECOM in 2014, 2015 and 2016.

Prior to undertaking targeted surveys in 2016, advice from DPaW was sought in lieu of current climate conditions. DPaW advised on ideal survey timing and survey methodology which verified previous survey effort as suitable (communication provided in Appendix A).

The identification of orchids encountered was based on their key morphological features defined by Jones (2006) and Brown *et al.* (2013).

Table 9 Factors considered to improve detectability of both *Thelymitra* species

Factor	Survey Year			
	2014a	2014b	2015	2016
Use of appropriate personnel	Dr Eleanor Bennett Priscilla Fleming	Dr Andrew Batty Lyn van Gorp	Dr Andrew Batty Lyn van Gorp Floora de Wit	Floora de Wit Lyn van Gorp
Determining the optimal timing of survey	20 Oct, 3 Nov	17-19 Nov	26-28 Oct 11-13 Nov. A known population of *T. magnifica* was visited to verify flowering period.	25-27 Oct, confirmed by A. Brown and J. Donaldson from DPaW
Characterisation of the study area	Suitable habitat identified prior to undertaking surveys.	Study area was categorised into three habitat types including Prime, Marginal and Unsuitable. Prime habitat was defined by vegetation most commonly associated with the species. Marginal habitat lacked typical associated species and/or soil types were not considered ideal. Unsuitable habitat lacked all associated species and/or foliage cover was considered unsuitable.		
Establishing a sample design	Transects of 5-10 metres were walked side by side, distance dependent on detectability of flower.			
Applying sufficient survey effort	Unknown	GPS track logs were used as a quality control measure to ensure adequate coverage of the study area, see Figure 2		

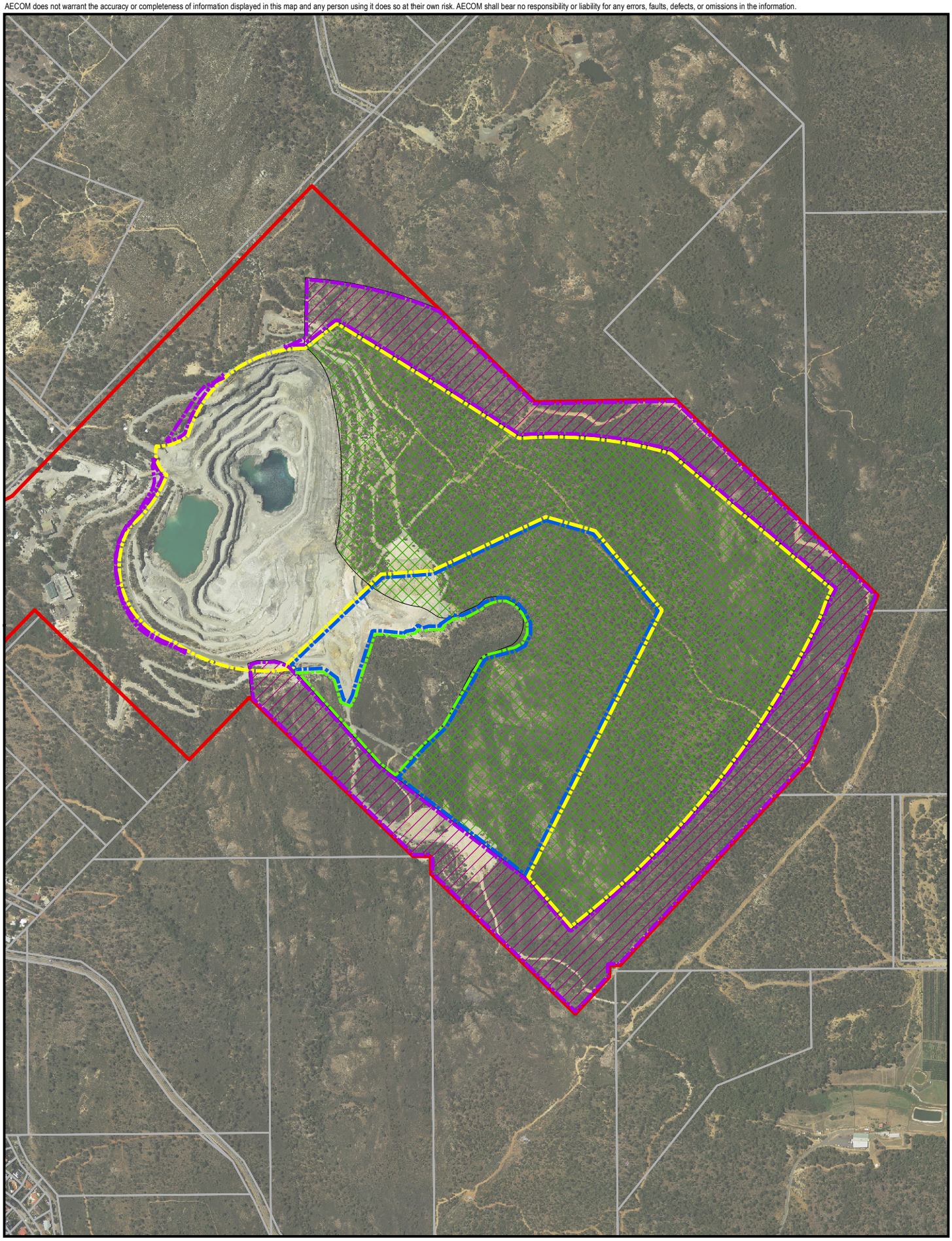
3.2.7 Other Threatened and Priority flora

Targeted flora searches were undertaken within a larger study area (targeted study area), most of which has been previously surveyed by AECOM in 2014 and 2015 (Figure 2).

Two flora species listed as Threatened under the EPBC Act were targeted during the 2016 surveys. *Darwinia apiculata* and *Goodenia arthrotricha* are both associated with rocky outcrops and heath. The field surveys were undertaken during both these species' flowering period (October). A DPaW record of *G. arthrotricha* was visited to obtain further species information. This record was located on a steep gravel slope north of the project area. The steep slope made it unsafe to undertake detailed searches at this location. The record is from 2005 therefore location data is likely to be accurate. Absence of a species from one survey event is not adequate to dismiss the species as present at this location.

Priority flora species have been recorded within the heath vegetation at the Quarry by Bennett (2006), Astron (2012b), and AECOM (2014 and 2015). All heath vegetation within the project area, excluding areas previously surveyed by Bennett (2006) and Astron (2012b) was subject to a targeted survey.

Previously recorded locations of Priority flora were visited to quantify and map the population size and extent. The 2016 survey provided comprehensive details for all Priority flora encountered at the Quarry. All heath vegetation was traversed by walking meandering transects. Where possible, Priority flora individuals were recorded using a hand-held GPS. Where populations of species extended over large areas, the population boundary was recorded and an estimated number was recorded at regular intervals. This provided an estimate of abundance for defined populations or sub-populations.



PROJECT ID 60522332
CREATED BY DGF/RNM
APPROVED BY FDW
LAST MODIFIED 29 AUG 2017

AECOM
www.aecom.com

N

DATUM GDA 1994, PROJECTION MGA ZONE 50

0 125 250 375 500
metres

1:12,500 when printed at A4

LEGEND

- Astron 2012 and Bennett 2014 Survey Area
- AECOM 2016 Survey Area
- AECOM 2015 Survey Area
- AECOM 2014 Survey Area
- AECOM 2016 Area Subject to the Flora and Vegetation Assessment (subject to Targeted Survey Including Thelymitra sp.).
- AECOM 2016 Targeted Survey Excluding Thelymitra
- Holcim Tenement
- Cadastre Boundaries

Data sources:

Base Data: (c) Based on information provided by and with the permission of the Western Australian Land Information Authority trading as Landgate (2010).

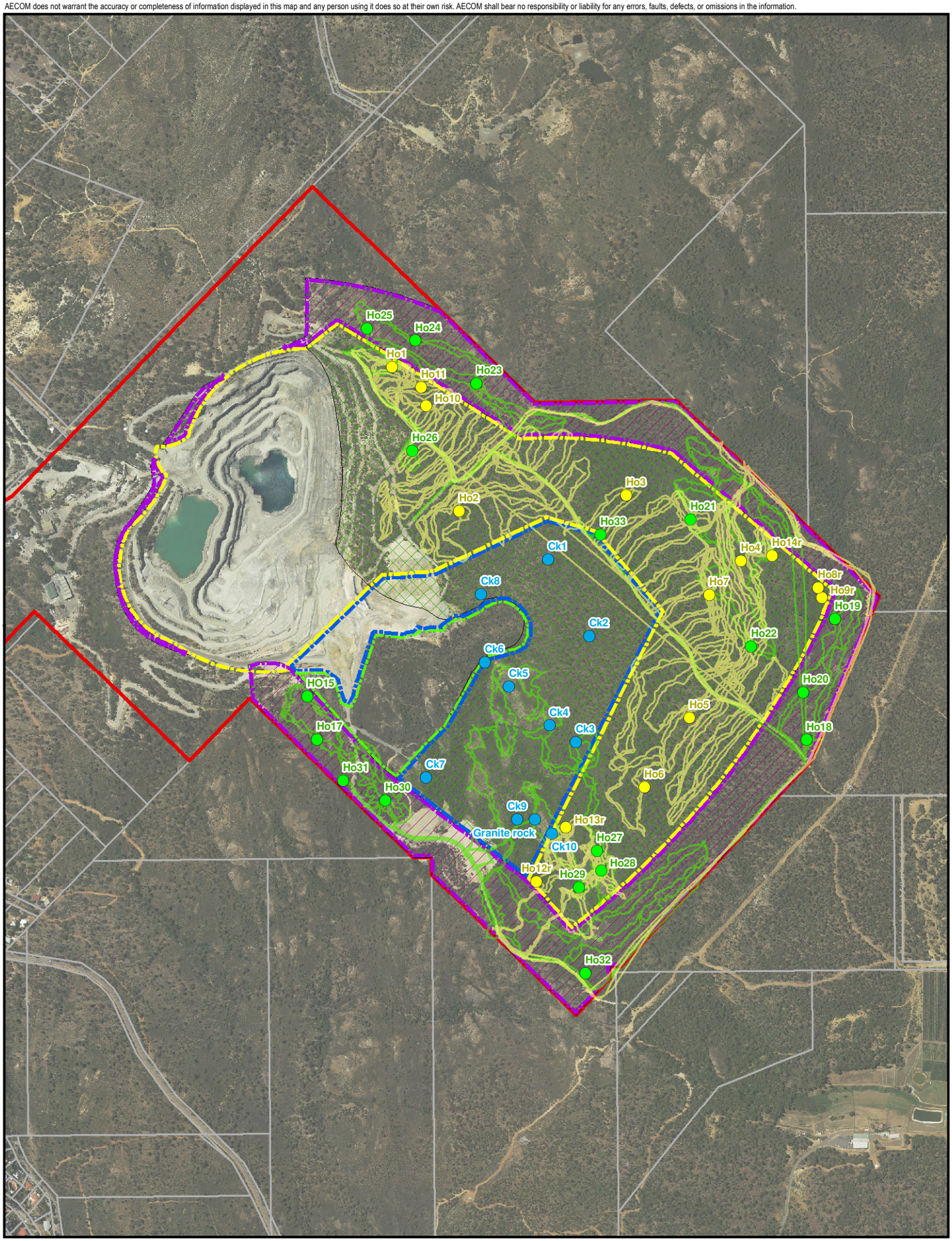
2016 Study Area

HOLCIM QUARRY

Figure 2

Map Document: P:\605X\60522332\4. Tech Work Area\4.99 GIS\02_MXDs\Figures\G60522332_Fig2_2016StudyArea_RNM_v03_20170829.mxd (rob.mcgregor)

A4 size



PROJECT ID 60522332
CREATED BY DGF/RNM
APPROVED BY FDW
LAST MODIFIED 29 AUG 2017

AECOM
www.aecom.com

N

DATUM GDA 1994, PROJECTION MGA ZONE 50

0 125 250 375 500
metres

1:12,500 when printed at A4

LEGEND

- 2014 Sites
- 2015 Sites
- 2016 Sites
- 2015 Track Logs
- 2016 Track Logs
- Holcim Tenement
- Cadastre Boundaries
- Astron 2012 and Bennett 2014 Survey
- AECOM 2014 Survey Area
- AECOM 2015 Survey Area
- AECOM 2016 Survey Area
- AECOM 2016 Area Subject to the Flora and Vegetation Assessment (subject to Targeted Survey Including Thelymitra sp.).
- AECOM 2016 Targeted Survey Excluding Thelymitra Sp.

Data sources:

Surveys Undertaken To-Date

HOLCIM QUARRY

Figure 3

Map Document: \\AUPER1FP001.AU.AECOMNET.COM\Projects\605X\60522332\4. Tech Work Area\4.99 GIS\02_MXDs\Figures\G60522332_Fig3_SurveysToDate_RNM_RNM_v03_20170829.mxd (rob.mcgregor)

A4 size

3.3 Reporting

3.3.1 Vegetation Community Mapping

Quantitative flora data were used to define the vegetation communities. Vegetation community mapping was undertaken by amalgamating the AECOM 2014, 2015 and 2016 data. Astron (2012b) and Bennett (2005) data was not included in any further data analysis. Vegetation community descriptions were based on the National Vegetation Information System (NVIS) framework (Commonwealth of Australia, 2003) to Level VI Sub-Association as prescribed in the flora survey technical guide (DPaW & EPA, 2015).

Mapping of a small portion of the study area was undertaken by Astron (2012a). Whilst traversing the study area and collecting additional data, this mapping was amended to reflect current communities observed. This particularly affected heath communities which were traversed entirely on foot for the targeted flora survey and observations made for species composition changes.

Vegetation condition was determined using the Keighery (1994) condition scale (Table 10). The scale is based on disturbance (e.g. grazing, erosion), degree of alteration to community and habitat structure and site ecology.

Table 10 Bushland Condition Ratings (Keighery 1994)

Descriptor	Explanation
Pristine	Pristine or nearly so, no obvious signs of disturbance.
Excellent	Vegetation structure intact, disturbance affecting individual species and weeds are non-aggressive species.
Very Good	Vegetation structure altered obvious signs of disturbance. For example, disturbance to vegetation structure caused by repeated fires, the presence of some more aggressive weeds, dieback, logging and grazing.
Good	Vegetation structure significantly altered by very obvious signs of multiple disturbances. Retains basic vegetation structure or ability to regenerate it. For example, disturbance to vegetation structure caused by very frequent fires, the presence of some very aggressive weeds at high density, partial clearing, dieback and grazing.
Degraded	Basic vegetation structure severely impacted by disturbance. Scope for regeneration but not to a state approaching good condition without intensive management. For example, disturbance of vegetation structure caused by very frequent fires, the presence of very aggressive weeds, partial clearing, dieback and grazing.
Completely Degraded	The structure of the vegetation is no longer intact and the area is completely or almost completely without native species. These areas are often described as “parkland cleared” with the flora comprising weed or crop species with isolated native trees or shrubs.

3.3.2 Priority Flora

Populations were mapped in accordance with DECs Threatened and Priority Flora Report Form Field Manual (DEC, 2010). Populations are a discrete group of interbreeding individuals of a species (DEC, 2010). The following guidelines were applied:

- Plants more than 500 m from a known population are considered a new population
- Within a population, plants that have considerable, recognisable separation between them are considered separate sub-populations
- Population data including a vouchered specimens, spatial data and abundance counts/estimated were provided to DPaW and WAH.

An assessment of local and regional significance of all Priority flora populations recorded at the Quarry was undertaken. This assessment was informed by existing information available for each species including DPaW and WAH database results obtained on 22 February 2016, and Florabase (WAH, 1998).

Priority flora populations at the Quarry were considered locally significant if they represented a significant proportion of locally known populations based on number of individuals and total number of populations recorded.

Priority flora populations were considered regionally significant if there are no known records on DPaW and/or WAH databases and/or they represent the limit or extension of their current known range (as published on Florabase).

Similar habitat was observed outside the study area which may provide suitable habitat for Priority species recorded within the study area.

Database records older than 1970 were discounted due to the uncertainty/unreliability of location.

3.4 Limitations

Limitations associated with the 2016 field surveys undertaken at the Quarry are discussed in Table 11. It should be noted that limitations do not consider methodology applied during previous surveys. These can be reviewed in the original flora and vegetation assessment reports of Bennett, Astron and AECOM.

Table 11 Limitations of the Assessment

Limitation	Impact on 2016 Survey
Competency/experience of consultant conducting survey	**Not a constraint.** The field surveys, mapping and reporting was led by Floora de Wit who has more than 9 years' experience undertaking similar scopes. She was involved with the 2014 and 2015 field surveys which gives her a good understanding of the floristic and vegetation values at the Quarry.
Scope (i.e. what life forms were sampled)	**Not a constraint.** All vascular flora species were recorded, including sampling species not able to be accurately identified in the field. Quality control samples of common species were taken to verify their identification at the WAH.
Proportion of flora identified, recorded and/or collected (based on sampling, timing and intensity)	**Not a constraint.** Results from previous surveys were used to inform the 2016 sample plan and targeted search locations. A combination of quadrats (19) and relevès (two) were used to sample flora and vegetation. Furthermore, the total AECOM survey effort including 2014 and 2015 incorporates 37 quadrats and five relevès. A minimum of three quadrats were sampled within each vegetation community in accordance with the technical guide. The field survey was undertaken during the ideal detection period for all Threatened and Priority flora species based on their known flowering period. Orchid survey methods and timing was verified by DPaW.

Limitation	Impact on 2016 Survey
Sources of information	**Not a constraint**. All previous surveys undertaken at the Quarry were considered and informed the sample plan and preliminary mapping. The SPRAT (2016) database provides adequate identification information for the three Threatened flora and Priority flora? species subject to targeted surveys. Publicly available information outlined in Section 3.1 is suitable for providing adequate context for evaluating results of the field survey.
Completion (is further work needed)	**Not a constraint.** Taking into account the total survey effort of the project area to-date, no additional survey work or resampling of quadrats is considered necessary.
Timing, weather, season, cycle	**Not a constraint.** The field survey was undertaken in Spring, coinciding with the flowering period of the majority of species including the three Threatened flora and Priority flora? species.
Disturbances (e.g. fire flood, accidental human intervention) which affected results of the survey	**Minor.** Minor clearing for drilling, including access tracks and drill pads, was observed in the study area. Access tracks resulted in the clearing and/or dissection of Priority flora populations in the area. The clearing for the exploration programme was approved as an exemption under the Environmental Protection (Clearing of Native Vegetation) Regulations 2004 for the clearing of vehicular tracks in 2015. No other disturbances were observed in the study area.
Intensity (was the intensity adequate)	**Not a constraint.** Floristic data was collected from 19 quadrats and two relevès, further supported by observations recorded whilst traversing the study area on foot during targeted flora searches.
Completeness (was relevant area fully surveyed)	**Not a constraint.** The entire study area was traversed on foot to document the flora and vegetation values.
Resources (degree of expertise available in plant/animal identification)	**Not a constraint.** The field survey and data analysis was undertaken by Floora de Wit who has more than 9 years' experience conducting similar surveys in the Jarrah Forest bioregion. Priority flora species were previously identified by Floora de Wit and Lyn van Gorp in 2015 and were therefore easily identified in the field.
Remoteness and/or access problems	**Not a constraint.** The entire study area was traversed on foot.
Availability of contextual information on the region	**Not a constraint**. DPaW and WAH database search results and previous surveys undertaken at the Quarry were used to provide local context. Regional context was obtained from publicly available resources including Beard (1979), Heddle *et al.* (1980) and Mattiske & Havel (1998).

4.0 Existing Environment

4.1 Climate

The Perth region has a warm Mediterranean climate, characterised by hot dry summers and cool to mild wet winters. The closest meteorological recording station with comprehensive long-term data is Gosnells City (Station 009106), located less than 2 km to the west of the Quarry. Gosnells City meteorological station is maintained by the Bureau of Meteorology (BoM) and commenced recording in 1961.

Gosnells City has experienced an average annual rainfall of 825 mm since 1961, with the majority of rainfall occurring between May and August (BoM, 2015). Mean maximum temperature at Gosnells City ranges from 18.7°C in June to 33.2°C in January. Average minimum temperatures range from 8.7°C in July to 18.8°C in February. The low temperatures experienced in July, August and particularly September was not considered to have affected flowering times. This was confirmed by DPaW when advice was sought regarding orchid flowering times.

Rainfall in the twelve months preceding the 2016 field survey (Figure 4) was close to the annual average for most months. June experienced significantly below average rainfall, with only 71.4 mm recorded despite the 167.7 mm historical average. The near-average rainfall recorded at City of Gosnells indicates that rainfall is not a limiting factor of the survey, in particular the presence of ephemeral species and germination of orchids.

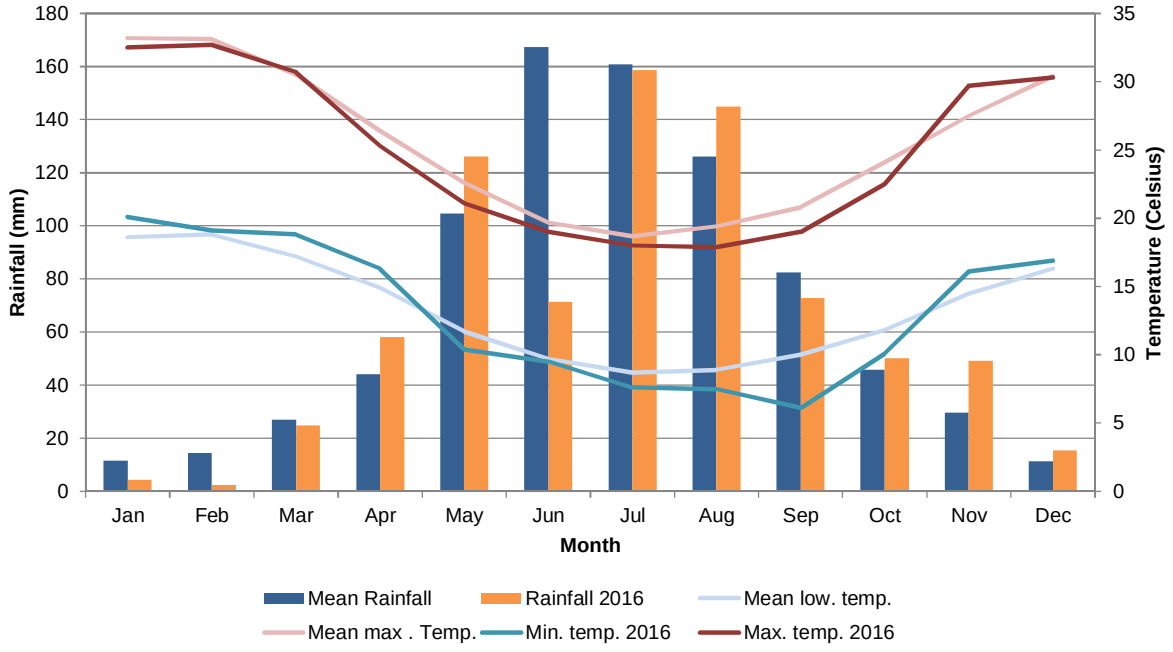


Figure 4 Rainfall statistics for Gosnells City meteorological recording station 9106 showing mean annual rainfall, monthly minimum and maximum temperatures, and rainfall and temperature recorded in the 12 months preceding the field survey. Note, November and December show 2015 data (BoM, 2016)

4.2 Soil and Geology

The Quarry is located on the eastern edge of the Darling Scarp. The surface geology of the entire study area consists of igneous felsic intrusives, which are described as undifferentiated felsic intrusive rocks, including monzogranite, granodiorite, granite, tonalite, quartz monzonite, syenogranite, diorite, monzodiorite, and pegmatite. Locally metamorphosed, foliated gneissic, local abundant mafic and ultramafic inclusions (Geological Survey of Western Australia and Geoscience, 2008).

The study area consists of two differing soil types, JZ1 and Mw31. Soil type JZ1 is described as dissected plateau having a strongly undulating relief, and with some moderately incised valleys. The unit comprises much of the western part of the Darling Range south of the Swan River. It is characterized by lateritic gravels and block laterite (Geological Survey of Western Australia and Geoscience, 2008).

Soil type Mw31 is described as deeply incised, steep scarp and valley side slopes of the Darling Scarp. The chief soils are acid red earths on colluvial slope deposits and are associated with soils on moderate to steep upper slopes with some soils containing ironstone gravel on spurs and ridge tops (Geological Survey of Western Australia and Geoscience, 2008).

4.3 IBRA Regions

There are 89 recognised Interim Biogeographic Regionalisation for Australia (IBRA) Regions across Australia that have been defined based on climate, geology, landforms and characteristic vegetation and fauna. The nationally agreed regionalisation of Australia was first published in Thackway & Cresswell (1995). This dataset is regularly updated to reflect current information on vegetation communities and ecosystem boundaries with IBRA7 reflecting the latest update (Commonwealth of Australia, 2012). The objective of mapping these boundaries was to inform the National Reserve System, providing quantitative data on the current extent of pre-European vegetation remaining within each bioregion, subregion, and local government area. Currently 7.06 % of Australia's native vegetation is protected in the National Reserve System (DPaW, 2016).

The Quarry lies within the Jarrah Forest IBRA Region. The Jarrah Forest Region, described by Thackway & Cresswell (1995), is a duricrusted plateau of Yilgarn Craton characterised by Jarrah-Marri forest on laterite gravels and, in the eastern part, by Marri-Wandoo woodlands on clayey soils. Eluvial and alluvial deposits support *Agonis* shrublands. In areas of Mesozoic sediments, Jarrah forests occur in a mosaic with a variety of species rich shrublands. Currently there is approximately 54% of the original pre-European vegetation remaining in the Jarrah Forest region, with 13.7% protected for conservation (DPaW, 2016).

The Jarrah Forest IBRA region comprises two subregions, the northern and southern Jarrah Forest. The Quarry lies within the Northern Jarrah Forest subregion. This subregion, described in the CALM (2002) Biodiversity Audit, incorporates the area east of the Darling Scarp which overlies Archaean granite and metamorphic rocks capped by extensive lateritic duricrust, dissected by drainage and broken by occasional granite hills.

Williams & Mitchell (2001) further characterise the Northern Jarrah Forest subregion, with Jarrah-Marri forest in the west, Bullich-Blackbutt in the valleys which shifts to Wandoo-Marri in the east, and Powder bark on breakaways. The granite rocks support heath communities and comprise the common understorey of the woodlands in the north and east. Land use is predominantly forestry, conservation, grazing and mining. Rare features of the area include the extensive native forest cover. There is currently 58.5% of the pre-European vegetation remaining, with 9.9% of this protected for conservation (DPaW, 2016).

4.4 Vegetation

4.4.1 Pre-European Vegetation

Broad-scale vegetation mapping has been undertaken for the south-west of Western Australia, including the Beard (1979) pre-European vegetation mapping which provides the basis for the National Reserve System in Western Australia, and the Heddle *et al.* (1980) vegetation complex mapping.

The study area lies within two Beard (1979) vegetation associations, including West Darling 3 medium forest; Jarrah-Marri and, West Darling 4: medium woodland Marri and Wandoo. Currently there is 79.6% and 32.4% of the pre-European vegetation extent remaining within these two vegetation associations respectively. Each of these vegetation complexes has greater than 30% of their pre-European extent remaining and the vegetation of the study area is therefore not considered to be of regional significance or below the critical threshold in accordance with EPA Position Statement 2 (EPA, 2000).

The study area intersects with three Heddle *et al*. (1980) vegetation complexes, described in Table 12. The study area is located on the Darling Scarp vegetation complex, described as a wide range of vegetation from bare rock and lichen-fields through to shrublands to woodlands of Marri (*Corymbia calophylla*), Wandoo (*Eucalyptus wandoo*), Butter-bark (*Eucalyptus laeliae*), Rock Sheoak (*Allocasuarina huegeliana*) and mountain Marri (*Corymbia haematoxylon*).

Table 12 Pre-European vegetation complexes within the study area

Vegetation complex	Landform	Vegetation description
Darling Scarp complex	Steeply sloping western margin of the Darling Plateau. Major valley floors and scarps.	A wide range of vegetation from bare rock and lichen-fields through shrublands to woodlands of Marri (*Corymbia calophylla*), Wandoo (*Eucalyptus wandoo*), Butter-bark (*E. laeliae*), Rock Sheoak (*Allocasuarina huegeliana*) and Mountain Marri (*C. haematoxylon*)
Dwellingup complex	Lateritic uplands, in medium to high rainfall.	Predominantly consists of open forest of Jarrah-Marri (*Eucalyptus marginata-Corymbia calophylla*)
Murray complex	Major valleys combining slopes, in medium to high rainfall in humid and sub humid zones.	Consists of open forest of Jarrah-Marri-Swan River Blackbutt (*Eucalyptus marginata-Corymbia calophylla-E. patens*) on valley slopes to a fringing woodland of Flooded Gum-Swamp Paperbark (*E. rudis – Melaleuca rhaphiophylla*) on the valley floors

**Source: Western Australian Local Government Association, 2013*

4.4.2 Floristic Community Types

In 1997, Markey undertook a detailed study of the Northern Darling Scarp, which includes the study area. The results of the study were used to define the major types of Floristic Community Types (FCT), of which there were three distinct groups:

Supergroup 1 – Woodland and Shrublands on Scarp and Valley Slopes

- FCT 1a – Upper slope *Eucalyptus wandoo* woodland
- FCT1b – *Eucalyptus wandoo – Corymbia calophylla* woodland on poorly drained clay flats
- FCT1c – Northern granite shrubland and woodland
- FCT 2 – Southern granite shrubland and woodland
- FCT 3 – Woodland on steep, loamy scarp and valley slopes
- FCT 4 – Woodland on steep colluvial slopes of scarp face and upper valleys.

Supergroup 2 - Ridge Hill Shelf Woodlands and Granite Shrublands

- FCT 5 – Central granite shrubland
- FCT 6 – Talbot Road *Corymbia calophylla – Eucalyptus wandoo* woodland and heath
- FCT 7 – Woodland on poorly drained colluvial deposits
- FCT 8 – Shrubland on upper slope granite outcrops.

Supergroup 3 - Woodlands of the Lateritic Uplands

- FCT 9 – Upper *Eucalyptus marginata* forest
- FCT 10 – Upland *Corymbia calophylla* woodland
- FCT 11 – Upland *Corymbia calophylla – Eucalyptus marginata* woodland.

The Bennett (2005) vegetation mapping and analysis identified the presence of FCT1b, FCT2, FCT9 and FCT11.

4.4.3 Vegetation Communities

Vegetation community mapping was undertaken in 2004. Bennett (2005) mapped and described nine vegetation communities. Additional vegetation community mapping was completed by Astron (2012b), describing six vegetation communities. The Bennett (2005) and Astron (2012b) vegetation communities have been amalgamated to provide a comprehensive overview, shown in Table 13. It should be noted that the Bennett (2005) survey covered a much larger area than Astron (2012b), explaining why not all Bennett communities were represented in the Astron report.

Table 13 Consolidation of Vegetation Communities Previously Mapped within the Project Area by Bennett (2005) and Astron (2012b)

Vegetation community description	Vegetation code	
	Bennett (2005)	Astron (2012b)
Eucalyptus marginata subsp. *thalassica* and *Corymbia calophylla* Open Forest over *Allocasuarina fraseriana* Low Woodland over mixed species Open Low Heath dominated by *Hibbertia hypericoides* and *Verticordia acerosa*	EmBg, representing FCT11	F1
Open Forest of *Corymbia calophylla* and *Eucalyptus marginata* subsp. *thalassica* over Tall Shrubland of *Hakea undulata* and *Calothamnus rupestris*	EmCr, representing FCT1b	NA
Open Forest of *Eucalyptus marginata* subsp. *thalassica* over a Tall Shrubland to Tall Open Scrub of *Dryandra sessilis* over Low Shrubland of mixed species (EmDs), representing FCT9	EmDs, representing FCT9	NA
Woodland of *Corymbia calophylla, Eucalyptus marginata* subsp. *thalassica* and *Allocasuarina fraseriana* over Tall Shrubland of *Hakea trifurcata* over Open Heath of *Petrophile biloba*	Pb, representing FCT1b	NA
Eucalyptus marginata subsp. *thalassica* Open Woodland over *Xanthorrhoea preissii* and *Kingia australis* Tall Shrubland over *Hakea undulata* Open Heath over mixed species Open Low Heath	EmXp, representing FCT1b	W1
Eucalyptus wandoo and *Corymbia calophylla* Woodland to Low Woodland over *Hakea lissocarpha* and *Hakea undulata* Closed Heath over *Hibbertia hypericoides* Closed Low Heath	Ew representing FCT1b	W2

Vegetation community description	Vegetation code	
	Bennett (2005)	Astron (2012b)
Corymbia calophylla occasionally with *Eucalyptus marginata* subsp. *thalassica* Woodland over *Eucalyptus drummondii* Low Open Woodland over *Hakea trifurcata* Tall Open Scrub over *Hakea undulata* Open Heath over *Hibbertia hypericoides* Closed Low Heath	CC and Ed, representing FCT1b	W3
Hakea erinacea and *Verticordia acerosa* Open Low Heath	He, representing FCT2	H1
Mixed species Open Low Heath	Va, representing FCT2	G1

5.0 Desktop Assessment

A summary of survey effort to date is included in Table 14.

Table 14 Survey and Sample Effort and Intensity

Surveyor	Size	Intensity/Sample Effort	Timing
Bennett 2005 Eleanor Bennett	Approximately 130 ha	20 sites	7-8 October 2004
Astron 2012b Alice Bott	10.52	7 relevès	8 October 2012
AECOM 2014 Catherine Krens Priscilla Fleming	46.75 ha	10 quadrats	17-19 November 2014
AECOM 2015 Floora de Wit Lyn van Gorp	151.20 ha	9 quadrats 5 relevès	13 and 26 October 2015
AECOM 2016 Floora de Wit Lyn van Gorp	47.7 ha	19 quadrats	25-27 October 2016

5.1 Threatened and Priority Flora

The search of the DPaW database and review of previous reports identified 46 conservation significant flora species as having the potential to occur within the study area. This included seven species listed under both the EPBC Act and WC Act, four species listed under just the WC Act and 35 species listed as Priority species by DPaW. Of the 46 species:

- four species are known to occur within the study area (AECOM, 2015)
- 17 were considered likely to occur
- 16 species may occur
- 12 species were considered unlikely to occur

The complete desktop assessment results including the likelihood of occurrence within the study area are provided in **Appendix B**. The results of the DPaW database search are presented in Figure 5. Those species that are known or considered likely to occur within the study area as a result of the desktop assessment are presented in Table 15.

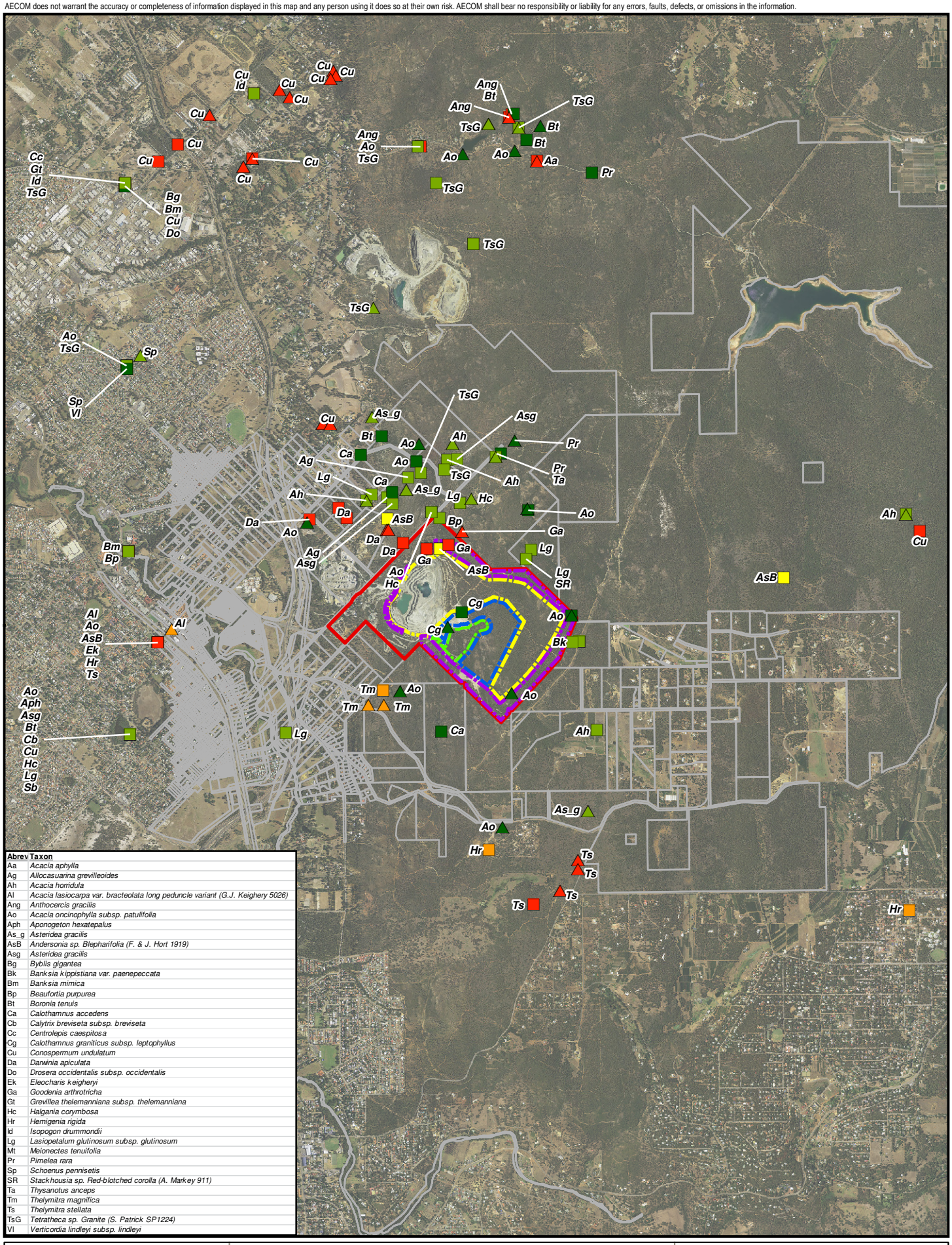
Previous flora and vegetation surveys have recorded four Priority flora species within the Holcim Gosnells Quarry boundary (Bennett, 2005 & 2006; Astron, 2012a). One species, *Calothamnus rupestris* was listed as a Priority 4 at the time of previous surveys in 2012, however has since been delisted. Details of Priority species previously recorded in the Holcim Gosnells Quarry boundary are provided in Table 15.

In 2014 Bennett Environmental Consulting identified two conservation significant terrestrial orchid species that have the potential to occur in the study area. These are *Thelymitra stellata* listed as Endangered under the EPBC Act and WC Act and *Thelymitra magnifica* listed a Priority 1 species by DPaW and endorsed by the Minister for Environment. Details of these species are also provided in Table 15.

Table 15 Conservation Significant Flora Species Known and Likely to Occur within the Study Area

Species	Conservation status	Description	Habitat
Known to occur			
Acacia oncinophylla subsp. *patulifolia*	Priority 4	Shrub, 0.5-3 m high. Minniritchi bark, phyllodes 40-90 mm long, 3-6 mm wide. Flowers are yellow occurring from Aug to Dec	Granitic soils, occasionally on laterite. Previously recorded within the Gosnells Quarry boundary adjacent to the study area by Bennett (2005) and Astron (2012a)
Asteridea gracilis	Priority 3	Annual, herb, 0.15-0.35 m high. Flowers are white-pink, Sep to Dec.	Sand, clay, gravelly soils.
Beaufortia purpurea	Priority 3	Erect or spreading shrub, 0.3-1.5 m high. Flowers are red-purple, Oct to Dec or Jan to Feb.	Lateritic or granitic soils. Rocky slopes.
Calothamnus graniticus subsp. *leptophyllus*	Priority 4	Erect, multi-stemmed shrub, 1-2 m high. Flowers are red occurring from June to Aug	Clay over granite, lateritic soils. Hillsides. Previously recorded within rehabilitation areas by Bennett (2005)
Likely to occur			
Acacia horridula	Priority 3	Harsh, slender, single-stemmed shrub, 0.3-0.6(-1) m high. Flowers are yellow, May to Aug.	Gravelly soils over granite, sand. Rocky hillsides.
Allocasuarina grevilleoides	Priority 3	Dioecious, lignotuberous shrub, 0.15-0.4 m high.	Sand over laterite, gravel. Previously recorded in open or dense low heathland in Ellis Brook Valley Reserve
Andersonia sp. Blepharifolia (F. & J. Hort 1919)	Priority 2	Low erect/spreading plant with white/cream flowers.	Previously found in Jarrah, Marri woodland or heathland
Banksia kippistiana var. *paenepeccata*	Priority 3	Erect, prickly, lignotuberous shrub, 0.3-1.2 m high. Flowers are yellow-cream occurring from Oct to Nov	Lateritic gravelly soils. Previously recorded within the Gosnells Quarry boundary adjacent to the study area by Bennett (2005)
Boronia tenuis	Priority 4	Flowers pale purple.	Previously recorded on slope amongst granite boulders and outcrop. Also recorded on various loam, clay, gravel soils over granite. Recorded in Sheoak thicket or heathland or open woodland
Calothamnus accedens	Priority 4	Erect & slender shrub, to 1.8 m high. Flowers are pink-red.	Sandy soils over laterite. Road verge. Previously recorded nearby in grey sand over gravel or rocky loam or rocky clay in open woodland or dense heath

Species	Conservation status	Description	Habitat
Darwinia apiculata	EPBC Act: EN WC Act: EN	Densely branched shrub, 0.4-0.5 m high. Flowers are green & yellow/red, Oct.	Lateritic soils. Previously recorded in gravel, grey sand clay over granite or dry laterite around disturbed gravel pit site. Previously recorded in heathland or Marri woodland
Goodenia arthrotricha	WC Act: EN	Erect perennial, herb, to 0.4 m high. Flowers are blue, Oct to Nov.	Gravel. Granite rocks, slopes.
Halgania corymbosa	Priority 3	Erect shrub, 0.35-1 m high. Flowers are blue-purple, Aug to Nov.	Gravelly soils, soils over granite.
Lasiopetalum glutinosum subsp. *glutinosum*	Priority 3	Low shrub with pink flowers	Previously recorded in various soil types including lateritic gravel and clay or brown, clayey sand with laterite.
Pimelea rara	Priority 4	Shrub, 0.2-0.35 m high. Flowers are white, Dec or Jan.	Lateritic soils.
Stackhousia sp. Red-blotched corolla	Priority 3	None available on Florabase	Previously recorded in light brown yellow silty-gravel with surface granite and lateritic gravel and cobbles in heathland
Tetratheca sp. Granite (S. Patrick SP1224)	Priority 3	Erect shrub, to 0.4 m high.	Clay, moist loam, clayey sand. Granite boulders.
Thelymitra magnifica	Priority 1	Perennial, herb.	Stony ridges.
Thelymitra stellata Star Sun Orchid	EPBC Act: EN WC Act: EN	Tuberous, perennial, herb, 0.15-0.25 m high. Flowers are yellow and brown occurring from Oct to Nov	Sand, gravel, lateritic loam. Identified as potentially occurring by Bennett (2014)



Abrev	Taxon
Aa	*Acacia aphylla*
Ag	*Allocasuarina grevilleoides*
Ah	*Acacia horridula*
Al	*Acacia lasiocarpa var. bracteolata long peduncle variant (G.J. Keighery 5026)*
Ang	*Anthocercis gracilis*
Ao	*Acacia oncinophylla subsp. patulifolia*
Aph	*Aponogeton hexatepalus*
As_g	*Asteridea gracilis*
AsB	*Andersonia sp. Blepharifolia (F. & J. Hort 1919)*
Asg	*Asteridea gracilis*
Bg	*Byblis gigantea*
Bk	*Banksia kippistiana var. paenepeccata*
Bm	*Banksia mimica*
Bp	*Beaufortia purpurea*
Bt	*Boronia tenuis*
Ca	*Calothamnus accedens*
Cb	*Calytrix breviseta subsp. breviseta*
Cc	*Centrolepis caespitosa*
Cg	*Calothamnus graniticus subsp. leptophyllus*
Cu	*Conospermum undulatum*
Da	*Darwinia apiculata*
Do	*Drosera occidentalis subsp. occidentalis*
Ek	*Eleocharis keigheryi*
Ga	*Goodenia arthrotricha*
Gt	*Grevillea thelemanniana subsp. thelemanniana*
Hc	*Halgania corymbosa*
Hr	*Hemigenia rigida*
Id	*Isopogon drummondii*
Lg	*Lasiopetalum glutinosum subsp. glutinosum*
Mt	*Meionectes tenuifolia*
Pr	*Pimelea rara*
Sp	*Schoenus pennisetis*
SR	*Stackhousia sp. Red-blotched corolla (A. Markey 911)*
Ta	*Thysanotus anceps*
Tm	*Thelymitra magnifica*
Ts	*Thelymitra stellata*
TsG	*Tetratheca sp. Granite (S. Patrick SP1224)*
Vl	*Verticordia lindleyi subsp. lindleyi*

PROJECT ID 60522332
CREATED BY DGF/RNM
APPROVED BY FDW
LAST MODIFIED 29 AUG 2017

AECOM
www.aecom.com

N

DATUM GDA 1994, PROJECTION MGA ZONE 50

0 500 1,000 1,500 2,000
metres

1:50,000 when printed at A4

LEGEND

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

WA Herb
- Threatened
- Priority 1
- Priority 2
- Priority 3
- Priority 4

- Astron 2012 and Bennett 2014 Survey Area
- AECOM 2014 Survey Area
- AECOM 2015 Survey Area
- AECOM 2016 Survey Area
- Holcim Tenement
- Cadastre Boundaries

Data sources:

Base Data: (c) Based on information provided by and with the permission of the Western Australian Land Information Authority trading as Landgate (2010).

Desktop Priority Flora Results

HOLCIM QUARRY

Figure 5

Map Document: P:\605X\60522332\4. Tech Work Area\4.99 GIS\02_MXDs\Figures\G60522332_Fig5_DesktopPriorityFlora_RNM_v03_20170829.mxd (rob.mcgregor)

A4 size

5.2 Vegetation

A review of available literature conducted by Astron Environmental Services (2012a) identified two TECs that occur within 10 km of the study area. These include Claypans of the Swan Coastal Plain, and *Corymbia calophylla-Kingia australis* woodlands on heavy soils of the Swan Coastal Plain (Table 16). Both TECs are restricted to the Swan Coastal Plain bioregion and are therefore not expected to occur within the study area. Neither of these communities are listed under the EPBC Act.

No TECs or PECs have been recorded within the study area during previous surveys and none are anticipated to occur.

Table 16 Threatened Ecological Communities within close proximity to the study area

Threatened Ecological Community	Conservation status	Distance from study area
Claypans of the Swan Coastal Plain	Critically Endangered	TEC likely to occur within 10 km of the study area. This TEC is restricted to the Swan Coastal Plain bioregion.
Corymbia calophylla – Kingia australis woodlands on heavy soils of the Swan Coastal Plain	Endangered	TEC known to occur within 10 km of the study area. This TEC is restricted to the Swan Coastal Plain bioregion region.

6.0 Results and Discussion

6.1 Vegetation Communities

Nine vegetation communities have been mapped and described within the study area. These include:

- four heath communities
- one *Calothamnus* thicket
- three forest communities
- one woodland community.

One woodland community, the *E. wandoo* woodland, is considered locally significant as it supports one population of Priority flora (this species is discussed further in Section 5.1). The delineation of the forest and woodland communities was supported by floristic/cluster analysis of quantitative quadrat data. The dendrogram showed clear grouping of quadrats, used as a basis for writing community descriptions (Figure 6).

Vegetation associated with granite outcrops are considered unique in high species diversity as they often represent isolated and disjunct vegetation communities (Hopper *et al.,* 1997). The granite outcrops within the study area are not considered geographically isolated as they are less than 1 km apart and are likely to continue to exchange genetic material. They are however very diverse, evident in the high species richness recorded in communities BpSr, HeSb, IdBc and VaBs (52, 122, 87 and 75 native species respectively). Combined, the species richness of these heath communities is 200 species (192 native species).

The vegetation communities on granite outcrops represent a mosaic of heaths and forbs. Floristic data analysis was undertaken in an attempt to identify clear differentiation between quadrats (Figure 7). All four heath communities are considered locally and regionally significant due to the unique floristic composition, high species diversity, and the provision of habitat for multiple Priority flora species.

The four heath communities are characterised by multiple shrub strata including a tall, medium and low layer. The code uses the dominant species from one of these strata informed by the quantitative floristic data collected from all quadrats completed within the study area since the commencement of the project by AECOM in 2014.

Table 17 presents a description of the vegetation communities, survey effort, extent, species richness and representative photographs.

Table 17 Vegetation communities described within the study area

Code	Description	Comments	Photograph
BpSr	*Beaufortia purpurea, Hakea uncinata, Verticordia acerosa* var. *acerosa, Petrophile squamata* subsp. *squamata* and *Allocasuarina humilis* mid shrubland over *Beaufortia macrostemon, Banksia armata* var. *armata, Astroloma glaucescens, Babingtonia pelloeae* and *Hibbertia hypericoides* low open shrubland over *Stylidium repens, Thysanotus manglesianus, Goodenia coerulea* and *Stylidium bulbiferum* low sparse forbland. Supports populations of *Beaufortia purpurea* (P3) and *Lasiopetalum glutinosum* subsp. *glutinosum* (P3). These are further discussed in Section 6.3.1.	Species richness: 52 native species. Survey effort: CK3, HO28, HO29. Area: 4.43 ha	
HeSb	*Eucalyptus wandoo* low isolated trees over *Hakea erinacea, Verticordia acerosa* var. *acerosa, Leucopogon sprengelioides, Melaleuca radula* and *Xanthorrhoea drummondii* mid shrubland over *Hibbertia hypericoides, Melaleuca parviceps, Babingtonia camphorosmae, Beaufortia purpurea* and *Hakea incrassata* low shrubland over *Stylidium bulbiferum, Stylidium calcaratum, Cassytha racemosa* forma *racemosa, Stylidium eriopodum* and *Drosera glanduligera* low sparse forbland. Predominantly heathland with some mallee form *Eucalyptus wandoo* and *Corymbia calophylla* as an ecotone to adjacent forest. Variable in density of *Hakea erinacea*. Supports populations of *Asteridea gracilis* (P3), *Beaufortia purpurea* (P3) and *Lasiopetalum glutinosum* subsp. *glutinosum* (P3). These are further discussed in Section 6.3.1.	Species richness: 122 native species, four weed species. Survey effort: HO1, HO17, HO26, HO30, HO31. Area: 10.11 ha	

Code	Description	Comments	Photograph
IdBc	*Acacia oncinophylla* subsp. *patulifolia* and *Xanthorrhoea drummondii* tall open shrubland over *Isopogon dubius, Verticordia acerosa* var. *acerosa, Hakea erinacea, Melaleuca holosericea* and *Allocasuarina humilis* medium shrubland over *Astroloma glaucescens, Cryptandra pungens, Hibbertia subvaginata, Melaleuca parviceps, Hakea undulata* and *Hibbertia hypericoides* low shrubland with *Borya constricta, Stylidium eriopodum, Pterochaeta paniculata, Stylidium brunonianum,* and *Thysanotus scaber* low sparse forbland. Dominated by *A. oncinophylla* subsp. *patulifolia* (P4) throughout most of the community with the exception of HO21 and HO25. This is further discussed in Section 6.3.1.	Species richness: 87 native species. Survey effort: HO4, HO14r, HO21, HO22, HO25. Area: 3.32 ha	
VaBs	*Acacia oncinophylla* subsp. *patulifolia* and *Melaleuca holosericea* tall sparse shrubs over *Verticordia acerosa* var. *acerosa, Verticordia insignis* subsp. *insignis*, *Verticordia plumosa* var. *plumosa* and *Hakea erinacea* mid shrubland over *Borya sphaerocephala, Stylidium bulbiferum*, *Drosera gigantea, Glischrocaryon aureum* and *Pterochaeta paniculata* low open forbland. Supports populations of *Acacia oncinophylla* subsp. *patulifolia* (P4), *Beaufortia purpurea* (P3) and *Lasiopetalum glutinosum* subsp. *glutinosum* (P3). These are further discussed in Section 6.3.1.	Species richness: 75 native species, eight weed species. Survey effort: CK4, CK5, CK10, HO13r, HO27. Area: 15.18 ha	

Code	Description	Comments	Photograph
Thicket			
CcCrTc	*Corymbia calophylla* mid isolated trees over *Calothamnus rupestris, Xanthorrhoea preissii* and *Hakea undulata* tall closed shrubland over *Hibbertia hypericoides, Banksia dallanneyi* var*. dallanneyi, Gompholobium tomentosum, Synaphea acutiloba* and *Hakea amplexicaulis* low sparse shrubland with *Tetraria capillaris* and *Tetraria octandra* low sparse sedgeland with *Stylidium piliferum, Stylidium bulbiferum, Trichocline spathulata, Dampiera alata* and *Patersonia occidentalis* low sparse forbland. Supports population of *Acacia horridula* (P3), discussed in Section 6.3.1.	Species richness: 46 native species. Survey effort: HO8r, HO15, HO19. Area: 3.29 ha	
Forest and Woodlands			
CcHtHh	*Corymbia calophylla* and *Eucalyptus marginata* subsp. *marginata* mid open forest over *Hakea trifurcata, Xanthorrhoea preissii, Hakea undulata,* and *Hakea prostrata* mid to tall shrubland over *Hibbertia hypericoides, Hibbertia commutata, Banksia dallanneyi* var*. dallanneyi, Hibbertia huegelii* and *Bossiaea ornata* low open shrubland with *Lepidosperma leptostachyum* and *Cyathochaeta avenacea* mid open sedgeland with *Scaevola calliptera, Cassytha racemosa, Pentapeltis peltigera, Xanthosia candida, Conostylis setosa* and *Burchardia congesta* mid sparse forbland.	Species richness: 96 native species, one weed species. Survey effort: Ck6, CK7, CK9, HO3, HO12r, HO32. Area: 32.31 ha	

Code	Description	Comments	Photograph
EmBsBd	*Eucalyptus marginata* subsp. *marginata, Corymbia calophylla* and *Allocasuarina fraseriana* mid open forest over *Banksia sessilis* var. *sessilis*, *Xanthorrhoea preissii* and *Hakea undulata* tall shrubland over *Banksia dallanneyi* var. *dallanneyi, Hibbertia hypericoides, Bossiaea ornata, Hibbertia commutata* and *Hypocalymma robustum l*ow shrubland with *Lepidosperma leptostachyum, Tetraria capillaris* and *Lepidosperma pubisquameum* mid sparse sedgeland with *Orthrosanthus laxus* var. *laxus, Conostylis setosa*, *Lomandra caespitosa*, *Burchardia congesta, Pentapeltis peltigera,* and *Thysanotus manglesianus* low sparse forbland. Isolated occurrence of *Beaufortia purpurea* (P3) recorded in this community.	Species richness: 137 native species, two weed species. Survey effort: CK1, CK2, CK8, HO2, HO5, HO6, HO9r, HO33. Area: 53.50 ha	
EwHhSa	*Eucalyptus wandoo* subsp. *wandoo, Corymbia calophylla* and *Eucalyptus marginata* subsp. *marginata* medium open forest over *Xanthorrhoea preissii* and *occasional Xanthorrhoea drummondii tall open shrubland over Macrozamia riedlei, Hibbertia hypericoides, Acacia pulchella* var. *pulchella, Boronia ovata, Hakea lissocarpha* and *Hakea stenocarpa* low shrubland over *Stylidium affine, Acanthocarpus canaliculatus, Conostylis setosa, Lagenophora huegelii* and *Trichocline spathulata* low sparse forbland. Supports populations of *Asteridea gracilis* (P3), discussed in Section 5.1.	Species richness: 92 native species, three weed species. Survey effort: HO10, HO11, HO23, HO24. Area: 5.10 ha	

Code	Description	Comments	Photograph
EmKaLm	*Eucalyptus marginata* subsp. *marginata* and *Corymbia calophylla* mid open woodland over *Kingia australis* and *Xanthorrhoea drummondii* tall open shrubland over *Lambertia multiflora* var. *darlingensis, Beaufortia macrostemon, Hibbertia hypericoides, Paragonis grandiflora and Banksia armata* var. *armata* low shrubland with *Mesomelaena tetragona* and *Lepidosperma leptostachyum* mid sparse sedgeland over *Patersonia occidentalis, Lomandra effusa, Stylidium brunonianum, Dampiera linearis* and *Drosera glanduligera* low sparse forbland. Isolated occurrence of *Beaufortia purpurea* (P3) recorded in this community.	Species richness: 83 native species. Survey effort: HO7, HO18, HO20. Area: 10.54 ha	 

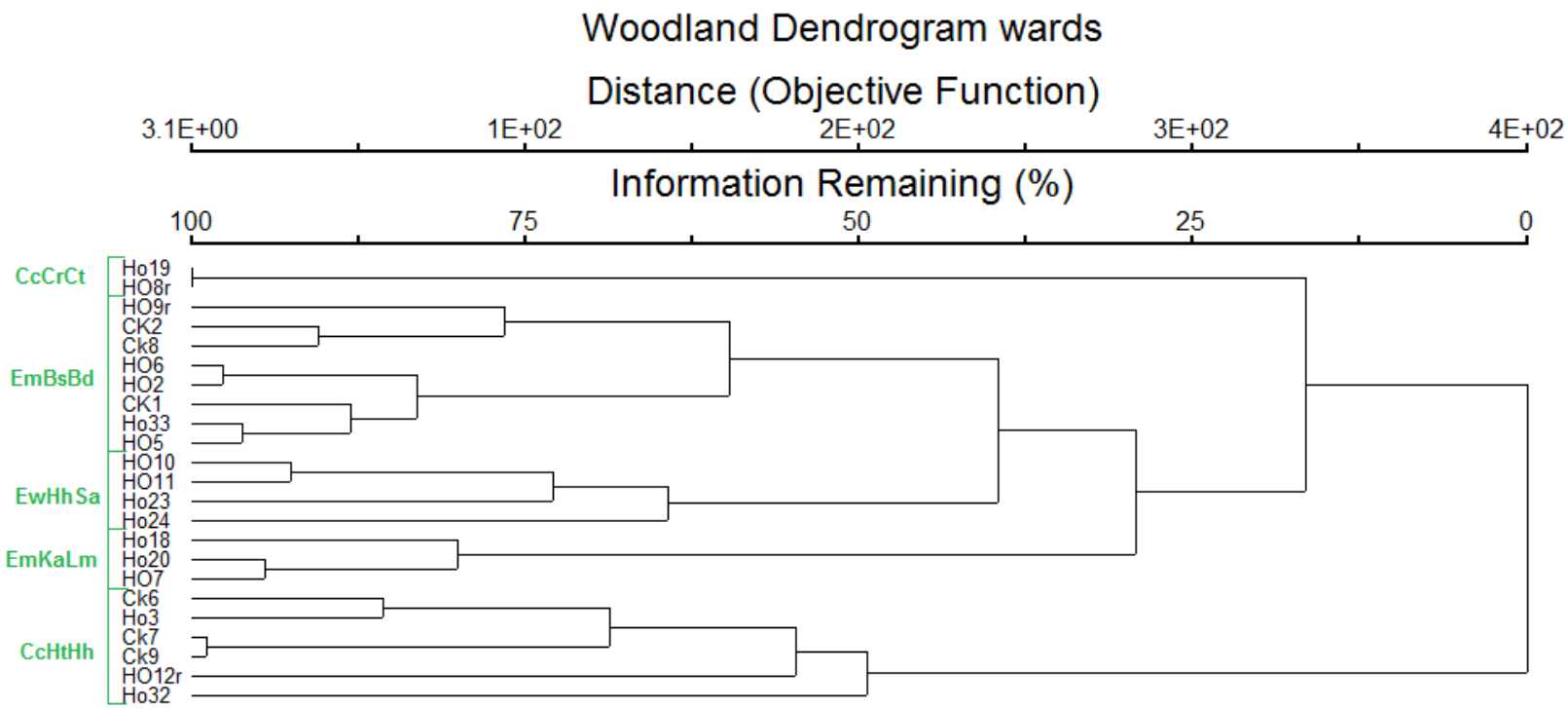


Figure 6 Cluster analysis of woodland communities

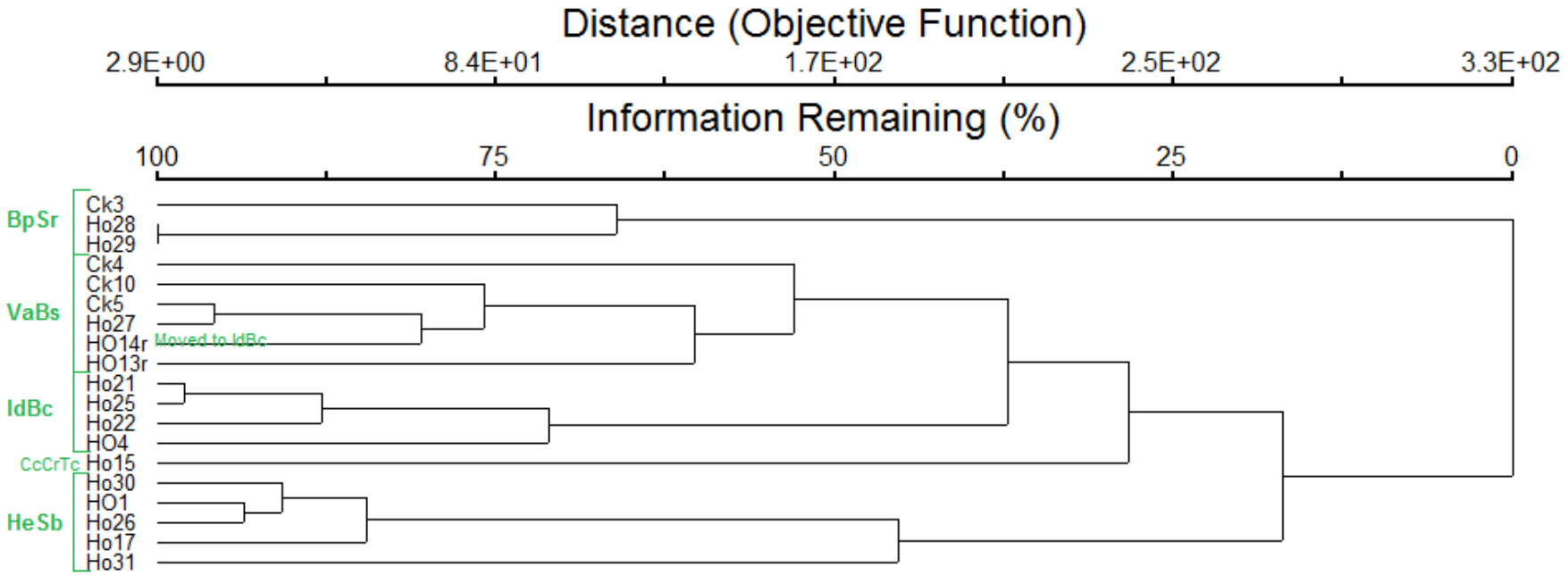
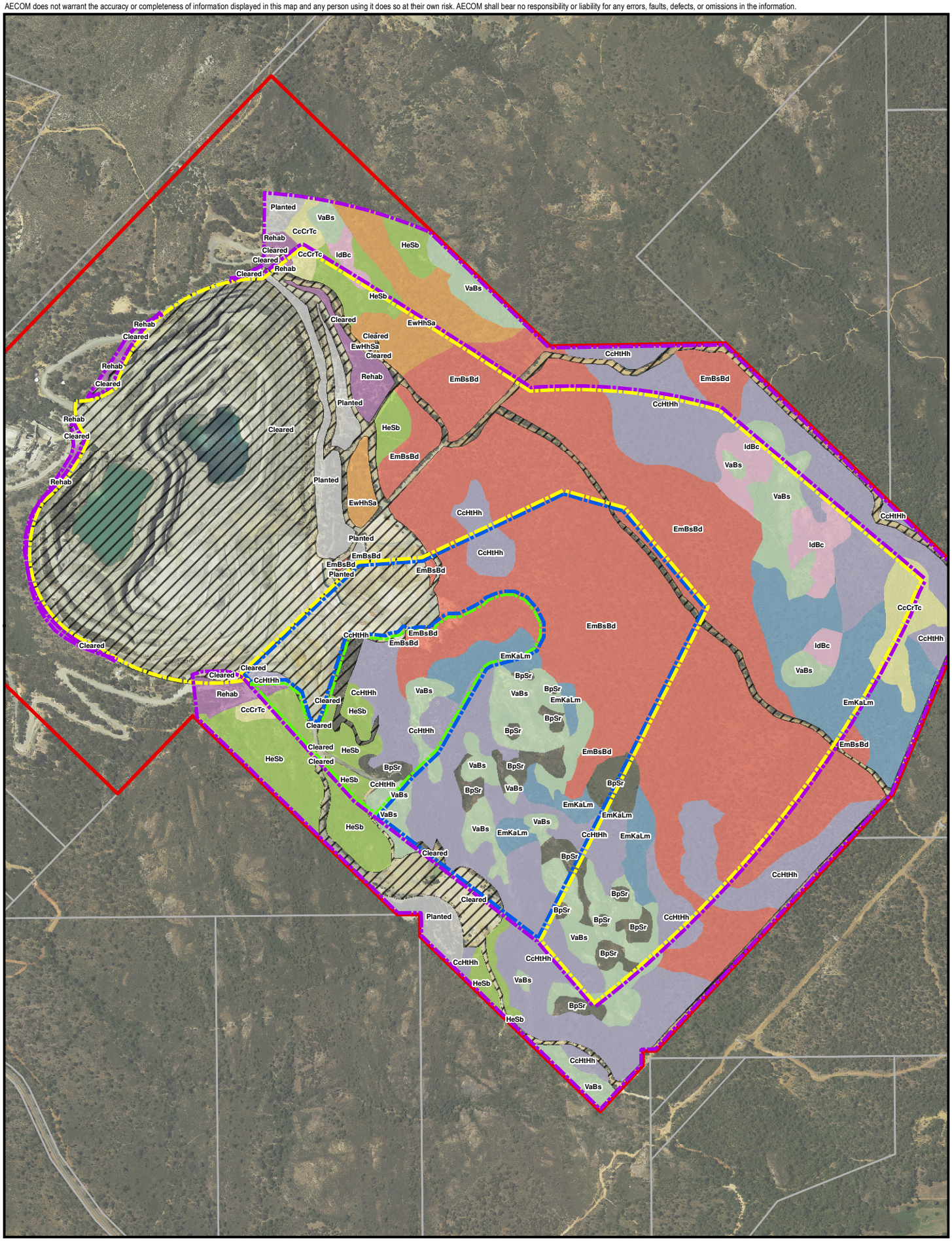


Figure 7 Cluster analysis of heath communities



PROJECT ID 60522332
CREATED BY DGF/RNM
APPROVED BY FDW
LAST MODIFIED 29 AUG 2017

AECOM
www.aecom.com

N

DATUM GDA 1994, PROJECTION MGA ZONE 50

0 100 200 300 400
metres

1:10,000 when printed at A4

LEGEND

- Astron 2012 and Bennett 2014 Survey Area
- AECOM 2014 Survey Area
- AECOM 2015 Survey Area
- AECOM 2016 Survey Area
- Holcim Tenement
- Cadastre Boundaries

- BpSe
- CcCrTc
- CcHtHh
- Cleared
- EmBsBd
- EmKaLm
- EwHhSa
- HeSb
- IdBc
- Planted
- Rehab
- VaBs

Data sources:

Base Data: (c) Based on information provided by and with the permission of the Western Australian Land Information Authority trading as Landgate (2010).

Vegetation Communities

HOLCIM QUARRY

Figure 8

Map Document: \\AUPER1FP001.AU.AECOMNET.COM\Projects\605X\60522332\4. Tech Work Area\4.99 GIS\02_MXDs\Figures\G60522332_Fig8_VegetationCommunity_RNM_v04_20170829.mxd (rob.mcgregor)

A4 size

6.2 Vegetation Condition

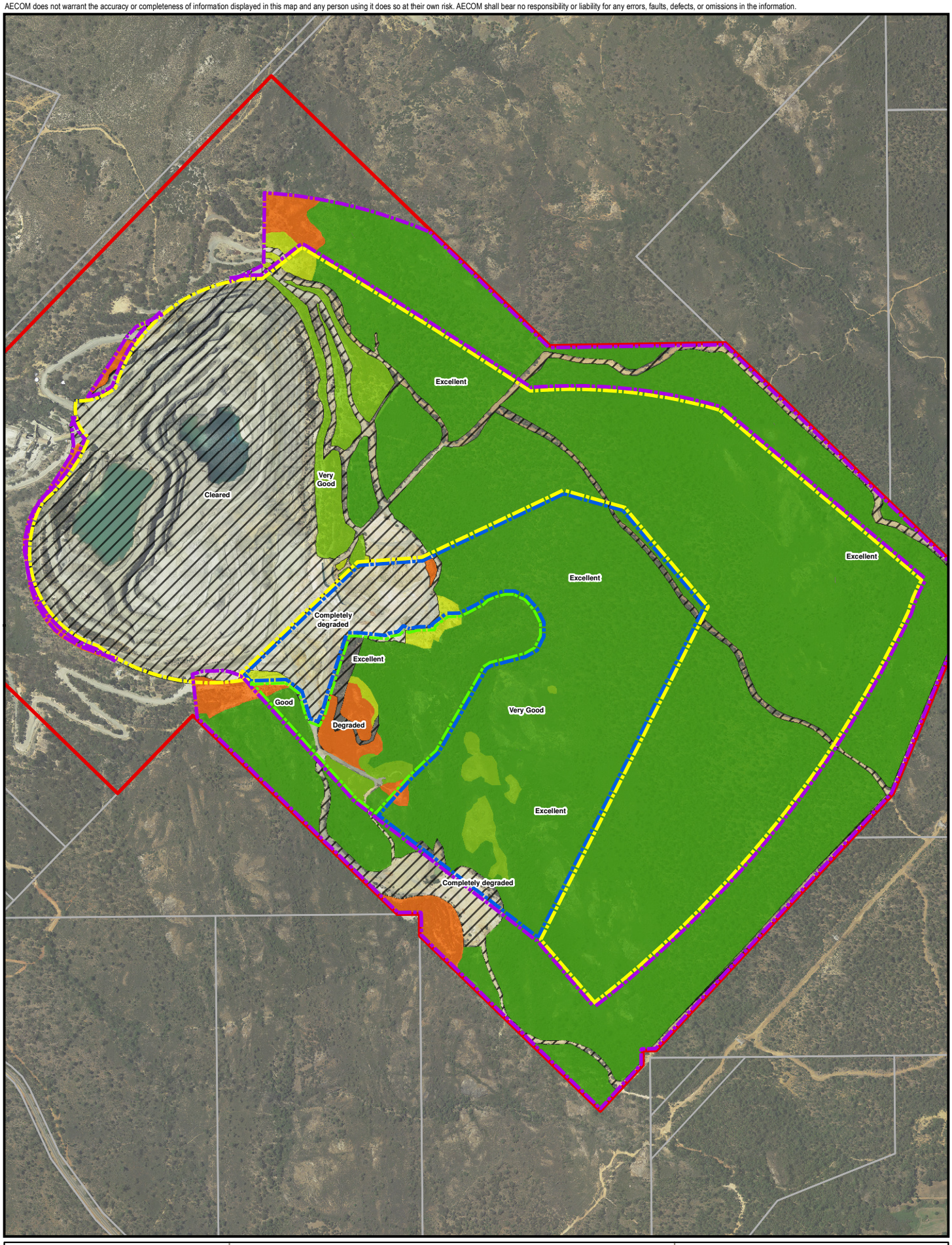
The condition of the vegetation in the study area ranged from 'Completely Degraded' to 'Excellent', with the majority of the vegetation in the study area in 'Excellent' condition (132.79 ha, 66% of the study area). 'Cleared areas were devoid of native vegetation with only weed species present (54.26 ha, 27% of the study area).

The study area is surrounded by neighbouring intact remnant vegetation, much of which is associated with Banyowla Regional Park. Low disturbance in adjacent vegetation has contributed to the low weeds recorded in the study area.

The area and percentage of vegetation condition categories within the study area is summarised in Table 18 and spatially presented in Figure 9.

Table 18 Vegetation Condition within the Study Area

Condition rating	AECOM 2014, 2015 and 2016 Condition Area	
	Area within study area (ha)	Percentage of study area (%)
Excellent	132.79	66
Very Good	7.01	4
Good	1.27	1
Degraded	4.58	2
Cleared	54.26	27
Total	**199.9**	**100**



PROJECT ID 60522332
CREATED BY DGF/RNM
APPROVED BY FDW
LAST MODIFIED 04 SEP 2017

AECOM
www.aecom.com

N

DATUM GDA 1994, PROJECTION MGA ZONE 50

0 100 200 300 400
metres

1:10,000 when printed at A4

LEGEND

- Astron 2012 and Bennett 2014 Survey Area
- AECOM 2014 Survey Area
- AECOM 2015 Survey Area
- AECOM 2016 Survey Area
- Holcim Tenement
- Cadastre Boundaries

Data sources:

Base Data: (c) Based on information provided by and with the permission of the Western Australian Land Information Authority trading as Landgate (2010).

Vegetation Condition

HOLCIM QUARRY

Figure 9

Map Document: P:\605X\60522332\4. Tech Work Area\4.99 GIS\02_MXDs\Figures\G60522332_Fig9_VegetationCondition_RNM_v04_20170829.mxd (rob.mcgregor)

A4 size

6.3 Flora

A total of 319 vascular flora species from 50 plant families and 150 genera and were recorded within the study area (inclusive of the 2014 and 2015 field surveys. This included 305 (95%) native species and 14 (5%) introduced (weed) species.

The most abundant families represented include Proteaceae (44 taxa; all native), Fabaceae (36 taxa; all native), Myrtaceae (32 taxa; all native) and Asparagaceae (18 species). The full list of flora species recorded is provided in Appendix C.

A species by communities matrix is provided in Appendix D.

6.3.1 Conservation Significant Species

No EPBC Act or WC Act listed flora species were recorded within the study area during the 2014 or 2015 surveys.

No individuals of *Thelymitra stellata* or *Thelymitra magnifica* were recorded within the study area. All areas of potentially suitable habitat were surveyed. Habitat surveyed was largely considered to provide marginal habitat for both species, excluding a small area of potential *Thelymitra stellata* prime habitat located on the northern boundary of the study area.

Five Priority flora species were recorded within the study area including:

- *Acacia horridula* (Priority 3)
- *Acacia oncinophylla* subsp. *patulifolia* (Priority 4)
- *Asteridea gracilis* (Priority 3)
- *Beaufortia purpurea* (Priority 3)
- *Lasiopetalum glutinosum* subsp. *glutinosum* (Priority 3).

Priority species confirmed to occur are discussed in Sections 6.3.1.1 to 6.3.1.5 below.

Similar habitat was observed outside the study area which may provide suitable habitat for Priority species recorded. This would need to be confirmed by survey.

6.3.1.1 *Acacia horridula* – Priority 3

A. horridula is a single-stemmed shrub that grows up to 1 m tall. It has short, pungent leaves and pale yellow flowers. A specimen suspected to be *A. horridula* was collected at one location and submitted to WAH for confirmation due to lack of identifying features available for comparison in the reference herbarium. Mike Hislop confirmed it as this species on 6 Dec 2016.

This species was recorded at one location within the study area comprising six individuals (Table 19). This population is located in community CcCrTc, extending only 0.009 ha despite extensive searching in the area. The species was recorded under a thicket of *Calothamnus rupestris.*

Table 19 *Acacia oncinophylla* subsp. *patulifolia* Population Details

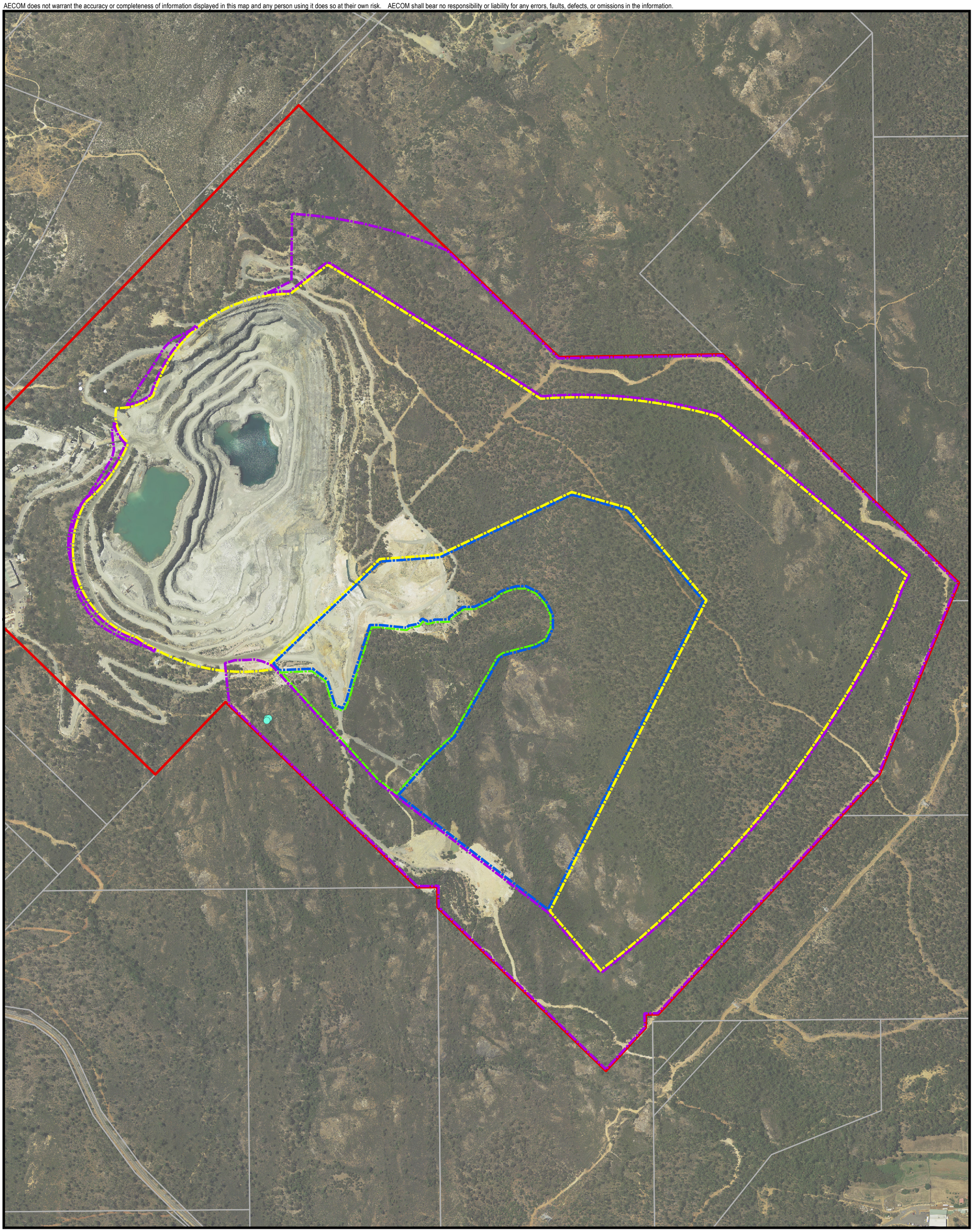
AECOM Populations	Number of Individuals[1] (est.)
1	6

The DPaW database shows six populations in the vicinity of the study area (Table 20). These were recorded between 1900 and 1999 with one record from 2008. Due to the age of the majority of these records it is uncertain how many of these individuals are alive today. Lacking count data the significance of a population of six individuals within the study area is difficult to determine. However, it has been recorded in several local government areas in the vicinity, including Armadale, Gingin, Kalamunda, Mundaring, and Perth. It is therefore unlikely to be locally or regionally significant.

Table 20 *Acacia horridula* Significance Assessment

Measure	AECOM Counts	Database Records[1]	WA Herb Vouchers[2]
Populations	1	6	32
Individuals	6	Est. 6	

1. Sourced from Database results, not all populations have counts provided
2. Sourced from WAH (1998-)



PROJECT ID	60522332
CREATED BY	DGF/RNM
APPROVED BY	FDW
LAST MODIFIED	29 AUG 2017

AECOM
www.aecom.com

N

DATUM GDA 1994, PROJECTION MGA ZONE 50

0 75 150 225 300

metres

1:7,500 (when printed at A3)

LEGEND

- Astron 2012 and Bennett 2014 Survey Area
- AECOM 2014 Survey Area
- AECOM 2015 Survey Area
- AECOM 2016 Survey Area
- Holcim Tenement
- Cadastre Boundaries

Priority Flora Point Individual Count

- 0 - 25

Priority Flora Area

- *Acacia horridula*

Data sources:

Base Data: (c) Based on information provided by and with the permission of the Western Australian Land Information Authority trading as Landgate (2010).

Priority Flora
Acacia horridula

Holcim Quarry

Figure

10

Map Document: P:\605X\60522332\4. Tech Work Area\4.99 GIS\02_MXDs\Figures\G60522332_Fig10_14_PrioirtyFlora_RNM_v04_20170829.mxd (rob.mcgregor)

A3 size

6.3.1.2 *Acacia oncinophylla* subsp. *patulifolia* – Priority 4

A. oncinophlylla subsp. *patulifolia* is a shrub that grows up to 3 m tall. It is easily identified from other Acacia species by the 'Minni-ritchi' bark (Plate 1). Flowers are yellow and flowering occurs from August to November or November to December. Plant occurs on granitic soils, and occasionally on laterite.

This species was recorded extensively in VaBs and IdBc, both associated with granite outcrops on upper slopes. This species is considered locally common within the study area. Five populations were recorded with comprising a minimum 3,533 individuals extending approximately 4.92 ha (Table 21). Populations were extensive therefore population counts are estimates only.

Table 21 *Acacia oncinophylla* subsp. *patulifolia* Population Details

AECOM Populations	Number of Individuals[1] (est.)
1	83
2	418
3	8
4	2966
5	58
TOTAL	3533

1. Individuals are estimates only due to large size of population

The DPaW database shows 15 populations in the vicinity of the study area (Table 22). This indicates that the species is locally common. WAH shows a wide distribution including the following local government areas: Armadale, Bridgetown-Greenbushes, Gosnells, Harvey, Kalamunda, Murray, Swan, Wandering. The population within the study area is not at the extent of its known range, and is not considered regionally significant.

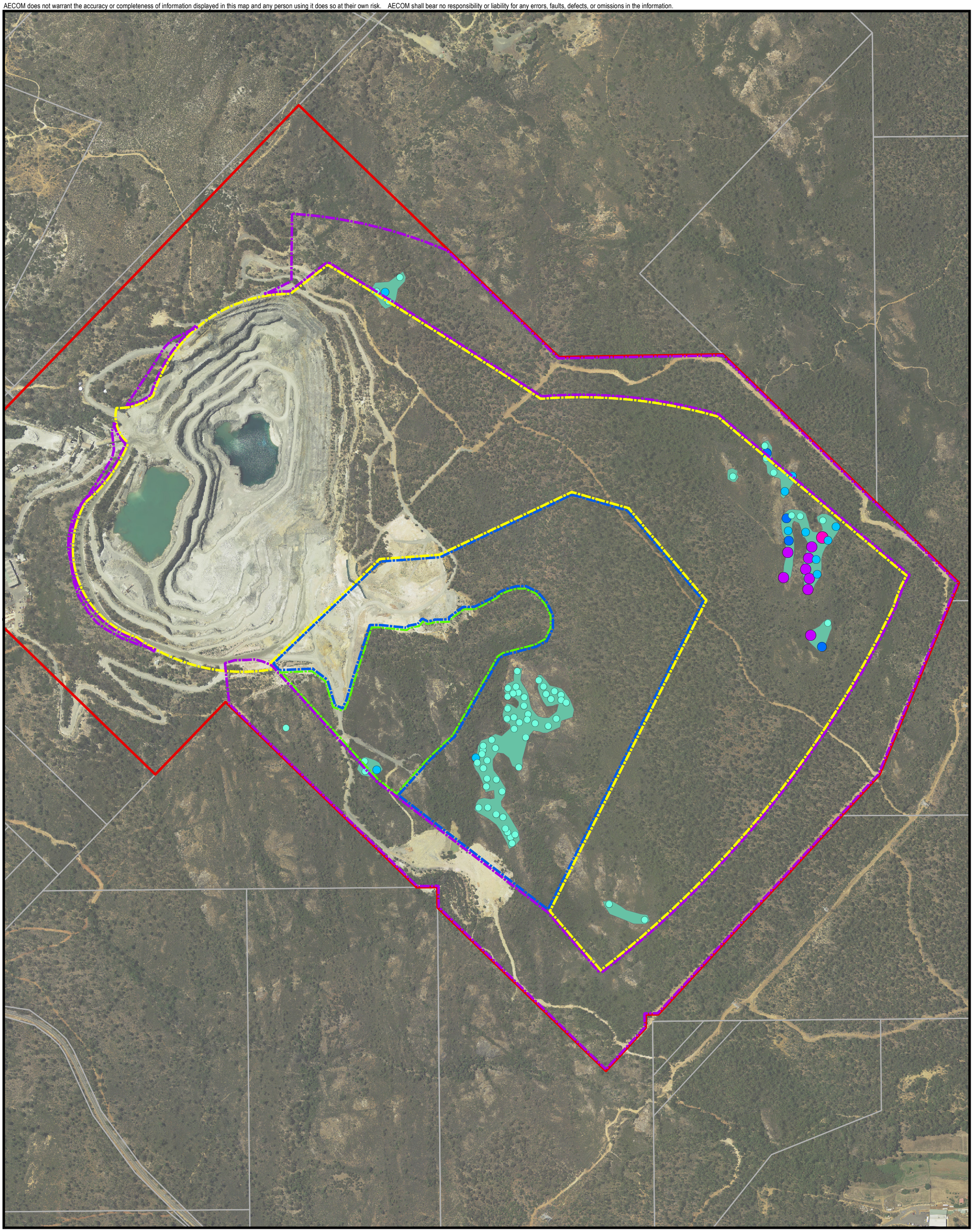
Lyn van Gorp collected *A. oncinophylla* subsp. *patulifolia* within the study area in 2015. This specimen has been lodged and vouchered at WAH and has since been registered on the WAH database (record number PERTH 08816611).

Table 22 *Acacia oncinophylla* subsp. *patulifolia* Significance Assessment

Measure	AECOM Counts	Database Records[1]	WA Herb Vouchers[2]
Populations	5	15	31
Individuals	3533	349	

1. Sourced from Database results, not all populations have counts provided
2. Sourced from WAH (1998-)

Plate 1 ***Acacia oncinophylla*** **subsp.** ***patulifolia*** **minni ritchi Bark, Leaves, and Habit**



PROJECT ID	60522332
CREATED BY	DGF/RNM
APPROVED BY	FDW
LAST MODIFIED	29 AUG 2017

AECOM
www.aecom.com

N

DATUM GDA 1994, PROJECTION MGA ZONE 50

0 75 150 225 300

metres

1:7,500 (when printed at A3)

LEGEND

- Astron 2012 and Bennett 2014 Survey Area
- AECOM 2014 Survey Area
- AECOM 2015 Survey Area
- AECOM 2016 Survey Area
- Holcim Tenement
- Cadastre Boundaries

Priority Flora Point Individual Count

- 0 - 25
- 26 - 50
- 51 - 100
- 101 - 300
- 301 - 1000

Priority Flora Area

- *Acacia oncinophylla subsp. patulifolia*

Data sources:

Base Data: (c) Based on information provided by and with the permission of the Western Australian Land Information Authority trading as Landgate (2010).

Priority Flora
Acacia oncinophylla subsp. patulifolia

Holcim Quarry

Figure

11

Map Document: P:\605X\60522332\4. Tech Work Area\4.99 GIS\02_MXDs\Figures\G60522332_Fig10_14_PrioirtyFlora_RNM_v04_20170829.mxd (rob.mcgregor)

A3 size

6.3.1.3 *Asteridea gracilis* – Priority 3

Asteridea gracilis is an annual herb with white to pink flowers. It was distinguished by its three-pronged white petals in the field (Plate 2). It is known to occur on sand, clay and gravelly soils. In the study area, two distinct populations were recorded, one south and one northwest of the existing pit (Figure 12**).** The northern population followed the *Eucalyptus wandoo* (EwHhSa) community, extending slightly into adjacent heath. The southern population was recorded in community HeSb, also associated with *Eucalyptus wandoo.* It appears to prefer a more open shrubland under a canopy of trees rather than the dense heath on granite. A total of 15 individuals were recorded, with population extent estimated at 0.53 ha (Table 23). Population extent is an estimate only, due to the small size of this species and arbitrary measure of 'extent' based on distance of individuals to one another.

Although extent of population has been provided it is an arbitrary measure as this species is so small, individuals could have been overlooked or hidden under foliage cover from other species.

Table 23 *Asteridea gracilis* Populations Recorded by AECOM (2016)

AECOM Populations	Number of Individuals
1	5
2	10

There are five populations of *A. gracilis* in the vicinity of the study area, with four of these lacking count data (Table 24). The 15 individuals recorded on the DPaW database therefore represents one population only. Total individual count is therefore likely to be higher. Furthermore, it is possible that due to the species' small size it may be under-sampled in the local area. With five populations present within 10 km it is not considered locally significant.

Florabase shows 11 vouchered records of *A. gracilis,* recorded within and between the Shire of Toodyay and Bremer Bay. The populations within the study area are likely to represent the western extent of its range, with all other records located on the Scarp (with the exception of one isolated record from the Esperance Plains). It therefore may be considered regionally significant.

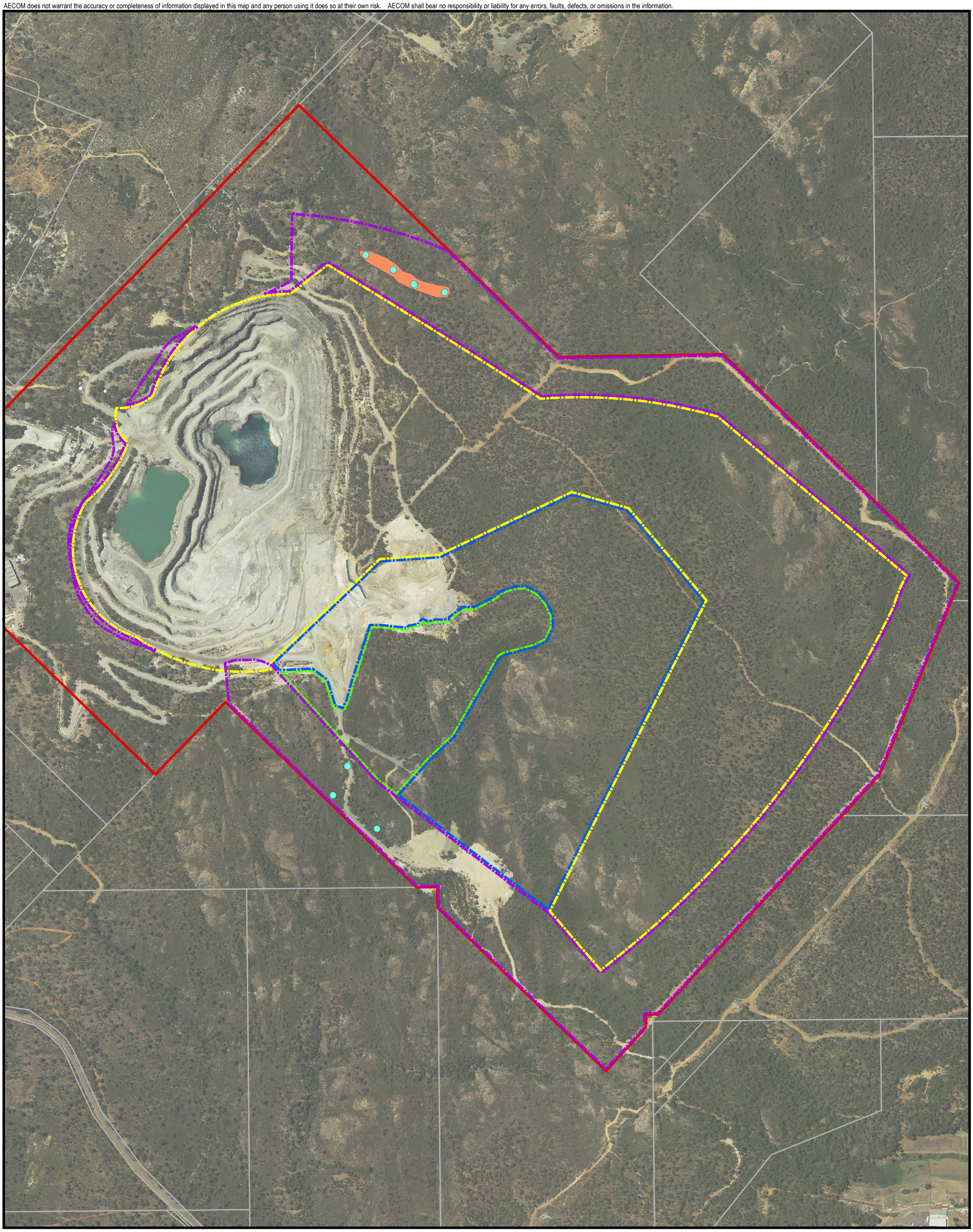
Lyn van Gorp collected *A. gracilis* within the study area in 2015. This specimen has been lodged and vouchered at WAH and has since been registered on the WAH database (record number PERTH 08816646).

Table 24 *Asteridea gracilis* Significance using DPaW and WA Herbarium Data

Measure	AECOM Counts	Database Records[1]	WA Herb Vouchers[3]
Populations	2	5	11
Individuals	15	15	

1. Sourced from Database results, count data missing from four populations
2. Sourced from WAH (1998-)

Plate 2 ***Asteridea gracilis***



PROJECT ID	60522332
CREATED BY	DGF/RNM
APPROVED BY	FDW
LAST MODIFIED	29 AUG 2017

AECOM
www.aecom.com

N

DATUM GDA 1994, PROJECTION MGA ZONE 50

0 75 150 225 300

metres

1:7,500 (when printed at A3)

LEGEND

- Astron 2012 and Bennett 2014 Survey Area
- AECOM 2014 Survey Area
- AECOM 2015 Survey Area
- AECOM 2016 Survey Area
- Holcim Tenement
- Cadastre Boundaries

Priority Flora Point Individual Count

- 0 - 25

Priority Flora Area

- *Asteridea gracilis*

Data sources:

Base Data: (c) Based on information provided by and with the permission of the Western Australian Land Information Authority trading as Landgate (2010).

Priority Flora
Asteridea gracilis

Holcim Quarry

Figure

12

Map Document: P:\605X\60522332\4. Tech Work Area\4.99 GIS\02_MXDs\Figures\G60522332_Fig10_14_PrioirtyFlora_RNM_v04_20170829.mxd (rob.mcgregor)

A3 size

6.3.1.4 *Beaufortia purpurea* – Priority 3

Beaufortia purpurea is an erect spreading shrub easily distinguished by its deep red to purple flowers (**Plate 3**). It grows on lateritic and granitic soils on rocky slopes.

An estimated 17,198 individuals occur within three distinct populations in the study area, extending approximately 9.28 ha (Table 23). Note that the extent of populations is not based on the community BpSe despite this community being dominated by this species.

B. purpurea was recorded in heath communities including BpSe, and some of VaBs and HeSb. There are some isolated occurrences in adjacent woodlands of EmKaLm and EmBsBd (Figure 13).

Table 25 *Beaufortia purpurea* Populations Recorded by AECOM (2016)

AECOM Populations	Number of Individuals[1]
1	17068
2	100
3	30
TOTAL	17198

1. Due to population size individual counts are estimates only

Database records show two populations of *B. purpurea* recorded in the vicinity of the study area (Table 24). Thirty-seven vouchered records exist for the species on FloraBase. Most of these have been recorded between Walyunga National Park and Gooseberry Hill. The species' distribution is restricted to five local government areas including Gosnells, Kalamunda, Mundaring, Swan and Toodyay.

Although the species was found to be common within the plant community BpSe, it is not considered locally or regionally common, shown by the lack of database records. Populations within the study area are therefore considered locally and potentially regionally significant due to the extent and size.

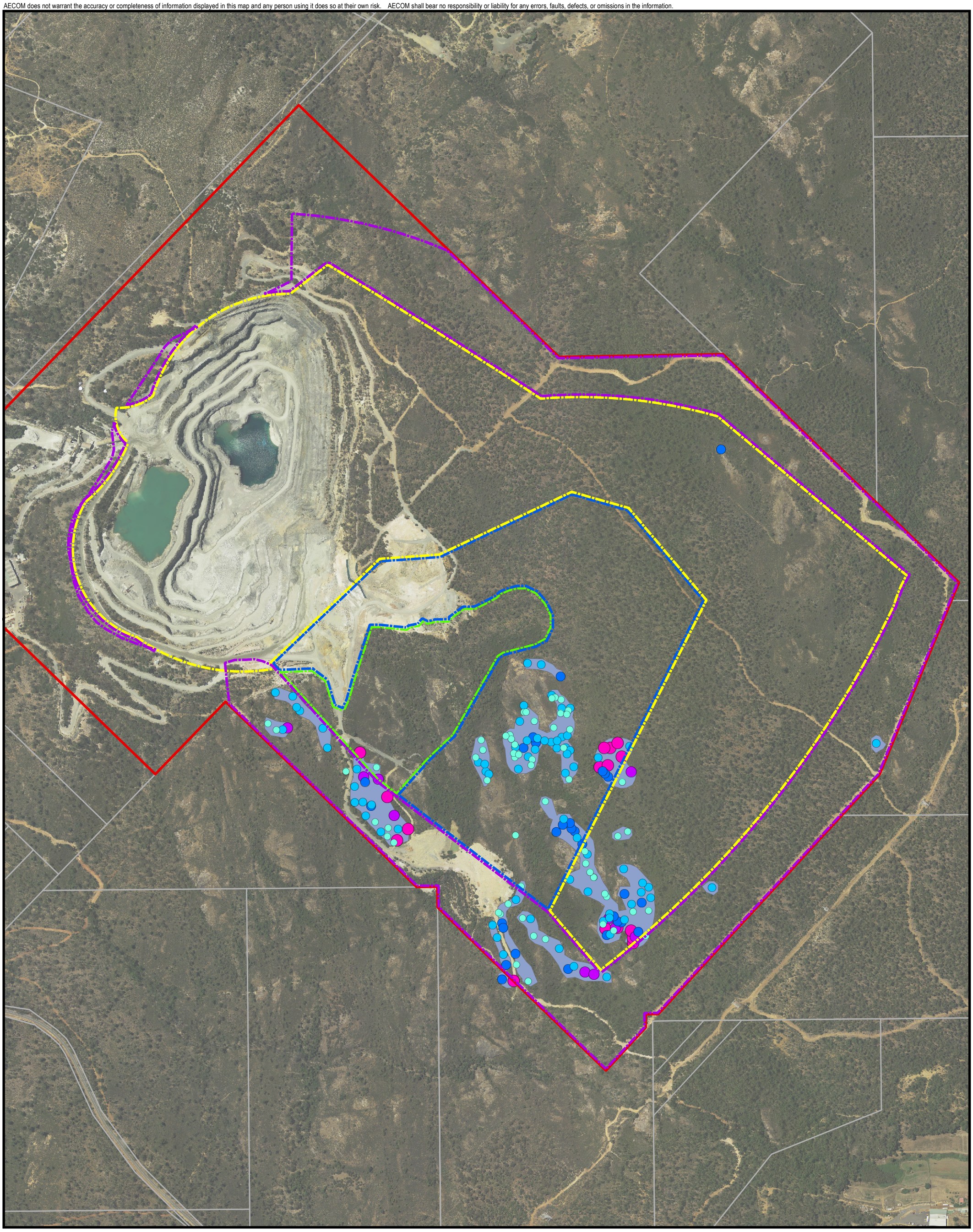
Lyn van Gorp collected *B. purpurea* within the study area in 2015. This specimen has been lodged and vouchered at WAH and has since been registered on the WAH database (record number PERTH 08816638).

Table 26 *Beaufortia purpurea* Significance using DPaW and WA Herbarium Data

Measure	AECOM Counts	Database Records[1]	WA Herb Vouchers[3]
Populations	3	2	37
Individuals	17198	No counts provided	

1. Sourced from Database results, count data missing from four populations
2. Sourced from WAH (1998-)

Plate 3 *Beaufortia purpurea* Flower and Habit



PROJECT ID	60522332
CREATED BY	DGF/RNM
APPROVED BY	FDW
LAST MODIFIED	29 AUG 2017

AECOM
www.aecom.com

N

DATUM GDA 1994, PROJECTION MGA ZONE 50

0 75 150 225 300

metres

1:7,500 (when printed at A3)

LEGEND

- Astron 2012 and Bennett 2014 Survey Area
- AECOM 2014 Survey Area
- AECOM 2015 Survey Area
- AECOM 2016 Survey Area
- Holcim Tenement
- Cadastre Boundaries

Priority Flora Point Individual Count

- 0 - 25
- 26 - 50
- 51 - 100
- 101 - 300
- 301 - 1000

Priority Flora Area

- *Beaufortia purpurea*

Data sources:

Base Data: (c) Based on information provided by and with the permission of the Western Australian Land Information Authority trading as Landgate (2010).

Priority Flora
Beaufortia purpurea

Holcim Quarry

Figure

13

Map Document: P:\605X\60522332\4. Tech Work Area\4.99 GIS\02_MXDs\Figures\G60522332_Fig10_14_PrioirtyFlora_RNM_v04_20170829.mxd (rob.mcgregor)

A3 size

6.3.1.5 *Lasiopetalum glutinosum* subsp. *glutinosum* – Priority 3

Lasiopetalum glutinosum subsp. *glutinosum* is an erect to straggling shrub with pink to purple flowers. It is easily distinguishable by the sticky residue on the flowers, and almost-heart-shaped leaves (Plate 4).

Six populations comprising 313 individuals were recorded in the study area extending approximately 3.51 ha (Table 27). Population extent for this species is an arbitrary measure. Individuals were often recorded widely spaced from one another (100 m or more) making it difficult to determine which population an individual would belong too. *L. glutinosum* subsp. *glutinosum* was recorded in heath communities associated with granite outcrops including VaBs, HeSb and BpSe (Figure 14).

Table 27 *Lasiopetalum glutinosum* subsp. *glutinosum* populations recorded by AECOM (2016)

AECOM Populations	Number of Individuals
1	25
2	124
3	25
4	22
5	114
6	3
TOTAL	313

There are only four populations of *L. glutinosum* subsp. *glutinosum* recorded in the vicinity of the study according to the DPaW database, and WAH showing 47 vouchered specimens (Table 28). The majority of these records are associated with the Darling Scarp and are distributed between the local government areas of Northam and Serpentine-Jarrahdale. Lack of count data provided makes it difficult to determine the significance of the number of individuals recorded within the study area. Due to the size of the population and the size and extent of *L. glutinosum* subsp. *glutinosum* populations in the study area, it should be considered locally and potentially regionally significant.

Lyn van Gorp collected *L. glutinosum* subsp. *glutinosum* within the study area in 2015. This specimen has been lodged and vouchered at WAH and has since been registered on the WAH database (record number PERTH 08816603).

Table 28 *Lasiopetalum glutinosum* subsp. *glutinosum* Significance using DPaW and WA Herbarium Data

Measure	AECOM Counts	Database Records[1]	WA Herb Vouchers[3]
Populations	6	4	47
Individuals	313	No counts provided	

1. Sourced from Database results, count data missing from four populations

2. Sourced from WAH (1998-)

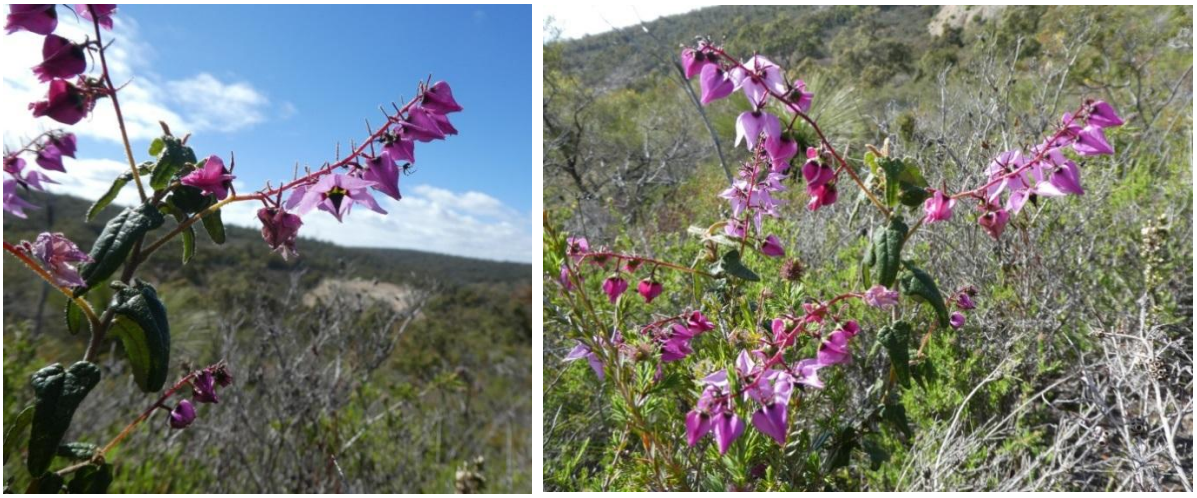


Plate 4 ***Lasiopetalum glutinosum*** **subsp.** ***glutinosum*** **Flower and Habit**

PROJECT ID	60522332
CREATED BY	DGF/RNM
APPROVED BY	FDW
LAST MODIFIED	29 AUG 2017

AECOM
www.aecom.com

N

DATUM GDA 1994, PROJECTION MGA ZONE 50

0 75 150 225 300

metres

1:7,500 (when printed at A3)

LEGEND

- Astron 2012 and Bennett 2014 Survey Area
- AECOM 2014 Survey Area
- AECOM 2015 Survey Area
- AECOM 2016 Survey Area
- Holcim Tenement
- Cadastre Boundaries

Priority Flora Point Individual Count

- 0 - 25

Priority Flora Area

- *Lasiopetalum glutinosum subsp. glutinosum*

Data sources:

Base Data: (c) Based on information provided by and with the permission of the Western Australian Land Information Authority trading as Landgate (2010).

Priority Flora
Lasiopetalum glutinosum subsp. glutinosum

Holcim Quarry

Figure

14

Map Document: P:\605X\60522332\4. Tech Work Area\4.99 GIS\02_MXDs\Figures\G60522332_Fig10_14_PrioirtyFlora_RNM_v04_20170829.mxd (rob.mcgregor)

A3 size

6.3.2 Weed species

A total of 14 introduced (weed) species were recorded within the study area. None of the recorded weed species are categorised as Declared Pests in accordance with Section 22 of the BAM Act, as Weeds of National Significance (WONS), or listed on the Swan Weeds database (which are environmental weeds posing a serious threat to the rich natural biodiversity of the Swan Region in Western Australia).

None of the weeds recorded are considered of 'high' significance in accordance with the Weed Strategy. The low weed species count reflects the high biodiversity value and excellent condition of vegetation within the study area. The weeds recorded can be viewed in the species list in Appendix C.

7.0 References

AECOM 2015. Flora, Vegetation and Targeted Orchid Assessment. Unpublished report prepared for Holcim (Australia) Pty Ltd.

AECOM Australia Pty Ltd (AECOM) 2014. Flora, Vegetation and Targeted Orchid Assessment. Unpublished report prepared for Holcim (Australia) Pty Ltd.

Astron Environmental Services (Astron), 2012a. Gosnells Quarry Desktop Flora, Vegetation and Fauna Survey. October 2012. Unpublished report prepared for Holcim (Australia) Pty Ltd.

Astron, 2012b. Gosnells Quarry Field Flora, Vegetation and Fauna Survey. October 2012. Unpublished report prepared for Holcim (Australia) Pty Ltd.

Beard JS, 1981 Swan, 1:1,000,000 vegetation series explanatory notes to sheet 7. The vegetation of the Swan University of Western Australia, Perth WA.

Bennett Environmental Consulting (Bennett), 2005. Vegetation and Flora Readymix Quarry Gosnells. Unpublished report prepared for Holcim.

Bennett, 2006. Untitled Report. Report on vegetation results at two sites adjacent to current quarry. 2006.

Bennett, 2014. Search for *Thelymitra stellata* and *Thelymitra magnifica.* Unpublished report prepared for Holcim.

Bettink, K and Keighery, G. 2008 Environmental Weed Census and Prioritisation, Swan NRM Region. Swan Catchment Council (SCC) and Department of Environment and Conservation publication.

Brown A, Dixon K, French C, Brockman G, 2013. Field Guide to the Orchids of Western Australia. Simon Nevill Publications, Perth.

Bureau of Meteorology (BoM) 2015. *Climate Statistics for Australian Locations: Monthly Climate Statistics – Summary Statistics Gosnells City,* viewed 14 December 2015. http://www.bom.gov.au/climate/averages/tables/cw_009021.shtml

Chapman, A. 2013. *A visual guide to the Interim Biogeographic Regionalisation of Australis (IBRA) in WA,* viewed January 2015 https://florabase.dpaw.wa.gov.au/help/ibra/#map

Commonwealth of Australia 2013a. Survey Guidelines for Australia's Threatened Orchids. Guidelines for Detecting Orchids Listed as 'Threatened' Under the Environmental Protection and Biodiversity Conservation Act 1999.

Commonwealth of Australia, 2003. Australian Vegetation Attribute Manual Version 6.0. Natural Heritage Trust, Canberra.

Commonwealth of Australia, 2012. Interim Biogeographic Regionalisation for Australia, Version 7. Department of the Environment and Energy, Canberra, Australian Capital Territory.

Conservation and Land Management (CALM), 2002. Bioregional Summary of the 2002 Biodiversity Audit for Western Australia. Department of Conservation and Land Management, Perth, Western Australia.

CSIRO Land and Water, 2014. Digital Atlas of Australian Soils. GIS data layer

DEC, 2010. Threatened and Priority Flora Report Form – Field Manual. Version 1.0. Department of Environment and Conservation, Kensington, WA.

Department of Environment and Conservation (DEC), 2009. *Standard Operating Procedure. Establishing Vegetation Quadrats. SOP No: 6.1.* Prepared by V. Clarke for Significant Native Species and Ecological Communities – Resource Condition Monitoring Project. Kensington.

Department of Parks and Wildlife (DPaW) 2015. Florabase. The western Australia Flora. Viewed November 2014. http://florabase.dpaw.wa.gov.au/

DPaW, 2016. Vegetation Statistics Statewide 2015. Available at: https://www2.landgate.wa.gov.au/web/guest/downloader.

Environmental Protection Authority (EPA), 2000. Environmental Protection of Native Vegetation in Western Australia. Position Statement 2, EPA, Perth WA.

EPA, 2004. Guidance for the Assessment of Environmental Factors: Terrestrial Flora and Vegetation Surveys for Environmental Impact Assessment in Western Australia. Guidance Statement No. 51. Environmental Protection Authority, Perth, Western Australia

Geological Survey of Western Australia and Geoscience Australia 2008. *Surface Geology of Australia 1:1,000,000 Western Australia*. GIS data layer.

Heard L, and Channon B. 1997. Guide to Native Vegetation Survey: Using the Biological Survey of South Australia.

Heddle EM, Loneragan OW and Havel JJ, 1980. Vegetation of the Darling System in *Atlas of Natural Resources Darling System, Western Australia*. Department of Conservation and Environment, Perth.

Hopper SD, Brown AP, Marchant NG. 1997. Plants of Western Australian Granite Outcrops. Journal of the Royal Society of Western Australia 80: 141-158.

Jones D, 2006. A Complete Guide To Native Orchids of Australia Including the Island Territories.

Keighery, B.J. 1994. *Bushland Plant Survey – A Guide to Plant Community Survey for the Community Wildflower Society of WA (inc)*, Nedlands, Western Australia

Markey A, 1997. A Floristic Survey of the Northern Darling Scarp, report to the Western Australian Department of Conservation and Land Management, the Department of Environmental Protection and the Western Australian Conservation Council (Inc.) for the Australia Heritage Commission, Perth.

Mattiske EM, Havel JJ, 1998. Regional Forest Agreement – Vegetation Complexes – 1:250,000 Mapsheets.

Thackway R and Cresswell ID, 1995. An Interim Biogeographic Regionalisation for Australia: A Framework for Setting Priorities in the National Reserves System Cooperative Program. Version 4. Australian Nature Conservation Agency, Canberra

URS 2013. Gosnells Quarry Clearing Permit CPS 5543/2 Amendment Application Supporting Information

Western Australian Local Government Association, 2013. 2013 Native vegetation in the Jarrah Forest and Warren IBRA regions. Publicly available information. Viewed 15 December, 2015, http://pbp.walga.asn.au/Publications.aspx

Williams K, and Mitchell D, 2001, 'Jarrah Forest 1 (JF1 – Northern Jarrah Forest subregion)' in CALM 2002. *Bioregional Summary of the 2002 Biodiversity Audit for Western Australia*. Department of Conservation and Land Management, Perth, Western Australia.

Appendix A

DPaW Consultation 2016

De Wit, Floora

From:	Donaldson, Jessica <Jessica.Donaldson@dpaw.wa.gov.au>
Sent:	Wednesday, 19 October 2016 1:37 PM
To:	De Wit, Floora
Cc:	Kirchner, Linda; Llorens, Tanya
Subject:	RE: Holcim Gosnells Quarry - advice for targeted surveys
Attachments:	G60444570_Map1_ProjectLocation_DF_v02_20160318.pdf; Gosnells Holcim Targeted Flora.docx

Hi Floora,

I am happy to provide advice pre-survey. Generally someone from Species and Communities will be able to assist in providing this advice and so if you are unsure of the correct contact please send the email to flora.data@dpaw.gov.au and it will be sent onto the appropriate staff member, and/or local District officer if relevant.

I would suggest using traverse line searches spaced at 10m apart, any wider and the ability to detect the orchid species *Thelymitra magnifica* and *Thelymitra stellata* would be compromised. As it is a targeted search, you need to be able to confidently state that you have systematically searched any potential habitat for the species being targeted.

I can see from our records that previous advice regarding the timing of targeted surveys for *Thelymitra magnifica* and *Thelymitra stellata* was provided by Anthea Jones (currently on maternity leave), with consultation with DPaW Orchid specialist Andrew Brown in this area in relation to a clearing permit application (CPS 5543). I have confirmed this advice with Andrew, which is that both species flowering time overlaps in late October and so surveys for these two species can be conducted then. Andrew has advised that a mid-November survey for *T. stellata* would be too late, this species flowers in the Perth area in late October to early November.

From my knowledge and discussions with other staff, there has not been any change in flowering times this year in the Swan Coastal area. I do not have any particular local knowledge of the area, the assessment of likelihood of potential conservation listed flora should be based on the habitat present in the survey area compared with the recorded habitat of the Threatened and Priority flora found in the local area. The local flora conservation officer is the best contact in regards to local knowledge of the District, the Perth Hills District flora conservation officer is Tanya Llorens (copied into this email).

For the species in your list that do not have a flowering time, it would be worthwhile checking the Departments Threatened and Priority flora list (https://www.dpaw.wa.gov.au/plants-and-animals/threatened-species-and-communities/threatened-plants) to see whether it is recorded here. Please note that the conservation codes for Priority flora on this published list are subject to change between lists being published, and so the current conservation status should always be checked using the florabase website. Whilst a species flowering time may not be recorded on florabase website the flowering period may be sourced from the paper where the name was published or from examining the flowering specimens that have been collected.

Kind Regards

Jessica Donaldson| Botanist| Species & Communities Branch
Department of Parks and Wildlife | Kensington | Ph. 9219 8760| jessica.donaldson@dpaw.wa.gov.au
Part Time: Tuesdays, Wednesdays and Thursdays

From: De Wit, Floora [mailto:Floora.DeWit@aecom.com]
Sent: Friday, 14 October 2016 11:30 AM
To: Donaldson, Jessica
Cc: Kirchner, Linda
Subject: Holcim Gosnells Quarry - advice for targeted surveys

Hi Jess,

We have recently been engaged by Holcim Gosnells Quarry to undertake additional flora and vegetation surveys including targeted searches.
Previously we have liaised with you regarding the *Thelymitra* surveys undertaken on their tenement. Additional surveys are now required for a suite of other Threatened and Priority species that are considered likely to occur. These include *Goodenia arthrotricha, Darwinia apiculata* and 17 Priority species (list attached).

We propose to undertake targeted surveys in in the next two weeks since October seems to be the best month with the most overlap of flowering periods of these species. *Thelymitra magnifica* will be included in these searches. Following this, *Thelymitra stellata* searches will be undertaken in mid-November. Transects of approximately 10-20 metres will be walked across the Project Area with a field guide to identification of these species.

So my questions are:

1. Do you think this method is suitable for the objective of the survey? (identifying the environmental value and potential of cons. sig flora to occur within the Project Area)
2. Are any species of particular concern or more or less likely to occur given your knowledge of the area?
3. Has the colder climate had any impact on flowering of species in your opinion?

Thanks I appreciate your time. The client is keen to get any input from DPaW at this stage of the survey as well. Requests for liaison with DPaW regarding survey methods is becoming more and more common. Please advise if there is a more suitable general email address to use for these requests.

Cheers,

Floora de Wit
Senior Botanist
D +61 8 6208 1073
Floora.DeWit@aecom.com

AECOM
Level 6, 3 Forrest Place, Perth, WA 6000
GPO Box B59 Perth WA 6849
T +61 8 6208 0000 F +61 8 6208 0999
aecom.com

Appendix B

Desktop Assessment

Appendix B Desktop Assessment

species	Conservation status (state)	Conservation status Cwlth	Description	Likelihood
Acacia aphylla	T (VU)	VU	Divaricately branched, spinescent, glaucous shrub, 0.9-2.5 m high. Fl. yellow, Aug to Oct. Sand, loam, clay loam. Granite outcrops, hills.	May. Suitable habitat present however no known records in vicinity of study area.
Acacia horridula	Priority 3	-	Harsh, slender, single-stemmed shrub, 0.3-0.6(-1) m high. Fl. yellow, May to Aug. Gravelly soils over granite, sand. Rocky hillsides.	Likely. Suitable habitat present and multiple known locations in vicinity of study area.
Acacia lasiocarpa var. bracteolata long peduncle variant (G.J. Keighery 5026)	Priority 1	-	Compact or rather diffuse, spinescent shrub, 0.2-0.6(-2.5) m high. Fl. yellow, Jun to Oct. Variety of soils	Unlikely. No known records and no suitable habitat present.
Acacia oncinophylla subsp. *patulifolia*	Priority 4	-	Shrub, 0.5-2.5(-3) m high, 'minni-ritchi' bark, phyllodes 4-9 cm long, 3-6 mm wide. Fl. yellow, Aug to Nov or Nov to Dec. Granitic soils, occasionally on laterite.	Likely. Suitable habitat present and multiple known locations in vicinity of study area.
Allocasuarina grevilleoides	Priority 3	-	Dioecious, lignotuberous shrub, 0.15-0.4 m high. Sand over laterite, gravel. Previously recorded in open or dense low heathland in Ellis Brook Valley Reserve	Likely. Suitable habitat present and multiple known locations in vicinity of study area.
Andersonia sp. Audax (F. Hort, B. Hort & J. Hort 3179)	Priority 3	-	No information available on habitat and no nearby records of species available	May. Unknown habitat, no known records in vicinity of study area.
Andersonia sp. Blepharifolia (F. & J. Hort 1919)	Priority 2	-	Low erect/spreading plant with whit/cream flowers. Previously found in Jarrah, Marri woodland or heathland	Likely. Suitable habitat present and multiple known locations in vicinity of study area.
Andersonia sp. Saxatilis (F. & J. Hort 3324)	Priority 1	-	No information available on habitat and no nearby records of species available	May. Unknown habitat, no known records in vicinity of study area.
Anthocercis gracilis	T (VU)	VU	Erect, spindly shrub, to 0.6(-1) m high. Fl. yellow-green, Sep to Oct. Sandy or loamy soils. Granite outcrops.	May. Suitable habitat present, one known record 10km from study area.

species	Conservation status (state)	Conservation status Cwlth	Description	Likelihood
Aponogeton hexatepalus	Priority 4	-	Rhizomatous or cormous, aquatic perennial, herb, leaves floating. Fl. green-white, Jul to Oct. Mud. Freshwater: ponds, rivers, claypans.	Unlikely. No known records and no suitable habitat present.
Asteridea gracilis	Priority 3	-	Annual, herb, 0.15-0.35 m high. Fl. white-pink, Sep to Dec. Sand, clay, gravelly soils.	Likely. Suitable habitat present and multiple known locations in vicinity of study area.
Austrostipa jacobsiana	T (CR)	-	No habitat or location data available. Assumed not occurring within 10 km due to lack of location data	May. Unknown habitat, no known records in vicinity of study area.
Banksia kippistiana var. *paenepeccata*	Priority 3	-	Erect, prickly, lignotuberous shrub, 0.3-1.2 m high. Fl. yellow-cream, Oct to Nov. Lateritic gravelly soils. Previously recorded in heath fringed by jarrah, Marri and Allocasuarina fraseriana open woodland or in open woodland of Eucalyptus marginata	Likely. Suitable habitat present and multiple known locations in vicinity of study area.
Banksia mimica	T (VU)	EN	Prostrate, lignotuberous shrub, 0.15-0.4 m high. Fl. yellow-brown, Dec or Jan to Feb. White or grey sand over laterite, sandy loam. Previously recorded in low scrub generally with Kingia	May. Suitable habitat present however no known records in vicinity of study area.
Beaufortia purpurea	Priority 3		Erect or spreading shrub, 0.3-1.5 m high. Flowers are red-purple, Oct to Dec or Jan to Feb. Lateritic or granitic soils. Rocky slopes.	Likely. Suitable habitat present and multiple known locations in vicinity of study area.
Boronia tenuis	Priority 4	-	Flowers pale purple. Previously recorded on slope amoungst granite boulders and outcrop. Also recorded on various loam, clay, gravel soils over granite. Recorded in Sheoak thicket or heathland or open woodland	Likely. Suitable habitat present and multiple known locations in vicinity of study area.
Byblis gigantea	Priority 3	-	Small, branched perennial, herb (or sub-shrub), to 0.45 m high. Fl. pink-purple/white, Sep to Dec or Jan. Sandy-peat swamps. Seasonally wet areas.	Unlikely. No known records and no suitable habitat present.

species	Conservation status (state)	Conservation status Cwlth	Description	Likelihood
Calothamnus accedens	Priority 4	-	*Erect & slender shrub, to 1.8 m high. Fl. pink-red. Sandy soils over laterite. Road verge. Previously recorded nearby in grey sand over gravel or rocky loam or rocky clay in open woodland or dense heath*	Likely. Suitable habitat present and multiple known locations in vicinity of study area.
Calothamnus graniticus subsp. *leptophyllus*	Priority 4	-	*Erect, multi-stemmed shrub, 1-2 m high. Fl. red, Jun to Aug. Clay over granite, lateritic soils. Hillsides. Previously recorded in rehabilitated area in Gosnells quarry boundary*	Known.
Calytrix breviseta subsp. *breviseta*	T (CR)	EN	Shrub, 0.4-1 m high. Fl. purple-blue, Oct to Nov. Sandy clay. Swampy flats.	Unlikely. No known records and no suitable habitat present.
Centrolepis caespitosa	Priority 4		Tufted annual, herb (forming a rounded cushion up to 25 mm across). Fl. Oct to Dec. White sand, clay. Salt flats, wet areas	Unlikely. No known records and no suitable habitat present.
Conospermum undulatum	T (VU)	VU	Erect, compact shrub, 0.6-2 m high. Fl. white-other, May to Oct. Grey or yellow-orange clayey sand.	Unlikely. No suitable habitat present. Multiple records in vicinity of study area however this species is restricted to the Swan Coastal Plain.
Darwinia apiculata	T (EN)	EN	Previously recorded in gravel, grey sand clay over granite or dry laterite around disturbed gravel pit site. Previously recorded in heathland or Marri woodland	Likely. Suitable habitat present and multiple known locations in vicinity of study area.
Drosera occidentalis subsp. *occidentalis*	Priority 4		Fibrous-rooted, rosetted perennial, herb, to 0.01 m high. Fl. pink/white, Nov to Dec. Sandy & clayey soils. Swamps & wet depressions.	Unlikely. No known records and no suitable habitat present.
Eleocharis keigheryi	T (VU)	VU	Rhizomatous, clumped perennial, grass-like or herb (sedge), to 0.4 m high. Fl. green, Aug to Nov. Clay, sandy loam. Emergent in freshwater: creeks, claypans.	Unlikely. No known records and no suitable habitat present.
Goodenia arthrotricha	T (EN)	-	Erect perennial, herb, to 0.4 m high. Fl. blue, Oct to Nov. Gravel. Granite rocks, slopes.	Likely. Suitable habitat present and multiple known locations in vicinity of study area.

species	Conservation status (state)	Conservation status Cwlth	Description	Likelihood
Grevillea crowleyae	Priority 2	-	Dense & spreading shrub, 0.5-1.5 m high. Fl. Aug to Nov. Gravel. In gravel pit. No nearby records of species exist in close proximity to study area	May. Suitable habitat present however no known records in vicinity of study area.
Grevillea manglesii subsp. ornithopoda	Priority 2	-	Spreading, virgate shrub, 1-3(-5) m high, up to 3 m wide. Fl. Sep to Nov. Prefers habitat amongst medium trees, or low trees, or tall (sclerophyll) shrubland, or low (sclerophyll) shrubland; in gravelly soil, or sand, or clay; occupying along creek beds. No nearby records of species available.	May. Suitable habitat present howoever no known records in vicinity of study area.
Grevillea thelemanniana subsp. *thelemanniana*	T (CR)	-	Low spreading bush with pink/red flowers. Previously recorded on sand below the scarp	Unlikely. No known records and no suitable habitat present.
Halgania corymbosa	Priority 3	-	Erect shrub, 0.35-1 m high. Fl. blue-purple, Aug to Nov. Gravelly soils, soils over granite.	Likely. Suitable habitat present and multiple known locations in vicinity of study area.
Hemigenia rigida	Priority 1	-	Upright or spreading shrub, 0.1-0.6(-1) m high. Fl. blue-purple/violet, Aug to Dec or Jan. Sandy soils, lateritic gravelly soils. Hillslopes, granite outcrops, flats, ironstone ridges.	May. Suitable habitat present however no recent records (1985 is the most recent) in vicinity of study area.
Isopogon drummondii	Priority 3	-	Erect, lignotuberous shrub, 0.4-1 m high. Fl. yellow/cream-yellow, Feb to Jun. White, grey or yellow sand, often over laterite.	Unlikely. No known records and no suitable habitat present.
Lasiopetalum glutinosum subsp. *glutinosum*	Priority 3	-	Previously recorded in various soil types including lateritic gravel and clay or brown, clayey sand with laterite.	Likely. Suitable habitat present and multiple known locations in vicinity of study area.
Meionectes tenuifolia	Priority 3	-	No information available on habitat preferences. Previous records occur on the Swan Coastal Plain more than 4.5km to the west	Unlikely. Unknown habitat preference, records restricted to the Swan Coastal Plain.
Paracaleana gracilicordata	Priority 1	-	Perennial, herb, to 0.07 m high. Fl. green-yellow-purple, Oct to Nov. Growing on moss mats, granite. Outcrops. No nearby records of species exist in close proximity to study area	May. Suitable habitat present however no known records in vicinity of study area.

species	Conservation status (state)	Conservation status Cwlth	Description	Likelihood
Paracaleana granitica	Priority 1	-	Perennial, herb, to 0.07 m high. Fl. green-purple, Oct to Dec. Growing on moss mats, granite. Outcrops. No nearby records of species exist in close proximity to study area	May. Suitable habitat present however no known records in vicinity of study area.
Pimelea rara	Priority 4	-	Shrub, 0.2-0.35 m high. Fl. white, Dec or Jan. Lateritic soils.	Likely. Suitable habitat present and multiple known locations in vicinity of study area.
Ptilotus sericostachyus subsp. *roseus*	Priority 1	-	Prostrate to ascending perennial, herb. Fl. pink-white, Sep to Dec. No nearby records of species exist in close proximity to study area	May. Unknown habitat preference and no records in vicinity of study area.
Schoenus benthamii	Priority 3	-	Rhizamatous perennial. Previously recorded in open grey sand over clay, open swamp	Unlikely. No known records and no suitable habitat present.
Schoenus pennisetis	Priority 3	-	Tufted sedge. Previously recorded in low lying sandy swamp, slightly saline	Unlikely. No known records and no suitable habitat present.
Stackhousia sp. Red-blotched corolla	Priority 3	-	Previously recorded in light brown yellow silty-gravel with surface granite and lateritic gravel and cobbels in heathland	Likely. Suitable habitat present and multiple known locations in vicinity of study area.
Tetratheca sp. Granite (S. Patrick SP1224)	Priority 3		Erect shrub, to 0.4 m high. Clay, moist loam, clayey sand. Granite boulders.	Likely. Suitable habitat present and multiple known locations in vicinity of study area.
Thelymitra magnifica	Priority 1	-	Perennial, herb. Stony ridges.	Likely. Suitable habitat present and multiple known locations in vicinity of study area.
Thelymitra stellata	T (EN)	-	Tuberous, perennial, herb, 0.15-0.25 m high. Fl. yellow & brown, Oct to Nov. Sand, gravel, lateritic loam. Considered to be likely to occur by DPaW	Likely. Suitable habitat present and multiple known locations in vicinity of study area.
Thysanotus anceps	Priority 3	-	Rhizomatous, leafless perennial, herb, to 0.4 m high. Fl. purple, Oct to Dec. White or grey sand, lateritic gravel, laterite.	May. Suitable habitat present however no known records in vicinity of study area.
Verticordia lindleyi subsp. *lindleyi*	Priority 4	-	Erect shrub, 0.2-0.75 m high. Fl. pink, May or Nov to Dec or Jan. Sand, sandy clay. Winter-wet depressions.	Unlikely. No known records and no suitable habitat present.

Appendix C

Flora Species List, Holcim 2016

Appendix C: Flora Species List, Holcim 2016

Family	Cons. / Weed	Taxon
Amaranthaceae		
		Ptilotus esquamatus
		Ptilotus manglesii
Anarthiaceae		
		Lyginia barbata
Apiaceae		
		Actinotus leucocephalus
		Pentapeltis peltigera
		Platysace juncea
		Xanthosia candida
		Xanthosia ciliata
Araliaceae		
		Trachymene grandis
		Trachymene pilosa
Asparagaceae		
		Acanthocarpus canaliculatus
		Chamaescilla corymbosa
		Laxmannia grandiflora
		Laxmannia squarrosa
		Lomandra ?preissii
		Lomandra brittanii
		Lomandra caespitosa
		Lomandra effusa
		Lomandra nigricans
		Lomandra preissii
		Lomandra sericea
		Lomandra sonderi
		Lomandra sp.
		Lomandra spartea
		Thysanotus dichotomous
		Thysanotus manglesianus
		Thysanotus scaber
		Thysanotus thyrsoideus
Asteraceae		
	P3	*Asteridea gracilis*
		Craspedia variabilis
		Hyalosperma cotula
	*	*Hypochaeris glabra*
		Lagenophora huegelii
		Millotia tenuifolia var. *tenuifolia*
		Pterochaeta paniculata
		Rhodanthe citrina
		Siloxerus filifolius
		Sonchus asper
		Sonchus sp. juvenile
	*	*Taraxacum officinale*
		Trichocline spathulata
	*	*Ursinia anthemoides*
	*	*Podolepis sp.*
Boraginaceae		
		Boraginaceae sp.
Boryaceae		
		Borya constricta
		Borya sphaerocephala

Family	Cons. / Weed	Taxon
Campanulaceae		
		Lobelia gibbosa
Casuarinaceae		
		Allocasuarina fraseriana
		Allocasuarina humilis
		Allocasuarina microstachya
Celastraceae		
		Stackhousia monogyna
		Stackhousia pubescens
		Tripterococcus brunonis
Centrolepidaceae		
		Aphelia brizula
Colchicaceae		
		Burchardia congesta
Cyperaceae		
		Cyathochaeta avenacea
		Lepidosperma apricola
		Lepidosperma drummondii
		Lepidosperma leptostachyum
		Lepidosperma pubisquameum (juvenile)
		Lepidosperma squamatum
		Lepidosperma sp.
		Mesomelaena tetragona
		Schoenus armeria
		Tetraria capillaris
		Tetraria octandra
		Schoenus nanus
Dasypogonaceae		
		Kingia australis
Dillenaceae		
		Hibbertia acerosa
		Hibbertia commutata
		Hibbertia commutata (hairy form)
		Hibbertia huegelii
		Hibbertia hypericoides
		Hibbertia mylnei
		Hibbertia pachyrrhiza
		Hibbertia subvaginata
Dioscoreaceae		
		Dioscorea hastifolia
Droseraceae		
		Drosera gigantea
		Drosera glanduligera
		Drosera macrantha subsp. *macrantha*
		Drosera menziesii subsp. *menziesii*
		Drosera sp.
		Drosera stolonifera
Elaeocarpaceae		
		Tetratheca hirsuta
		Tetratheca nuda

Family	Cons. / Weed	Taxon
Ericaceae		
		Andersonia aristata
		Astroloma ciliatum
		Astroloma glaucescens
		Astroloma pallidum
		Leucopogon capitellatus
		Leucopogon pulchellus
		Leucopogon sprengelioides
		Leucopogon squarrosus
		Styphelia tenuiflora
Fabaceae		
		Acacia alata
		Acacia barbinervis subsp. *barbinervis*
		Acacia divergens
	P3	*Acacia horridula*
		Acacia huegelii
		Acacia iteaphylla
		Acacia lateriticola
		Acacia obovata
	P4	*Acacia oncinophylla subsp. patulifolia*
		Acacia pulchella var. *pulchella*
		Acacia sp.
		Acacia teretifolia
		Bossiaea ornata
		Chorizema dicksonii
		Cristonia biloba subsp. *biloba*
		Daviesia decurrens
		Daviesia horrida
		Daviesia longifolia
		Gastrolobium acutum
		Gastrolobium dilatatum
		Gastrolobium spinosum
		Gompholobium aristatum
		Gompholobium knightianum
		Gompholobium marginatum
		Gompholobium polymorphum
		Gompholobium preissii
		Gompholobium tomentosum
		Hovea chorizemifolia
		Hovea elliptica
		Hovea pungens
		Hovea trisperma
		Jacksonia alata
		Kennedia prostrata
		Labichea punctata
		Mirbelia spinosa
		Pultenaea ericifolia
Gentianaceae		
	*	*Centaurium tenuiflorum*

Family	Cons. / Weed	Taxon
Goodeniaceae		
		Dampiera alata
		Dampiera coronata
		Dampiera linearis
		Goodenia coerulea
		Goodenia fasciculata
		Lechenaultia biloba
		Scaevola calliptera
		Scaevola platyphylla
		Scaevola repens
Haemodoraceae		
		Conostylis androstemma
		Conostylis serrulata
		Conostylis setosa
		Haemodorum laxum
		Tribonanthes brachypetala
Haloragaceae		
		Glischrocaryon aureum
		Glischrocaryon flavescens
		Gonocarpus cordiger
Hemerocallidaceae		
		Agrostocrinum scabrum subsp. *scabrum*
		Caesia micrantha
		Dianella revoluta
		Tricoryne elatior
Iridaceae		
	*	*Gladiolus undulatus*
		Orthrosanthus laxus var. *laxus*
		Patersonia occidentalis
		Patersonia pygmaea
	*	*Watsonia meriana*
Lamiaceae		
		Hemiandra sp.
		Hemigenia incana
		Microcorys longifolia
Lauraceae		
		Cassytha racemosa
		Cassytha racemosa forma *racemosa*
		Cassytha sp.
Loganiaceae		
		Phyllangium paradoxum
Loranthaceae		
		Nuytsia floribunda
Malvaceae		
		Lasiopetalum floribundum
	P3	*Lasiopetalum glutinosum* subsp. *glutinosum*
		Thomasia grandiflora
		Thomasia macrocarpa
Myrtaceae		
		Astartea leptophylla
		Babingtonia camphorosmae
		Babingtonia pelloeae
		Beaufortia macrostemon
	P3	*Beaufortia purpurea*
		Calothamnus quadrifidus subsp. *quadrifidus*
		Calothamnus rupestris
		Calothamnus sanguineus

Family	Cons. / Weed	Taxon
		Calothamnus torulosus
		Calytrix acutifolia
		Calytrix glutinosa
		Calytrix variabilis
		Corymbia calophylla
		Darwinia citriodora
		Eucalyptus marginata subsp. *thalassica*
		Eucalyptus wandoo
		Eucalyptus wandoo (mallee form)
		Hypocalymma angustifolium
		Hypocalymma robustum
		Leptospermum erubescens
		Melaleuca holosericea
		Melaleuca parviceps
		Melaleuca radula
		Paragonis grandiflora
		Verticordia ? densiflora var. cespitosa
		Verticordia acerosa var. *acerosa*
		Verticordia acerosa var. *preissii*
		Verticordia huegelii var. *huegelii*
		Verticordia insignis subsp. *insignis*
		Verticordia plumosa var. *plumosa*
Orchidaceae		
		Caladenia flava
		Caladenia longicauda subsp. *?clivicola*
		Caladenia sp.
	*	*Disa bracteata*
		Elythranthera emarginata
		Pterostylis sp.
		Pterostylis sp. nana complex
		Pyrorchis nigricans
		Spiculaea ciliata
		Thelymitra ?crinita
		Thelymitra crinita
		Thelymitra sp.
Orobanchaceae		
	*	*Bartsia trixago*
		Parentucellia latifolia
Phyllanthaceae		
		Phyllanthus calycinus
Pittosporaceae		
		Cheiranthera preissiana
Poaceae		
	*	*Aira caryophyllea*
		Amphipogon amphipogonoides
		Amphipogon turbinatus
		Austrostipa campylachne
	*	*Briza maxima*
	*	*Briza minor*
	*	*Bromus* sp.
		Neurachne alopecuroidea
		Rytidosperma acerosa
		Rytidosperma pilosum
		Tetrarrhena laevis
		Poa drummondiana

Family	Cons. / Weed	Taxon
Polygalaceae		
		Comesperma ciliatum
		Comesperma virgatum
Primulaceae		
	*	*Lysimachia arvensis*
Proteaceae		
		Adenanthos obovatus
		Banksia armata var. *armata*
		Banksia bipinnatifida subsp. *bipinnatifida*
		Banksia dallanneyi var. *dallanneyi*
		Banksia dallanneyi var. *mellicula*
		Banksia nivea
		Banksia sessilis var. *sessilis*
		Banksia squarrosa subsp. *squarrosa*
		Grevillea bipinnatifida subsp. *bipinnatifida*
		Grevillea manglesii subsp. *manglesii*
		Grevillea pilulifera
		Grevillea quercifolia
		Grevillea synaphea subsp. *synaphea*
		Grevillea vestida
		Grevillea wilsonii
		Hakea amplexicaulis
		Hakea auriculata
		Hakea cyclocarpa
		Hakea erinacea
		Hakea incrasatta
		Hakea incrassata
		Hakea lissocarpha
		Hakea neospathulata
		Hakea petiolaris subsp. *petiolaris*
		Hakea prostrata
		Hakea ruscifolia
		Hakea sp.
		Hakea stenocarpa
		Hakea trifurcata
		Hakea uncinata
		Hakea undulata
		Isopogon asper
		Isopogon dubius
		Isopogon sphaerocephalus
		Isopogon dubius
		Lambertia multiflora var. *darlingensis*
		Persoonia angustifolia
		Persoonia ellipticum
		Petrophile biloba
		Petrophile seminuda
		Petrophile squamata subsp. *squamata*
		Petrophile striata
		Synaphea acutiloba
		Synaphea petiolaris subsp. *petiolaris*
Restionaceae		
		Desmocladus fasciculatus
		Desmocladus flexuosus
		Dielsia stenostachya
		Lepidobolus preissianus subsp. *preissianus*

Family	Cons. / Weed	Taxon
Rhamnaceae		
		Cryptandra pungens
		Trymalium ledifolium
		Trymalium ledifolium var. *rosmarinifolium*
Rubiaceae		
		Opercularia echinocephala
		Opercularia vaginata
Rutaceae		
		Boronia crenulata
		Boronia cymosa
		Boronia ovata
		Philotheca spicata
Sapindaceae		
		Diplopeltis huegelii subsp. *lehmannii*
Stylidiaceae		
		Levenhookia dubia
		Levenhookia pusilla
		Stylidium ?bulbiferum
		Stylidium affine
		Stylidium amoenum
		Stylidium amoenum var. *caulescens*
		Stylidium androsaceum
		Stylidium brunonianum
		Stylidium bulbiferum
		Stylidium calcaratum
		Stylidium carnosum
		Stylidium eriopodum
		Stylidium hispidum
		Stylidium piliferum
		Stylidium repens
		Stylidium sp.
		Stylidium thesioides
Thymelaeaceae		
		Pimelea ciliata subsp. *ciliata*
		Pimelea imbricata var. *piligera*
		Pimelea spectabilis
		Pimelea suaveolens
		Pimelea suaveolens subsp. *suaveolens*
Xanthorrhoeaceae		
		?Xanthorrhoea preissii
		Xanthorrhoea drummondii
		Xanthorrhoea gracilis
		Xanthorrhoea preissii
Zamiaceae		
		Macrozamia riedlei

Appendix D

Species by Communities Matrix

Appendix D Species by Community Matrix

	Taxon	Community								
		BpSr	CcCrTc	CcHtHh	EmBsBd	EmKaLm	EwHhSa	HeSb	IdBc	VaBs
	?Xanthorrhoea preissii	x		x						x
	Acacia alata							x		
	Acacia barbinervis subsp. *barbinervis*				x					
	Acacia divergens			x						
	Acacia horridula		x							
	Acacia huegelii					x				
	Acacia iteaphylla				x					
	Acacia lateriticola			x	x		x	x		
	Acacia obovata			x	x					
	Acacia oncinophylla subsp. patulifolia								x	x
	Acacia pulchella var. pulchella	x	x	x	x		x	x	x	
	Acacia sp.	x								x
	Acacia teretifolia							x		
	Acanthocarpus canaliculatus						x			
	Actinotus leucocephalus									x
	Adenanthos obovatus				x	x	x			
	Agrostocrinum scabrum subsp. scabrum				x					
*	*Aira caryophyllea*				x			x		x
	Allocasuarina fraseriana			x	x	x	x			
	Allocasuarina humilis	x	x					x	x	
	Allocasuarina microstachya					x				
	Amphipogon amphipogonoides			x		x				
	Amphipogon turbinatus			x	x			x		x
	Andersonia aristata									x
	Aphelia brizula			x						
	Astartea leptophylla			x	x					
	Asteridea gracilis						x	x		
	Astroloma ciliatum				x	x	x	x		
	Astroloma glaucescens	x		x	x	x		x	x	x
	Astroloma pallidum			x	x	x				
	Austrostipa campylachne						x			
	Babingtonia camphorosmae	x		x		x		x	x	
	Babingtonia pelloeae	x			x					x
	Banksia armata var. armata	x		x		x		x		x
	Banksia bipinnatifida subsp. bipinnatifida		x		x	x	x	x	x	

	Taxon	Community								
		BpSr	CcCrTc	CcHtHh	EmBsBd	EmKaLm	EwHhSa	HeSb	IdBc	VaBs
	Banksia dallanneyi var. dallanneyi	x	x	x	x		x	x	x	x
	Banksia dallanneyi var. mellicula				x	x	x			
	Banksia nivea					x				
	Banksia sessilis var. sessilis	x			x				x	
	Banksia squarrosa subsp. squarrosa	x	x			x		x	x	
*	*Bartsia trixago*									
	Beaufortia macrostemon	x		x		x				
	Beaufortia purpurea	x		x	x	x		x		x
	Boraginaceae sp.									x
	Boronia crenulata		x							
	Boronia cymosa								x	
	Boronia ovata			x	x	x	x		x	
	Borya constricta							x	x	x
	Borya sphaerocephala								x	x
	Bossiaea ornata		x	x	x	x	x			
*	*Briza maxima*							x		x
*	*Briza minor*									x
*	*Bromus* sp.				x					
	Burchardia congesta	x		x	x		x	x	x	
	Caesia micrantha			x		x				
	Caladenia flava		x				x			
	Caladenia longicauda subsp. *?clivicola*						x			
	Caladenia sp.									
	Calothamnus quadrifidus subsp. *quadrifidus*			x						
	Calothamnus rupestris		x					x	x	
	Calothamnus sanguineus								x	
	Calothamnus torulosus					x			x	
	Calytrix acutifolia		x							
	Calytrix glutinosa								x	x
	Calytrix variabilis	x						x		x
	Cassytha racemosa		x	x	x		x	x	x	
	Cassytha racemosa forma *racemosa*	x	x			x	x	x	x	
	Cassytha sp.	x			x					x
*	*Centaurium tenuiflorum*									x
	Chamaescilla corymbosa			x	x					
	Cheiranthera preissiana			x						
	Chorizema dicksonii							x		

	Taxon	Community								
		BpSr	CcCrTc	CcHtHh	EmBsBd	EmKaLm	EwHhSa	HeSb	IdBc	VaBs
	Comesperma ciliatum								x	
	Comesperma virgatum	x								
	Conostylis androstemma									x
	Conostylis serrulata					x				
	Conostylis setosa	x	x	x	x	x	x			x
	Corymbia calophylla		x	x	x	x	x	x		
	Craspedia variabilis									x
	Cristonia biloba subsp. *biloba*								x	
	Cryptandra pungens							x	x	
	Cyathochaeta avenacea		x	x						
	Dampiera alata		x	x	x		x	x		
	Dampiera coronata			x						
	Dampiera linearis			x	x	x	x	x		
	Darwinia citriodora	x		x						x
	Daviesia decurrens				x			x		
	Daviesia horrida					x		x		
	Daviesia longifolia					x				
	Desmocladus fasciculatus				x			x		
	Desmocladus flexuosus			x		x		x		
	Dianella revoluta	x		x	x					
	Dielsia stenostachya									x
	Dioscorea hastifolia									
	Diplopeltis huegelii subsp. *lehmannii*						x		x	
*	*Disa bracteata*									
	Drosera gigantea				x				x	x
	Drosera glanduligera				x	x		x	x	x
	Drosera macrantha subsp. *macrantha*				x	x	x	x		
	Drosera menziesii subsp. *menziesii*	x			x		x	x	x	x
	Drosera sp.				x					
	Drosera stolonifera				x					
	Elythranthera emarginata								x	
	Eucalyptus marginata subsp. *thalassica*			x	x	x	x			
	Eucalyptus wandoo						x	x	x	
	Eucalyptus wandoo (mallee form)							x		
	Gastrolobium acutum							x		
	Gastrolobium dilatatum				x	x			x	
	Gastrolobium spinosum						x			

	Taxon	Community								
		BpSr	CcCrTc	CcHtHh	EmBsBd	EmKaLm	EwHhSa	HeSb	IdBc	VaBs
*	*Gladiolus undulatus*							x		x
	Glischrocaryon aureum								x	x
	Glischrocaryon flavescens									x
	Gompholobium aristatum						x			
	Gompholobium knightianum		x	x	x	x				
	Gompholobium marginatum	x		x	x		x	x	x	
	Gompholobium polymorphum			x	x					
	Gompholobium preissii			x	x					
	Gompholobium tomentosum		x							
	Gonocarpus cordiger									x
	Goodenia coerulea	x			x					x
	Goodenia fasciculata									x
	Goodeniaceae sp.			x						
	Grevillea bipinnatifida subsp. *bipinnatifida*						x	x	x	
	Grevillea manglesii subsp. *manglesii*				x					
	Grevillea pilulifera						x	x		
	Grevillea quercifolia					x				
	Grevillea synaphea subsp. *synaphea*				x					
	Grevillea vestida			x						
	Grevillea wilsonii				x					
	Haemodorum laxum			x		x	x	x	x	x
	Hakea amplexicaulis		x		x	x	x			
	Hakea auriculata								x	
	Hakea cyclocarpa					x				
	Hakea erinacea				x		x	x	x	x
	Hakea incrassata	x						x	x	x
	Hakea lissocarpha			x	x		x	x		
	Hakea neospathulata							x		
	Hakea petiolaris subsp. *petiolaris*									
	Hakea prostrata			x						
	Hakea ruscifolia					x				
	Hakea sp.				x					
	Hakea stenocarpa			x	x	x	x	x		
	Hakea trifurcata	x	x	x	x			x		x
	Hakea uncinata	x		x	x					x
	Hakea undulata		x	x	x	x	x	x	x	
	Hemiandra sp.			x						

	Taxon	Community								
		BpSr	CcCrTc	CcHtHh	EmBsBd	EmKaLm	EwHhSa	HeSb	IdBc	VaBs
	Hemigenia incana	x					x	x	x	
	Hibbertia acerosa			x	x	x	x			
	Hibbertia commutata			x	x	x	x	x		
	Hibbertia commutata (hairy form)				x					
	Hibbertia huegelii			x	x	x				
	Hibbertia hypericoides	x	x	x	x	x	x	x	x	x
	Hibbertia mylnei						x	x	x	
	Hibbertia pachyrrhiza				x	x				
	Hibbertia subvaginata			x				x	x	
	Hovea chorizemifolia				x	x	x			
	Hovea elliptica			x	x		x	x		
	Hovea pungens									x
	Hovea trisperma				x					
	Hyalosperma cotula							x		
	Hypocalymma angustifolium						x	x		
	Hypocalymma robustum		x	x	x	x				
*	*Hypochaeris glabra*						x	x		x
	Isopogon asper			x		x		x	x	
	Isopogon dubius	x		x		x			x	
	Isopogon sphaerocephalus				x		x			
	Isopogon dubius	x			x				x	
	Jacksonia alata				x	x		x	x	
	Kennedia prostrata			x	x					
	Kingia australis			x		x			x	
	Labichea punctata				x	x				
	Lagenophora huegelii						x	x	x	
	Lambertia multiflora var. *darlingensis*	x				x		x		
	Lasiopetalum floribundum						x			
	Lasiopetalum glutinosum subsp. *glutinosum*	x						x	x	
	Laxmannia grandiflora							x		x
	Laxmannia squarrosa							x	x	
	Lechenaultia biloba		x	x	x	x		x		
	Lepidobolus preissianus subsp. *preissianus*								x	
	Lepidosperma apricola							x	x	
	Lepidosperma drummondii						x		x	x
	Lepidosperma leptostachyum			x	x	x		x		
	Lepidosperma pubisquameum (juvenile)				x					

	Taxon	Community								
		BpSr	CcCrTc	CcHtHh	EmBsBd	EmKaLm	EwHhSa	HeSb	IdBc	VaBs
	Lepidosperma sp.								x	
	Lepidosperma squamatum						x	x		
	Leptospermum erubescens		x						x	
	Leucopogon capitellatus			x	x		x			
	Leucopogon pulchellus	x							x	
	Leucopogon sprengelioides	x						x		
	Leucopogon squarrosus									x
	Levenhookia dubia				x				x	x
	Levenhookia pusilla				x		x	x		x
	Lobelia gibbosa				x		x			
	Lomandra ?preissii				x					
	Lomandra brittanii				x					
	Lomandra caespitosa				x		x			
	Lomandra effusa					x				
	Lomandra nigricans				x					
	Lomandra preissii				x	x		x		
	Lomandra sericea						x			
	Lomandra sonderi					x				
	Lomandra sp.			x	x					
	Lomandra spartea				x					
	Lyginia barbata								x	
*	*Lysimachia arvensis*						x			
	Macrozamia riedlei						x	x		
	Melaleuca holosericea	x		x			x		x	x
	Melaleuca parviceps		x		x	x	x	x	x	x
	Melaleuca radula		x	x			x	x		x
	Mesomelaena tetragona			x	x	x		x		
	Microcorys longifolia							x	x	
	Millotia tenuifolia var. *tenuifolia*							x		
	Mirbelia spinosa								x	x
	Neurachne alopecuroidea						x	x	x	
	Nuytsia floribunda								x	
	Opercularia echinocephala		x	x	x			x		
	Opercularia vaginata				x	x		x		
	Orthrosanthus laxus var. *laxus*				x			x		
	Paragonis grandiflora	x		x		x		x		
	Parentucellia latifolia									x

	Taxon	Community								
		BpSr	CcCrTc	CcHtHh	EmBsBd	EmKaLm	EwHhSa	HeSb	IdBc	VaBs
	Patersonia occidentalis		x	x	x	x	x	x	x	x
	Patersonia pygmaea			x	x		x	x		
	Pentapeltis peltigera		x	x	x	x				
	Persoonia angustifolia				x					
	Persoonia ellipticum					x				
	Petrophile biloba				x			x		x
	Petrophile seminuda							x		
	Petrophile squamata subsp. *squamata*	x						x		
	Petrophile striata				x	x	x		x	
	Philotheca spicata				x	x		x		
	Phyllangium paradoxum							x		x
	Phyllanthus calycinus			x	x		x	x		x
	Pimelea ciliata subsp. *ciliata*				x					x
	Pimelea imbricata var. *piligera*	x					x	x	x	x
	Pimelea spectabilis					x	x	x		
	Pimelea suaveolens			x			x			
	Pimelea suaveolens subsp. *suaveolens*			x		x				
	Platysace juncea				x					
	Poa drummondiana							x		
*	*Podolepis* sp.						x			
	Pterochaeta paniculata				x		x	x	x	x
	Pterostylis sp.				x					
	Pterostylis sp. nana complex		x							
	Ptilotus esquamatus			x	x					
	Ptilotus manglesii				x		x			
	Pultenaea ericifolia							x	x	
	Pyrorchis nigricans				x					
	Rhamnaceae sp.	x								
	Rhodanthe citrina				x					
	Rytidosperma acerosa				x			x		
	Rytidosperma pilosum							x		
	Scaevola calliptera			x	x					
	Scaevola platyphylla						x			
	Scaevola repens									x
	Schoenus armeria	x							x	
	Schoenus nanus							x		x
	Siloxerus filifolius							x		x

	Taxon	Community								
		BpSr	CcCrTc	CcHtHh	EmBsBd	EmKaLm	EwHhSa	HeSb	IdBc	VaBs
	Sonchus asper						x			
	Sonchus sp. juvenile		x							
	Spiculaea ciliata									x
	Stackhousia monogyna							x	x	
	Stackhousia pubescens						x			
	Stylidium ?bulbiferum					x				
	Stylidium affine			x	x		x	x		
	Stylidium amoenum			x	x	x				
	Stylidium amoenum var. *caulescens*	x		x	x	x				
	Stylidium androsaceum				x					
	Stylidium brunonianum	x			x	x		x	x	
	Stylidium bulbiferum	x	x		x		x	x	x	x
	Stylidium calcaratum				x		x	x	x	
	Stylidium carnosum			x						
	Stylidium eriopodum	x		x	x		x	x	x	x
	Stylidium hispidum								x	
	Stylidium piliferum		x		x		x			
	Stylidium repens	x						x	x	x
	Stylidium sp.			x	x			x		x
	Stylidium thesioides		x					x		x
	Styphelia tenuiflora				x		x			
	Synaphea acutiloba		x		x			x	x	
	Synaphea petiolaris subsp. *petiolaris*			x						
*	*Taraxacum officinale*									x
	Tetraria capillaris	x	x	x	x	x	x	x		
	Tetraria octandra		x			x	x	x	x	
	Tetrarrhena laevis			x	x		x			
	Tetratheca hirsuta				x	x				
	Tetratheca nuda					x			x	
	Thelymitra ?crinita									
	Thelymitra crinita				x	x		x		
	Thelymitra sp.		x	x	x				x	
	Thomasia grandiflora			x		x	x			
	Thomasia macrocarpa									
	Thysanotus dichotomous				x					
	Thysanotus manglesianus	x	x		x		x	x		
	Thysanotus scaber								x	

	Taxon	Community								
		BpSr	CcCrTc	CcHtHh	EmBsBd	EmKaLm	EwHhSa	HeSb	IdBc	VaBs
	Thysanotus thyrsoideus			x	x	x	x			
	Trachymene grandis						x			
	Trachymene pilosa				x			x	x	
	Tribonanthes brachypetala									x
	Trichocline spathulata		x	x	x		x	x		
	Tricoryne elatior			x			x			
	Tripterococcus brunonis									x
	Trymalium ledifolium		x	x	x		x	x		x
	Trymalium ledifolium var. *rosmarinifolium*			x	x			x		
*	*Ursinia anthemoides*									x
	Verticordia ? densiflora var. *cespitosa*									x
	Verticordia acerosa var. *acerosa*	x	x			x		x	x	x
	Verticordia acerosa var. *preissii*									x
	Verticordia huegelii var. *huegelii*							x		x
	Verticordia insignis subsp. *insignis*	x	x					x		x
	Verticordia plumosa var. *plumosa*	x							x	x
	Verticorida insignis subsp. *insignis*									x
*	*Watsonia meriana*			x						
	Xanthorrhoea drummondii	x		x		x	x	x	x	x
	Xanthorrhoea gracilis				x					
	Xanthorrhoea preissii		x	x	x		x	x		
	Xanthosia candida			x	x		x	x		
	Xanthosia ciliata				x				x	

Appendix E

Plot Data

Plot Data

Site No: Ck1	Type: Quadrat	Latitude: -32.072184	Longitude: 116.039143

Date: 11/17/2014
Observer: C Krens
Topography: Mid Slope
Rocky Type: Granite
Vegetation Condition: Excellent.

Soil Types: Sandy loam gravel some clay
Soil Colour: Brown
Soil Condition: Dry
Fire History: 5-10

Taxon	Cons. Code	Height (cm)	% Alive
Acacia barbinervis subsp. barbinervis		30	0.1
Acacia pulchella var. pulchella		40	0.2
Banksia dallanneyi var. dallanneyi		20	0.5
Banksia sessilis var. sessilis		450	50
Boronia ovata		20	0.1
Bossiaea ornata		40	2
Cassytha sp.			0.1
Conostylis setosa		20	0.1
Corymbia calophylla		1500	30
Drosera stolonifera			0.1
Eucalyptus marginata subsp. thalassica		1200	15
Gompholobium knightianum		20	0.1
Goodenia coerulea		20	0.1
Hakea erinacea		60	2
Hakea stenocarpa		120	0.2
Hakea undulata		60	1
Hibbertia commutata		40	0.2
Hibbertia huegelii		20	0.1
Hibbertia hypericoides		40	3
Hypocalymma robustum		60	0.5
Isopogon sphaerocephalus		40	0.2
Kennedia prostrata			0.1
Lepidosperma leptostachyum		40	0.1
Lepidosperma pubisquameum (juvenile)		60	0.5
Lobelia gibbosa		5	0.1
Lomandra sp.		40	0.1
Opercularia echinocephala		10	0.1
Opercularia vaginata		20	0.2
Orthrosanthus laxus var. laxus		40	0.1

Taxon	Cons. Code	Height (cm)	% Alive
Pentapeltis peltigera		10	0.2
Petrophile biloba			
Platysace juncea		60	0.1
Thysanotus thyrsoideus		40	0.1
Trymalium ledifolium		40	0.5
Xanthorrhoea preissii		120	2

Site No: Ck2	Type: Quadrat	Latitude: -32.07394	Longitude: 116.040228

Date: 11/17/2014 Soil Types: Loam, gravel, clay

Observer: C Krens Soil Colour: Brown

Topography: Upper Slope Soil Condition: Dry

Rocky Type: Granite Fire History: 5-10

Vegetation Condition: Excellent. Possible dieback cant see front some jarrah deaths

Taxon	Cons. Code	Height (cm)	% Alive
Acacia obovata		20	0.1
Acacia pulchella var. pulchella		60	1
Allocasuarina fraseriana		300	1
Astroloma pallidum		10	0.1
Banksia bipinnatifida subsp. bipinnatifida		30	0.2
Banksia dallanneyi var. dallanneyi		30	1
Bossiaea ornata		30	0.1
Bossiaea ornata		30	0.1
Bromus sp.	*	30	0.1
Burchardia congesta		40	0.1
Cassytha sp.			0.1
Conostylis setosa		5	0.1
Conostylis setosa		30	0.5
Corymbia calophylla		1500	25
Dampiera alata		20	0.1
Daviesia decurrens		40	0.1
Desmocladus fasciculatus		10	0.1
Eucalyptus marginata subsp. thalassica		1200	30
Gompholobium knightianum		30	0.2
Gompholobium marginatum		20	0.1
Goodenia coerulea		30	0.1
Hakea amplexicaulis		80	0.5
Hakea erinacea		180	2
Hakea undulata		100	2
Hibbertia acerosa		30	1
Hibbertia commutata		40	0.2
Hibbertia hypericoides		50	20
Hypocalymma robustum		40	0.5
Isopogon sphaerocephalus		30	0.1
Kennedia prostrata			0.1
Lepidosperma leptostachyum		80	0.2

Taxon	Cons. Code	Height (cm)	% Alive
Levenhookia pusilla		5	0.1
Pentapeltis peltigera		10	0.1
Phyllanthus calycinus		30	0.1
Ptilotus manglesii		3	0.1
Scaevola calliptera		10	0.1
Stylidium amoenum var. caulescens		30	0.1
Stylidium eriopodum		10	0.1
Synaphea acutiloba		20	0.1
Tetratheca hirsuta		60	0.5
Thelymitra crinita		10	
Xanthorrhoea preissii		150	7

Site No: Ck3	Type: Quadrat	Latitude: -32.076356	Longitude: 116.039838

Date: 11/17/2014
Observer: C Krens
Topography: Mid Slope
Rocky Type:
Vegetation Condition: Excellent.

Soil Types: Loam, gravel, clay
Soil Colour: Orange
Soil Condition: Dry
Fire History: 10+

Taxon	Cons. Code	Height (cm)	% Alive
?Xanthorrhoea preissii		200	5
Acacia sp.		40	0.1
Allocasuarina humilis		120	0.2
Astroloma glaucescens		40	0.2
Babingtonia pelloeae		60	5
Banksia armata var. armata		60	7
Banksia dallanneyi var. dallanneyi		30	0.5
Banksia sessilis var. sessilis		60	2
Beaufortia macrostemon		40	10
Beaufortia purpurea	P3	100	60
Burchardia congesta		40	0.1
Cassytha sp.			0.1
Comesperma virgatum		60	0.1
Dianella revoluta		80	0.1
Goodenia coerulea		30	0.1
Hakea incrassata		80	0.1
Hakea uncinata		150	15
Hibbertia hypericoides		40	2
Isopogon dubius		120	1
Lambertia multiflora var. darlingensis		40	1
Melaleuca holosericea		60	1
Paragonis grandiflora		60	2
Rhamnaceae sp.		60	0.2
Stylidium amoenum var. caulescens		30	0.1
Stylidium eriopodum		10	0.1
Tetraria capillaris		10	0.1

Site No: Ck4	Type: Quadrat	Latitude: -32.075966	Longitude: 116.039145

Date: 11/17/2014
Observer: C Krens
Topography: Lower Slope
Rocky Type: Granite
Vegetation Condition: Excellent.

Soil Types: Loam, gravel, clay
Soil Colour: Light brown
Soil Condition: Dry
Fire History: <5

Taxon	Cons. Code	Height (cm)	% Alive
?Xanthorrhoea preissii		180	5
Amphipogon turbinatus		50	0.1
Andersonia aristata		10	0.1
Astroloma glaucescens		40	0.5
Babingtonia pelloeae		40	10
Banksia armata var. armata		60	2
Banksia dallanneyi var. dallanneyi		30	2
Beaufortia purpurea	P3	60	1
Borya sphaerocephala		5	0.5
Cassytha sp.			0.1
Conostylis setosa		10	0.1
Goodenia coerulea		20	0.1
Goodenia coerulea		30	0.2
Haemodorum laxum		100	0.1
Hakea incrassata		80	3
Hakea uncinata		80	0.2
Hibbertia hypericoides		40	2
Levenhookia dubia		3	0.1
Melaleuca holosericea		60	20
Mirbelia spinosa		40	10
Patersonia occidentalis		60	0.1
Petrophile biloba		40	0.1
Phyllanthus calycinus		40	0.2
Pimelea imbricata var. piligera		10	0.1
Pterochaeta paniculata		3	0.1
Stylidium bulbiferum		3	0.1
Stylidium eriopodum		10	1
Stylidium sp.		10	0.1
Verticordia ? densiflora var. cespitosa		60	3
Verticordia acerosa var. preissii		70	40
Verticordia insignis subsp. insignis		50	0.1

Site No: Ck5	Type: Quadrat	Latitude: -32.075076	Longitude: 116.038067

Date: 11/18/2014
Observer: C Krens
Topography: Outcrop
Rocky Type: Granite
Vegetation Condition: Excellent.

Soil Types: Loam, gravel, clay
Soil Colour: Brown
Soil Condition: Dry
Fire History: 10+

Taxon	Cons. Code	Height (cm)	% Alive
Acacia sp.		150	1
Aira caryophyllea	*	10	0.2
Borya sphaerocephala		5	15
Briza maxima	*	10	0.1
Briza minor	*	5	0.1
Centaurium tenuiflorum	*	10	0.1
Melaleuca radula		100	0.5
Siloxerus filifolius		3	0.1
Siloxerus filifolius		5	0.1
Spiculaea ciliata		10	0.1
Ursinia anthemoides	*	10	0.1
Verticordia plumosa var. plumosa		20	0.5

Site No: Ck6	Type: Quadrat	Latitude: -32.074514	Longitude: 116.037426

Date: 11/18/2014
Observer: C Krens
Topography: Mid Slope
Rocky Type:
Vegetation Condition: Excellent.

Soil Types: Sandy loam gravel some clay
Soil Colour: Brown
Soil Condition: Dry
Fire History: 10+

Taxon	Cons. Code	Height (cm)	% Alive
Banksia dallanneyi var. dallanneyi		30	0.5
Bossiaea ornata			2
Burchardia congesta		40	0.1
Conostylis setosa		10	0.1
Corymbia calophylla		1200	15
Darwinia citriodora		70	1
Eucalyptus marginata subsp. thalassica		1500	15
Gompholobium knightianum		20	0.1
Hakea trifurcata		350	60
Hakea uncinata		200	7
Hibbertia commutata		20	0.1
Hibbertia huegelii		50	0.1
Hibbertia hypericoides		40	2
Lepidosperma leptostachyum		60	5
Pentapeltis peltigera		10	0.1
Scaevola calliptera		30	0.1
Stylidium amoenum var. caulescens		30	0.1
Xanthorrhoea preissii		150	2

Site No: Ck7	Type: Quadrat	Latitude: -32.077129	Longitude: 116.035815

Date: 11/18/2014
Observer: C Krens
Topography: Valley
Rocky Type: Granite
Vegetation Condition: Excellent.

Soil Types: Loamy clay
Soil Colour: Brown
Soil Condition: Dry
Fire History: 10+

Taxon	Cons. Code	Height (cm)	% Alive
?Xanthorrhoea preissii		200	3
Acacia obovata		60	0.1
Acacia pulchella var. pulchella		40	0.1
Amphipogon turbinatus		50	0.1
Aphelia brizula		40	0.1
Babingtonia camphorosmae		40	1
Banksia armata var. armata		60	0.5
Banksia dallanneyi var. dallanneyi		20	0.5
Beaufortia macrostemon		120	1
Beaufortia purpurea	P3	100	2
Cassytha racemosa			0.1
Corymbia calophylla		1000	30
Cyathochaeta avenacea		40	3
Dampiera alata		30	0.1
Dampiera coronata			0.1
Dampiera linearis		10	0.1
Goodeniaceae sp.		20	0.3
Hakea prostrata		250	5
Hakea trifurcata		400	40
Hibbertia huegelii		80	0.2
Hibbertia hypericoides		60	10
Kennedia prostrata			0.1
Lomandra sp.		40	0.1
Melaleuca holosericea		60	1
Melaleuca radula		60	0.1
Opercularia echinocephala		10	0.1
Paragonis grandiflora		120	2
Pentapeltis peltigera		10	0.1
Phyllanthus calycinus		80	0.1
Scaevola calliptera		20	0.1
Stylidium amoenum var. caulescens		30	0.1

Taxon	Cons. Code	Height (cm)	% Alive
Stylidium eriopodum		10	0.1
Stylidium sp.		10	0.1
Trymalium ledifolium		80	0.2
Watsonia meriana	*	60	0.1
Xanthosia candida		5	0.1

Site No: Ck8	Type: Quadrat	Latitude: -32.072961	Longitude: 116.037335

Date: 11/18/2014
Observer: C Krens
Topography: Upper Slope
Rocky Type: Granite
Vegetation Condition: Excellent.

Soil Types: Sandy gravel, clay
Soil Colour: Brown
Soil Condition: Dry
Fire History: 5-10

Taxon	Cons. Code	Height (cm)	% Alive
Acacia barbinervis subsp. barbinervis		20	0.1
Acacia obovata		30	0.1
Acacia obovata		40	0.2
Acacia pulchella var. pulchella		40	0.2
Allocasuarina fraseriana		600	15
Amphipogon turbinatus		40	0.1
Astartea leptophylla		10	0.1
Astroloma glaucescens		40	0.5
Babingtonia pelloeae		40	5
Banksia dallanneyi var. dallanneyi		20	0.5
Banksia sessilis var. sessilis		250	2
Boronia ovata		20	0.1
Bossiaea ornata		30	0.1
Burchardia congesta		60	0.1
Cassytha sp.			0.2
Conostylis setosa		20	0.1
Corymbia calophylla		1500	5
Dianella revoluta		60	0.1
Eucalyptus marginata subsp. thalassica		1800	40
Hakea amplexicaulis		60	0.2
Hakea sp.		100	0.1
Hakea stenocarpa		60	2
Hakea uncinata		100	0.5
Hibbertia acerosa		20	0.2
Hibbertia commutata		30	3
Hibbertia huegelii		20	0.1
Hibbertia hypericoides		60	20
Hovea trisperma		20	0.2
Hypocalymma robustum		40	0.2
Isopogon sphaerocephalus		80	1
Lepidosperma leptostachyum		30	0.1

Taxon	Cons. Code	Height (cm)	% Alive
Lepidosperma pubisquameum (juvenile)		40	0.2
Levenhookia pusilla		3	0.1
Lobelia gibbosa		5	0.1
Patersonia occidentalis		60	0.2
Pentapeltis peltigera		10	0.1
Petrophile striata		60	1
Pterochaeta paniculata		3	0.1
Ptilotus esquamatus		20	0.1
Stylidium amoenum var. caulescens		30	0.1
Stylidium eriopodum		10	0.1
Stylidium eriopodum		10	0.1
Stylidium sp.		10	0.1
Tetraria capillaris		20	0.1
Thysanotus manglesianus		30	0.1
Trymalium ledifolium		40	0.5
Trymalium ledifolium		40	0.1

Site No: Ck9	Type: Quadrat	Latitude: -32.078102	Longitude: 116.03825

Date: 11/19/2014
Observer: C Krens
Topography: Mid Slope
Rocky Type:
Vegetation Condition: Excellent.

Soil Types: Loam, gravel, peat
Soil Colour: Dark brown
Soil Condition: Moist
Fire History: 5-10

Taxon	Cons. Code	Height (cm)	% Alive
?Xanthorrhoea preissii		400	10
Acacia pulchella var. pulchella		100	0.1
Astartea leptophylla		30	0.1
Banksia dallanneyi var. dallanneyi		40	1
Banksia dallanneyi var. dallanneyi		40	0.1
Beaufortia purpurea	P3	50	10
Bossiaea ornata		0	0.1
Cassytha racemosa			0.1
Cheiranthera preissiana			0.1
Corymbia calophylla		1200	40
Cyathochaeta avenacea		40	3
Goodeniaceae sp.		10	0.1
Hakea prostrata		120	0.5
Hakea trifurcata		350	15
Hakea undulata		200	0.5
Hemiandra sp.		20	0.1
Hibbertia huegelii		20	0.1
Hibbertia hypericoides		40	10
Pimelea suaveolens		80	0.5
Tetrarrhena laevis		40	0.1
Watsonia meriana	*	80	0.1
Xanthosia candida		5	0.1

Site No: Ck10	Type: Quadrat	Latitude: -32.078433	Longitude: 116.03918

Date: 11/19/2014
Observer: C Krens
Topography: Outcrop
Rocky Type: Granite
Vegetation Condition: Excellent.

Soil Types: Gravel
Soil Colour: Brown skeletal
Soil Condition: Dry
Fire History: 10+

Taxon	Cons. Code	Height (cm)	% Alive
Actinotus leucocephalus		30	0.1
Aira caryophyllea	*	5	0.1
Amphipogon turbinatus		40	0.2
Beaufortia purpurea	P3	60	3
Boraginaceae sp.		30	0.1
Borya sphaerocephala		5	25
Conostylis androstemma		20	0.2
Craspedia variabilis		5	0.1
Darwinia citriodora		40	2
Gladiolus undulatus	*	60	0.2
Glischrocaryon flavescens		50	15
Gonocarpus cordiger		40	0.1
Hakea erinacea		60	1
Hakea trifurcata		120	1
Hovea pungens		1	40
Laxmannia grandiflora		60	0.1
Lepidosperma drummondii		100	0.2
Pterochaeta paniculata		3	0.1
Scaevola repens		30	0.2
Stylidium bulbiferum		3	0.1
Stylidium eriopodum		3	0.1
Taraxacum officinale	*	5	0.1
Trymalium ledifolium		40	0.1
Ursinia anthemoides	*	10	0.1
Verticordia acerosa var. preissii		60	0.5
Verticordia plumosa var. plumosa		50	5

Site No: HO01	Type: Quadrat	Latitude: -32.067765	Longitude: 116.034999

Date: 10/13/2015
Observer: F de Wit, L van Gorp
Topography: Upper Slope
Rocky Type: Laterite
Vegetation Condition: Excellent.

Soil Types: Sandy loam gravel
Soil Colour:
Soil Condition:
Fire History: 10+

Taxon	Cons. Code	Height (cm)	% Alive
Acacia alata		10	0.01
Acacia lateriticola		40	5
Acacia pulchella var. pulchella		80	0.3
Acacia teretifolia		60	0.1
Allocasuarina humilis		40	0.1
Amphipogon turbinatus		10	0.1
Asteridea gracilis	P3	10	0.01
Babingtonia camphorosmae		40	3
Banksia armata var. armata		70	3
Banksia bipinnatifida subsp. bipinnatifida		10	0.1
Beaufortia purpurea	P3	30	10
Calothamnus rupestris		150	4
Cassytha racemosa			0.1
Chorizema dicksonii		60	0.1
Cryptandra pungens		50	0.4
Drosera glanduligera		5	0.1
Eucalyptus wandoo (Mallee form)		200	2
Gastrolobium acutum		40	0.1
Grevillea pilulifera		20	0.1
Haemodorum laxum		100	0.1
Hakea erinacea		80	3
Hakea incrassata		50	0.2

Taxon	Cons. Code	Height (cm)	% Alive
Hakea neospathulata		50	0.2
Hakea stenocarpa		30	0.2
Hakea undulata		50	0.1
Hibbertia hypericoides		30	10
Hibbertia subvaginata		20	0.2
Jacksonia alata		20	0.2
Lasiopetalum glutinosum subsp. glutinosum	P3		
Laxmannia squarrosa		20	0.1
Lepidosperma leptostachyum		50	0.3
Lepidosperma squamatum		50	0.3
Leucopogon sprengelioides		80	6
Melaleuca parviceps		50	6
Melaleuca parviceps			
Melaleuca radula		100	0.4
Mesomelaena tetragona		60	0.3
Microcorys longifolia		50	0.5
Patersonia pygmaea		15	0.1
Petrophile biloba		100	0.1
Pimelea imbricata var. piligera		15	0.1
Pterochaeta paniculata		6	0.1
Pultenaea ericifolia		30	0.1
Rytidosperma acerosa		20	0.1
Stackhousia monogyna		20	0.1
Stylidium brunonianum		15	0.1
Stylidium bulbiferum		6	0.01
Stylidium calcaratum		5	0.01
Stylidium eriopodum		5	0.02
Stylidium sp.		15	0.1
Synaphea acutiloba		20	0.03
Tetraria capillaris		20	0.2
Trymalium ledifolium var. rosmarinifolium		15	0.1
Verticordia acerosa var. acerosa		80	1
Xanthorrhoea drummondii		120	1
Xanthosia candida		10	0.1

Site No: HO02	Type: Quadrat	Latitude: -32.071069	Longitude: 116.036767

Date: 10/13/2015
Observer: F de Wit, L van Gorp
Topography: Upper Slope
Rocky Type:
Vegetation Condition: Excellent. Dieback

Soil Types: Sandy loam, clay
Soil Colour:
Soil Condition:
Fire History: 10+

Taxon	Cons. Code	Height (cm)	% Alive
Acacia lateriticola		70	0.5
Acacia obovata		40	0.5
Astroloma glaucescens		10	0.1
Banksia dallanneyi var. dallanneyi		10	5
Banksia dallanneyi var. mellicula		20	3
Banksia sessilis var. sessilis		250	30
Boronia ovata		40	0.5
Bossiaea ornata		10	2
Conostylis setosa		20	0.2
Eucalyptus marginata subsp. thalassica		800	6
Gompholobium preissii		20	0.1
Hakea amplexicaulis		30	0.1
Hakea lissocarpha		30	0.5
Hibbertia acerosa		20	0.2
Hibbertia commutata		30	0.1
Hibbertia hypericoides		30	50
Hovea chorizemifolia		1	0.1
Hovea elliptica		40	0.1
Hypocalymma robustum		60	0.3
Isopogon sphaerocephalus		40	0.1
Lepidosperma leptostachyum		50	0.5

Taxon	Cons. Code	Height (cm)	% Alive
Lomandra brittanii		10	0.1
Opercularia echinocephala		10	0.1
Pentapeltis peltigera		4	0.1
Scaevola calliptera		20	0.1
Stylidium amoenum		1	0.1
Stylidium piliferum		10	0.1
Styphelia tenuiflora		40	0.2
Tetratheca hirsuta		15	0.1
Thysanotus dichotomous		40	0.1
Trichocline spathulata		5	0.1
Xanthorrhoea gracilis		40	0.2

Site No: HO03	Type: Quadrat	Latitude: -32.07074	Longitude: 116.041248

Date: 10/13/2015
Observer: F de Wit, L van Gorp
Topography: Mid Slope
Rocky Type: Laterite
Vegetation Condition: Excellent.

Soil Types: Sandy loam gravel
Soil Colour:
Soil Condition:
Fire History: 10+

Taxon	Cons. Code	Height (cm)	% Alive
Acacia divergens		20	0.01
Acacia lateriticola		100	0.1
Allocasuarina fraseriana		900	2
Astroloma glaucescens		60	10
Astroloma pallidum		7	0.1
Babingtonia camphorosmae		30	0.2
Banksia dallanneyi var. dallanneyi		15	0.5
Boronia ovata		15	0.1
Burchardia congesta		80	0.1
Calothamnus quadrifidus subsp. quadrifidus		80	0.1
Cassytha racemosa			0.1
Chamaescilla corymbosa		10	0.1
Conostylis setosa		20	0.1
Corymbia calophylla		2000	10
Dampiera linearis		10	0.1
Dianella revoluta		80	0.1
Eucalyptus marginata subsp. thalassica		900	3
Gompholobium marginatum		10	0.1
Gompholobium preissii		30	0.1
Gompholobium preissii		40	0.1

Taxon	Cons. Code	Height (cm)	% Alive
Haemodorum laxum		60	0.1
Hakea stenocarpa		60	0.5
Hakea trifurcata		250	50
Hakea undulata		160	2
Hibbertia acerosa		10	0.1
Hibbertia commutata		10	0.1
Hibbertia hypericoides		50	4
Hibbertia subvaginata		40	0.2
Hovea elliptica		40	0.1
Hypocalymma robustum		70	0.2
Isopogon asper		50	0.1
Isopogon dubius		150	2
Lechenaultia biloba			
Mesomelaena tetragona		50	0.1
Paragonis grandiflora		80	0.1
Patersonia occidentalis		70	2
Patersonia pygmaea		15	0.1
Pimelea suaveolens subsp. suaveolens		50	0.1
Ptilotus esquamatus		20	0.01
Scaevola calliptera		10	0.1
Stylidium affine		40	0.1
Stylidium amoenum		20	0.1
Stylidium carnosum		5	0.1
Stylidium sp.		10	0.1
Tetraria capillaris		40	0.3
Tetrarrhena laevis		10	0.1
Thomasia grandiflora		40	0.2
Thysanotus thyrsoideus		30	0.1
Trichocline spathulata		7	0.1
Tricoryne elatior		80	0.1
Trymalium ledifolium var. rosmarinifolium		100	0.2
Xanthorrhoea drummondii		120	5

Site No: HO04	Type: Quadrat	Latitude: -32.072254	Longitude: 116.044306

Date: 10/13/2015
Observer: F de Wit, L van Gorp
Topography: Outcrop, US, MS
Rocky Type: Granite
Vegetation Condition: Excellent.

Soil Types: Sandy loam
Soil Colour:
Soil Condition:
Fire History: 10+

Taxon	Cons. Code	Height (cm)	% Alive
Acacia oncinophylla subsp. patulifolia	P4	240	10
Allocasuarina humilis		50	0.5
Astroloma glaucescens		40	10
Babingtonia camphorosmae		30	4
Banksia bipinnatifida subsp. bipinnatifida			
Boronia cymosa		20	0.5
Borya sphaerocephala		5	1
Calothamnus rupestris		200	
Calytrix glutinosa		50	0.1
Cassytha racemosa			0.1
Comesperma ciliatum		15	0.01
Comesperma ciliatum			
Cryptandra pungens		100	15
Drosera glanduligera		4	0.1
Glischrocaryon aureum		90	0.3
Gompholobium marginatum		5	0.1
Haemodorum laxum		60	0.1
Hakea erinacea		120	5
Hakea undulata		50	0.2
Hemigenia incana			
Hibbertia hypericoides		50	1

Taxon	Cons. Code	Height (cm)	% Alive
Hibbertia subvaginata		30	0.1
Isopogon dubius		130	15
Lasiopetalum glutinosum subsp. glutinosum	P3	150	0.2
Lepidobolus preissianus subsp. preissianus		20	0.2
Lepidosperma drummondii		40	0.2
Leptospermum erubescens		80	1
Melaleuca parviceps		40	2
Pimelea imbricata var. piligera			
Pultenaea ericifolia			
Schoenus armeria		30	0.2
Stackhousia monogyna		40	0.1
Stylidium brunonianum		15	0.1
Stylidium eriopodum		10	0.1
Stylidium repens		7	0.1
Tetratheca nuda		15	0.1
Thysanotus scaber		15	0.1
Verticordia acerosa var. acerosa		120	4
Verticordia plumosa var. plumosa			
Xanthorrhoea drummondii		180	1

Site No: HO05	Type: Quadrat	Latitude: -32.075822	Longitude: 116.04289

Date: 10/13/2015
Observer: F de Wit, L van Gorp
Topography: Upper Slope
Rocky Type: Laterite
Vegetation Condition: Very good. Dieback

Soil Types: Sandy loam gravel
Soil Colour: Red brown
Soil Condition:
Fire History: 10+


Taxon	Cons. Code	Height (cm)	% Alive
Acacia lateriticola		50	0.2
Acacia pulchella var. pulchella		80	0.2
Banksia dallanneyi var. dallanneyi		15	0.5
Banksia sessilis var. sessilis		400	20
Beaufortia purpurea	P3		
Burchardia congesta		50	0.01
Chamaescilla corymbosa		10	0.1
Conostylis setosa		15	0.1
Corymbia calophylla		800	8
Dampiera linearis		10	0.3
Drosera glanduligera			
Drosera menziesii subsp. menziesii		15	0.1
Eucalyptus marginata subsp. thalassica		800	8
Gompholobium marginatum		5	0.01
Gompholobium preissii		50	0.1
Grevillea wilsonii		100	3
Hibbertia commutata		15	0.1
Hibbertia hypericoides		30	2
Lepidosperma leptostachyum		60	0.5
Levenhookia pusilla		10	0.01
Lomandra caespitosa		30	0.2

Taxon	Cons. Code	Height (cm)	% Alive
Lomandra preissii		50	0.1
Lomandra spartea		20	0.1
Orthrosanthus laxus var. laxus		50	12
Patersonia pygmaea		15	0.1
Philotheca spicata		20	0.1
Rhodanthe citrina			
Rhodanthe citrina			
Rytidosperma acerosa		10	0.01
Stylidium androsaceum		7	0.01
Stylidium bulbiferum		10	0.01
Stylidium piliferum		10	0.1
Tetraria capillaris		40	0.5
Thelymitra sp.			
Thysanotus manglesianus			0.1
Thysanotus thyrsoideus		15	0.01
Trachymene pilosa		5	0.01
Trichocline spathulata		10	0.1
Trymalium ledifolium var. rosmarinifolium		40	1.5
Xanthorrhoea preissii		120	
Xanthosia ciliata		5	0.2

Site No: HO06	Type: Quadrat	Latitude: -32.077394	Longitude: 116.041665

Date: 10/13/2015
Observer: F de Wit, L van Gorp
Topography: Mid Slope
Rocky Type: Laterite
Vegetation Condition: Excellent.

Soil Types: Sandy loam gravel
Soil Colour: Brown
Soil Condition:
Fire History: 10+


Taxon	Cons. Code	Height (cm)	% Alive
Acacia lateriticola		60	0.2
Acacia pulchella var. pulchella		20	0.1
Adenanthos obovatus		20	0.1
Allocasuarina fraseriana		600	2
Astroloma ciliatum		10	
Banksia dallanneyi var. dallanneyi		10	2
Banksia dallanneyi var. mellicula		30	0.2
Banksia sessilis var. sessilis		400	50
Boronia ovata		20	0.1
Bossiaea ornata		30	0.5
Burchardia congesta		40	0.1
Conostylis setosa		20	0.1
Corymbia calophylla		1500	5
Dampiera linearis		10	0.1
Daviesia decurrens			
Desmocladus fasciculatus		10	0.1
Drosera macrantha subsp. macrantha			0.1
Drosera menziesii subsp. menziesii			
Drosera sp.		15	0.1
Eucalyptus marginata subsp. thalassica		800	30
Grevillea manglesii subsp. manglesii		10	0.1

Taxon	Cons. Code	Height (cm)	% Alive
Grevillea wilsonii		40	
Hakea amplexicaulis		40	0.5
Hakea lissocarpha		30	0.2
Hakea trifurcata			
Hakea undulata		240	0.2
Hibbertia acerosa		20	0.1
Hibbertia commutata (hairy form)		15	0.1
Hibbertia hypericoides		40	6
Hovea chorizemifolia		50	0.1
Hypocalymma robustum		80	0.5
Isopogon sphaerocephalus		60	0.3
Jacksonia alata		10	0.01
Labichea punctata		10	0.1
Lepidosperma leptostachyum		30	0.2
Leucopogon capitellatus		20	0.2
Lomandra ?preissii		40	0.01
Lomandra caespitosa		60	0.01
Lomandra nigricans		40	0.1
Pentapeltis peltigera		4	0.01
Persoonia angustifolia		10	0.1
Petrophile striata		80	0.5
Philotheca spicata		80	0.1
Pimelea ciliata subsp. ciliata		10	0.1
Pterostylis sp.			
Pyrorchis nigricans			
Stylidium affine		20	0.1
Stylidium amoenum		20	0.1
Stylidium piliferum		10	0.1
Styphelia tenuiflora		30	0.2
Tetraria capillaris			
Tetrarrhena laevis		20	0.1
Tetratheca hirsuta		20	0.01
Thysanotus manglesianus			0.1
Thysanotus thyrsoideus			
Trichocline spathulata		10	0.1
Trymalium ledifolium var. rosmarinifolium		80	0.2
Xanthorrhoea gracilis		80	7
Xanthorrhoea preissii		100	0.5

Site No: HO07	Type: Quadrat	Latitude: -32.073021	Longitude: 116.04345

Date: 10/13/2015
Observer: F de Wit, L van Gorp
Topography: Upper Slope
Rocky Type:
Vegetation Condition:

Soil Types:
Soil Colour:
Soil Condition:
Fire History:

Taxon	Cons. Code	Height (cm)	% Alive
Adenanthos obovatus			
Allocasuarina fraseriana		230	0.5
Allocasuarina microstachya		30	0.2
Astroloma glaucescens		20	0.2
Astroloma pallidum		20	2
Babingtonia camphorosmae		40	0.5
Banksia armata var. armata		100	6
Banksia bipinnatifida subsp. bipinnatifida		10	0.1
Banksia dallanneyi var. mellicula		20	0.2
Beaufortia macrostemon		30	4
Beaufortia purpurea	P3	50	1
Boronia ovata		20	0.2
Boronia ovata			
Bossiaea ornata		15	0.1
Calothamnus torulosus		40	0.3
Conostylis setosa		30	0.1
Corymbia calophylla		500	2
Daviesia horrida		130	0.3
Daviesia longifolia		30	0.1
Drosera glanduligera		5	0.1
Drosera macrantha subsp. macrantha			0.01

Taxon	Cons. Code	Height (cm)	% Alive
Eucalyptus marginata subsp. thalassica		800	4
Gastrolobium dilatatum		70	0.2
Haemodorum laxum		70	0.1
Hakea amplexicaulis		60	0.2
Hakea cyclocarpa		220	0.2
Hakea stenocarpa			
Hakea undulata		100	0.3
Hibbertia hypericoides		40	3
Hibbertia pachyrrhiza		10	0.1
Hypocalymma robustum		50	0.1
Isopogon dubius		40	0.5
Jacksonia alata		10	0.1
Kingia australis		500	2
Labichea punctata		15	0.2
Labichea punctata		40	0.1
Lambertia multiflora var. darlingensis		70	3
Lepidosperma leptostachyum		50	0.1
Lomandra effusa		60	0.1
Lomandra sonderi		30	0.2
Melaleuca parviceps		60	1
Mesomelaena tetragona		60	0.2
Opercularia vaginata		15	0.1
Paragonis grandiflora		80	3
Patersonia occidentalis		50	2
Pimelea suaveolens subsp. suaveolens		50	0.1
Stylidium amoenum		10	0.1
Stylidium brunonianum		15	0.1
Tetratheca nuda		40	0.1
Xanthorrhoea drummondii		150	8

Site No: HO08r	Type: Releve	Latitude: -32.072882	Longitude: 116.046364

Date: 10/13/2015
Observer: F de Wit, L van Gorp
Topography: Mid Slope
Rocky Type:
Vegetation Condition: Excellent.

Soil Types: Sandy loam gravel
Soil Colour:
Soil Condition:
Fire History: 10+

Taxon	Cons. Code	Height (cm)	% Alive
Acacia pulchella var. pulchella		180	0.5
Calothamnus rupestris		350	80
Cassytha racemosa			0.1
Corymbia calophylla		600	5
Hakea undulata		200	0.5
Hypocalymma robustum		100	0.2
Stylidium thesioides		15	0.1
Tetraria capillaris		40	1
Tetraria octandra		40	0.2
Trichocline spathulata		10	0.1
Xanthorrhoea preissii		150	3

Site No: HO09r	Type: Releve	Latitude: -32.073112	Longitude: 116.046468

Date: 10/26/2015
Observer: F de Wit, L van Gorp
Topography: Upper Slope
Rocky Type:
Vegetation Condition: Excellent.

Soil Types: Sandy loam
Soil Colour:
Soil Condition:
Fire History: 10+


Taxon	Cons. Code	Height (cm)	% Alive
Acacia iteaphylla		50	0.2
Acacia lateriticola		15	0.1
Acacia pulchella var. pulchella		100	0.5
Agrostocrinum scabrum subsp. scabrum		80	0.2
Astroloma glaucescens		40	0.2
Banksia bipinnatifida subsp. bipinnatifida		15	2
Banksia dallanneyi var. dallanneyi		15	2
Bossiaea ornata		25	0.3
Burchardia congesta		80	0.1
Cassytha racemosa			
Conostylis setosa			
Corymbia calophylla		800	20
Desmocladus fasciculatus		10	0.1
Gastrolobium dilatatum		50	0.2
Gompholobium marginatum		20	0.2
Gompholobium polymorphum		30	0.1
Gompholobium preissii		20	0.2
Grevillea wilsonii		40	0.2
Hakea amplexicaulis		50	0.5
Hakea lissocarpha		50	2
Hakea undulata		220	25

Taxon	Cons. Code	Height (cm)	% Alive
Hibbertia acerosa			
Hibbertia hypericoides		40	30
Hibbertia pachyrrhiza		15	0.1
Hovea elliptica		15	0.5
Hypocalymma robustum		40	0.2
Lechenaultia biloba		10	0.1
Lepidosperma leptostachyum		30	0.1
Melaleuca parviceps		40	0.3
Mesomelaena tetragona		60	2
Myrt pink clumps		50	0.5
Patersonia occidentalis		50	0.5
Pentapeltis peltigera			
Petrophile striata		100	1
Philotheca spicata		30	0.2
Phyllanthus calycinus		40	0.2
Stylidium brunonianum		10	0.1
Tetraria capillaris		30	2
Trichocline spathulata			
Xanthorrhoea preissii		200	5

Site No: HO10	Type: Quadrat	Latitude: -32.068663	Longitude: 116.035913

Date: 10/26/2015
Observer: F de Wit, L van Gorp
Topography: Upper Slope
Rocky Type: Laterite
Vegetation Condition: Excellent.

Soil Types: Sandy loam gravel
Soil Colour: Brown
Soil Condition: Dry
Fire History: 10+


Taxon	Cons. Code	Height (cm)	% Alive
Acacia lateriticola		60	0.2
Acanthocarpus canaliculatus		10	2
Adenanthos obovatus		30	0.3
Allocasuarina fraseriana		800	6
Astroloma ciliatum		10	0.1
Banksia dallanneyi var. dallanneyi		10	7
Boronia ovata		30	0.4
Cassytha racemosa			0.1
Corymbia calophylla		800	4
Drosera menziesii subsp. menziesii			
Eucalyptus marginata subsp. thalassica		1100	10
Eucalyptus wandoo		1500	30
Haemodorum laxum		100	0.1
Hakea lissocarpha		70	0.2
Hakea stenocarpa		40	0.2
Hibbertia acerosa		20	0.2
Hibbertia commutata		30	0.3
Hibbertia hypericoides		70	8
Hovea chorizemifolia		20	0.1
Isopogon sphaerocephalus		40	0.1
Lepidosperma squamatum		50	0.1

Taxon	Cons. Code	Height (cm)	% Alive
Leucopogon capitellatus		20	0.1
Lomandra caespitosa		40	0.2
Macrozamia riedlei		200	10
Melaleuca radula		200	0.2
Patersonia occidentalis		20	0.5
Pimelea spectabilis		80	
Ptilotus manglesii		5	0.2
Scaevola platyphylla		40	0.2
Stylidium affine		15	0.5
Stylidium eriopodum		10	0.1
Styphelia tenuiflora		60	1
Tetraria capillaris		20	0.2
Thysanotus manglesianus			0.1
Trichocline spathulata		10	0.1
Xanthorrhoea preissii		220	10

Site No: HO11	Type: Quadrat	Latitude: -32.068234	Longitude: 116.035783

Date: 10/26/2015
Observer: F de Wit, L van Gorp
Topography: Mid Slope
Rocky Type: Laterite
Vegetation Condition: Excellent.

Soil Types: Sandy loam gravel
Soil Colour:
Soil Condition:
Fire History: 10+


Taxon	Cons. Code	Height (cm)	% Alive
Acacia lateriticola		50	0.3
Acacia pulchella var. pulchella		80	0.1
Acanthocarpus canaliculatus		10	1
Austrostipa campylachne		120	0.1
Banksia bipinnatifida subsp. bipinnatifida		30	0.2
Banksia dallanneyi var. mellicula		40	1
Boronia ovata		40	0.5
Cassytha racemosa			0.1
Conostylis setosa		30	0.1
Eucalyptus wandoo		1800	40
Gastrolobium spinosum		30	0.1
Gompholobium marginatum		5	0.1
Hakea lissocarpha		70	0.1
Hakea stenocarpa		50	0.1
Hakea undulata		50	0.2
Hibbertia commutata		40	0.4
Hibbertia hypericoides		40	40
Hovea elliptica		20	2
Lagenophora huegelii		2	0.1
Leucopogon capitellatus		20	0.2
Lomandra caespitosa		30	0.2

Taxon	Cons. Code	Height (cm)	% Alive
Lomandra sericea		40	0.1
Macrozamia riedlei		130	5
Petrophile striata		80	0.2
Podolepis sp.	*	40	0.1
Pterochaeta paniculata		5	0.1
Stylidium affine		30	5
Tetrarrhena laevis		40	0.1
Trichocline spathulata		10	0.1
Xanthorrhoea preissii		200	10

Site No: HO12r	Type: Releve	Latitude: -32.079523	Longitude: 116.038753
Date: 10/26/2015		Soil Types:	
Observer: F de Wit, L van Gorp		Soil Colour:	
Topography:		Soil Condition:	
Rocky Type:		Fire History:	
Vegetation Condition:			

Taxon	Cons. Code	Height (cm)	% Alive
Corymbia calophylla			15
Grevillea vestita			30
Hakea trifurcata			50
Hibbertia commutata			50
Kingia australis			5

Site No: HO13r	Type: Releve	Latitude: -32.078294	Longitude: 116.039557

Date: 10/26/2015
Observer: F de Wit, L van Gorp
Topography: Upper Slope
Rocky Type: Granite
Vegetation Condition: Excellent.

Soil Types: Sandy loam gravel
Soil Colour:
Soil Condition:
Fire History: 10+

Taxon	Cons. Code	Height (cm)	% Alive
Beaufortia purpurea	P3		10
Calytrix glutinosa		80	30
Hakea erinacea		60	2
Leucopogon squarrosus		60	2
Melaleuca parviceps			
Stylidium eriopodum			
Tripterococcus brunonis			
Verticordia insignis subsp. insignis		50	10
Xanthorrhoea drummondii		100	2

Site No: HO14r	Type: Releve	Latitude: -32.072145	Longitude: 116.045145

Date: 10/26/2015
Observer: F de Wit, L van Gorp
Topography: Mid Slope
Rocky Type: Granite
Vegetation Condition: Excellent.

Soil Types: Loam
Soil Colour:
Soil Condition:
Fire History: 10+

Taxon	Cons. Code	Height (cm)	% Alive
Acacia oncinophylla subsp. patulifolia	P4	350	10
Borya sphaerocephala		10	30
Drosera gigantea			
Glischrocaryon aureum		80	4
Lepidosperma drummondii			5
Pimelea ciliata subsp. ciliata			
Verticordia acerosa var. acerosa		100	40
Verticordia huegelii var. huegelii			
Verticordia insignis subsp. insignis		30	1

Site No: HO15	Type: Releve	Latitude: -32.0752544	Longitude: 116.032655

Date: 10/25/2016
Soil Types: Loam Gravel
Observer: F de Wit, L van Gorp
Soil Colour:
Topography: Mid Slope
Soil Condition: Dry
Rocky Type:
Fire History: 10+
Vegetation Condition: Excellent.

Taxon	Cons. Code	Height (cm)	% Alive
Acacia horridula	P3		
Acacia pulchella var. pulchella		30	0.1
Allocasuarina humilis		200	5
Banksia dallanneyi var. dallanneyi		30	0.2
Banksia squarrosa subsp. squarrosa			
Boronia crenulata			
Calothamnus rupestris		300	90
Calytrix acutifolia		100	0.3
Corymbia calophylla		400	5
Cyathochaeta avenacea		30	1
Dampiera alata		10	0.1
Hakea trifurcata		80	0.3
Hakea undulata		30	0.1
Hibbertia hypericoides		30	1
Melaleuca parviceps		40	0.1
Melaleuca radula		200	0.2
Pterostylis sp. nana complex			
Sonchus sp. juvenile		5	0.1
Stylidium bulbiferum		10	0.3
Thysanotus manglesianus			0.1
Trymalium ledifolium		60	0.2
Verticordia acerosa var. acerosa			
Verticordia insignis subsp. insignis			

Site No: Ho17	Type: Quadrat	Latitude: -32.07624307	Longitude: 116.0329072

Date: 10/25/2016
Observer: F de Wit, L van Gorp
Topography: Mid Slope
Rocky Type: Granite
Vegetation Condition:

Soil Types: Clay Sand
Soil Colour: Medium Brown
Soil Condition:
Fire History:

Taxon	Cons. Code	Height (cm)	% Alive
Acacia pulchella var. pulchella		150	1
Aira caryophyllea	*	10	0.3
Babingtonia camphorosmae		30	2
Banksia dallanneyi var. dallanneyi		10	0.5
Banksia squarrosa subsp. squarrosa		100	0.5
Beaufortia purpurea	P3	80	2
Cassytha racemosa forma racemosa			0.1
Corymbia calophylla		500	3
Dampiera alata		20	0.5
Desmocladus fasciculatus		15	0.01
Drosera glanduligera		5	0.1
Drosera menziesii subsp. menziesii			0.1
Eucalyptus wandoo		700	5
Gladiolus undulatus	*		
Gompholobium marginatum		10	0.1
Hakea erinacea		100	10
Hakea incrassata		50	0.2
Hakea trifurcata		300	2
Hakea undulata		30	0.3
Hemigenia incana		20	0.1
Hibbertia hypericoides		50	7

Taxon	Cons. Code	Height (cm)	% Alive
Hovea elliptica		40	0.1
Hyalosperma cotula		5	0.1
Hypocalymma angustifolium		40	3
Hypochaeris glabra	*		0.1
Lepidosperma apricola		40	0.1
Lepidosperma leptostachyum		40	0.2
Levenhookia pusilla		3	0.1
Lomandra preissii		15	0.1
Melaleuca parviceps		50	8
Melaleuca radula		180	3
Millotia tenuifolia var. tenuifolia		5	0.1
Neurachne alopecuroidea		10	0.1
Opercularia echinocephala		20	0.1
Petrophile seminuda		60	1
Philotheca spicata		20	0.1
Poa drummondiana		40	0.2
Rytidosperma pilosum			
Schoenus nanus		10	0.2
Siloxerus filifolius		3	0.1
Stylidium bulbiferum		5	2
Stylidium calcaratum		5	0.2
Tetraria octandra		20	0.1
Thysanotus manglesianus			0.1
Trachymene pilosa			
Trichocline spathulata			
Trymalium ledifolium		30	3
Xanthorrhoea drummondii		100	3

Site No: Ho18	Type: Quadrat	Latitude: -32.07634692	Longitude: 116.04601753

Date: 10/25/2016
Observer: F de Wit, L van Gorp
Topography: Upper Slope
Rocky Type: Laterite
Vegetation Condition: Excellent.

Soil Types: Clay Loam
Soil Colour: Medium Brown
Soil Condition: Dry
Fire History:

Taxon	Cons. Code	Height (cm)	% Alive
Amphipogon amphipogonoides		40	0.1
Astroloma ciliatum		10	0.1
Banksia bipinnatifida subsp. bipinnatifida		15	0.1
Banksia nivea		10	2
Banksia squarrosa subsp. squarrosa		40	0.3
Beaufortia macrostemon		40	4
Beaufortia macrostemon		30	10
Bossiaea ornata		30	0.5
Caesia micrantha		80	0.1
Cassytha racemosa forma racemosa			0.1
Conostylis setosa		30	0.01
Corymbia calophylla		600	5
Dampiera linearis		10	0.1
Desmocladus flexuosus		10	0.1
Drosera glanduligera		5	0.1
Drosera macrantha subsp. macrantha			0.01
Eucalyptus marginata subsp. thalassica		700	16
Gastrolobium dilatatum		30	0.2
Gompholobium knightianum			0.1
Grevillea quercifolia		30	1
Hakea amplexicaulis		40	0.5

Taxon	Cons. Code	Height (cm)	% Alive
Hakea cyclocarpa		80	0.2
Hakea ruscifolia		80	0.1
Hakea stenocarpa		40	0.1
Hakea undulata		50	0.4
Hibbertia hypericoides		40	15
Hypocalymma robustum		20	0.5
Jacksonia alata		20	0.1
Kingia australis		500	
Labichea punctata		40	0.1
Lambertia multiflora var. darlingensis		30	1
Lechenaultia biloba		20	0.2
Lepidosperma leptostachyum		70	3
Lomandra effusa		30	1
Lomandra preissii		80	0.1
Mesomelaena tetragona		30	8
Paragonis grandiflora		50	3
Patersonia occidentalis		30	1
Pentapeltis peltigera		10	0.1
Persoonia ellipticum			
Petrophile striata		20	0.1
Philotheca spicata		30	0.1
Pimelea spectabilis		30	0.1
Stylidium amoenum var. caulescens		20	0.1
Stylidium brunonianum		20	0.1
Tetraria capillaris		30	3
Thelymitra crinita		20	0.1
Thysanotus thyrsoideus		20	0.01
Verticordia acerosa var. acerosa		40	0.2
Xanthorrhoea drummondii		220	7

Site No: Ho19	Type: Releve	Latitude: -32.0735957	Longitude: 116.04681314

Date: 10/25/2016
Observer: F de Wit, L van Gorp
Topography: Mid Slope
Rocky Type:
Vegetation Condition: Excellent.

Soil Types: Loam Clay
Soil Colour: Medium Brown
Soil Condition: Moist
Fire History: 10+

Taxon	Cons. Code	Height (cm)	% Alive
Banksia bipinnatifida subsp. bipinnatifida		20	0.2
Banksia dallanneyi var. dallanneyi		30	0.5
Bossiaea ornata		20	0.5
Caladenia flava		15	0.1
Calothamnus rupestris		300	75
Cassytha racemosa forma racemosa			0.1
Conostylis setosa		20	0.2
Dampiera alata		20	0.1
Gompholobium knightianum		20	0.1
Gompholobium tomentosum		20	0.5
Hakea amplexicaulis		80	0.3
Hakea undulata		30	0.1
Hibbertia hypericoides		30	20

Taxon	Cons. Code	Height (cm)	% Alive
Lechenaultia biloba		10	0.1
Leptospermum erubescens			
Opercularia echinocephala		20	0.1
Patersonia occidentalis		30	0.2
Pentapeltis peltigera		5	0.1
Stylidium piliferum		20	0.3
Synaphea acutiloba		20	0.3
Tetraria capillaris		30	2
Tetraria octandra		20	0.2
Thelymitra sp.		30	0.1
Trichocline spathulata		10	0.1
Xanthorrhoea preissii		80	5

Site No: Ho20	Type: Quadrat	Latitude: -32.0752714	Longitude: 116.045937
Date: 10/25/2016		Soil Types: Clay Loam	
Observer: F de Wit, L van Gorp		Soil Colour: Medium Brown	
Topography: Upper Slope		Soil Condition: Dry	
Rocky Type:		Fire History: 10+	
Vegetation Condition:			

Taxon	Cons. Code	Height (cm)	% Alive
Acacia huegelii		20	0.2
Astroloma ciliatum		10	0.2
Banksia nivea		20	0.2
Beaufortia macrostemon		20	5
Boronia ovata		40	1
Caesia micrantha		5	0.1
Conostylis serrulata		10	0.1
Dampiera linearis		10	0.1
Desmocladus flexuosus		5	0.1
Eucalyptus marginata subsp. thalassica		1000	8
Gompholobium knightianum		15	0.2
Hakea amplexicaulis		70	0.4
Hibbertia acerosa			

Taxon	Cons. Code	Height (cm)	% Alive
Hibbertia commutata		20	0.2
Hibbertia huegelii		20	0.1
Hibbertia hypericoides		30	16
Hovea chorizemifolia		15	0.1
Hypocalymma robustum		40	0.5
Isopogon asper		40	0.3
Kingia australis		350	7
Labichea punctata		10	0.2
Lambertia multiflora var. darlingensis		110	8
Mesomelaena tetragona		30	0.3
Paragonis grandiflora		60	2
Patersonia occidentalis		30	0.4
Philotheca spicata		60	0.2
Stylidium ?bulbiferum		10	0.2
Stylidium brunonianum		15	0.1
Tetraria octandra		20	0.5
Tetratheca hirsuta		20	0.1
Thomasia grandiflora		40	0.2
Xanthorrhoea drummondii		150	12

Site No: Ho21	Type: Quadrat	Latitude: -32.0712986	Longitude: 116.0429663
Date: 10/25/2016		Soil Types: Gravel Clay	
Observer: F de Wit, L van Gorp		Soil Colour: Grey	
Topography: Lower Slope		Soil Condition: Dry	
Rocky Type: Laterite		Fire History: 10+	
Vegetation Condition:			

Taxon	Cons. Code	Height (cm)	% Alive
Allocasuarina humilis		60	0.5
Astroloma glaucescens		30	1
Babingtonia camphorosmae		30	1
Borya constricta		5	5
Calothamnus sanguineus		50	
Calothamnus torulosus			
Cristonia biloba subsp. biloba		10	0.01
Gompholobium marginatum		10	0.1
Haemodorum laxum			
Hakea undulata		40	0.2
Hibbertia hypericoides			
Isopogon asper			
Ispogon dubius		80	8

Taxon	Cons. Code	Height (cm)	% Alive
Jacksonia alata		15	0.1
Kingia australis			
Levenhookia dubia		5	0.1
Lyginia barbata		20	0.5
Melaleuca parviceps		50	0.3
Mirbelia spinosa		20	0.1
Neurachne alopecuroidea		40	0.1
Patersonia occidentalis		30	0.1
Petrophile striata		60	1
Pimelea imbricata var. piligera		15	0.1
Pterochaeta paniculata		5	0.1
Schoenus armeria		20	0.2
Stackhousia monogyna		50	0.2
Stylidium brunonianum		20	0.01
Stylidium eriopodum		10	0.5
Stylidium repens		10	1
Tetratheca nuda		20	0.1
Verticordia acerosa var. acerosa		90	15
Xanthorrhoea drummondii		180	3

Site No: Ho22	Type: Quadrat	Latitude: -32.074204	Longitude: 116.044557

Date: 10/25/2016
Observer: F de Wit, L van Gorp
Topography: Upper Slope
Rocky Type: Laterite
Vegetation Condition: Excellent.

Soil Types: Loam Clay
Soil Colour: Grey
Soil Condition: Dry
Fire History: 10+

Taxon	Cons. Code	Height (cm)	% Alive
Acacia oncinophylla subsp. patulifolia	P4	450	20
Allocasuarina humilis		100	4
Astroloma glaucescens		30	2
Babingtonia camphorosmae		30	3
Banksia dallanneyi var. dallanneyi		30	0.1
Banksia squarrosa subsp. squarrosa		100	0.5
Boronia ovata		30	0.1
Borya constricta		5	4
Burchardia congesta		70	0.1
Cassytha racemosa forma racemosa			0.1
Cryptandra pungens		80	0.5
Drosera gigantea			
Drosera menziesii subsp. menziesii			0.1
Elythranthera emarginata		15	0.1
Gastrolobium dilatatum		110	0.5
Glischrocaryon aureum		100	4
Grevillea bipinnatifida subsp. bipinnatifida		80	1
Hakea auriculata		30	0.3
Hakea erinacea		100	5
Hakea incrassata		30	0.3
Hakea undulata		40	2

Taxon	Cons. Code	Height (cm)	% Alive
Hibbertia hypericoides		30	0.4
Hibbertia subvaginata		80	1
Isopogon dubius		80	10
Kingia australis		400	1.5
Lepidosperma sp.		60	0.5
Lyginia barbata		20	1
Melaleuca holosericea		80	0.2
Melaleuca parviceps		50	3
Pterochaeta paniculata		5	0.1
Stylidium calcaratum		10	0.1
Stylidium eriopodum		10	
Tetraria octandra		20	0.4
Thelymitra sp.		40	0.1
Thysanotus scaber		20	0.1
Verticordia acerosa var. acerosa		140	1
Xanthorrhoea drummondii		200	6
Xanthosia ciliata		15	0.1

Site No: Ho23	Type: Quadrat	Latitude: -32.06816258	Longitude: 116.0372687

Date: 10/25/2016
Observer: F de Wit, L van Gorp
Topography: Upper Slope
Rocky Type: Laterite
Vegetation Condition: Excellent.

Soil Types: Loam Gravel
Soil Colour: Medium Brown
Soil Condition: Dry
Fire History: 10+

Taxon	Cons. Code	Height (cm)	% Alive
Acacia pulchella var. pulchella		90	2
Astroloma ciliatum		10	0.1
Banksia bipinnatifida subsp. bipinnatifida		20	0.2
Banksia dallanneyi var. dallanneyi		20	5
Boronia ovata		50	1
Bossiaea ornata		60	0.2
Burchardia congesta		100	0.01
Cassytha racemosa forma racemosa			0.1
Conostylis setosa		20	0.1
Dampiera alata		30	0.3
Dampiera linearis		10	0.1
Eucalyptus marginata subsp. thalassica		800	6
Eucalyptus wandoo		1500	10
Gompholobium aristatum		15	0.2
Gompholobium marginatum		15	0.1
Grevillea pilulifera		50	0.3
Hakea amplexicaulis		100	0.2
Hakea lissocarpha		40	0.2
Hakea stenocarpa		60	0.2
Hibbertia hypericoides		70	30
Hibbertia mylnei		20	0.5

Taxon	Cons. Code	Height (cm)	% Alive
Lepidosperma drummondii		70	1
Melaleuca holosericea		30	0.2
Melaleuca parviceps		40	1
Melaleuca parviceps		100	0.5
Melaleuca radula		130	0.3
Neurachne alopecuroidea		30	0.3
Patersonia pygmaea		10	0.1
Petrophile striata		60	0.5
Pimelea suaveolens		70	0.3
Stylidium calcaratum		5	0.01
Stylidium piliferum		25	0.1
Tetraria capillaris		30	2
Tetraria octandra		30	1
Thomasia grandiflora		50	0.1
Thysanotus thyrsoideus		40	0.1
Tricoryne elatior		30	0.1
Xanthorrhoea drummondii		250	10
Xanthosia candida		20	0.1

Site No: Ho24	Type: Quadrat	Latitude: -32.06716966	Longitude: 116.035638

Date: 10/25/2016
Observer: F de Wit, L van Gorp
Topography: Mid Slope
Rocky Type: Laterite
Vegetation Condition: Excellent.

Soil Types: Loam Clay
Soil Colour:
Soil Condition: Moist
Fire History: 10+

Taxon	Cons. Code	Height (cm)	% Alive
Acacia pulchella var. pulchella		100	0.5
Asteridea gracilis	P3	10	0.01
Astroloma ciliatum		20	0.1
Caladenia flava			
Caladenia longicauda subsp. ?clivicola			
Cassytha racemosa forma racemosa			
Corymbia calophylla		2100	20
Diplopeltis huegelii subsp. lehmannii		30	0.3
Drosera macrantha subsp. macrantha			0.1
Eucalyptus wandoo		2200	20
Grevillea bipinnatifida subsp. bipinnatifida		100	0.5
Hakea erinacea		120	0.5
Hakea lissocarpha		50	0.2
Hakea undulata		100	0.2
Hemigenia incana		20	0.1
Hibbertia hypericoides		30	2
Hypocalymma angustifolium		60	8
Hypochaeris glabra	*	2	0.2
Lagenophora huegelii			0.2
Lasiopetalum floribundum		30	0.2
Levenhookia pusilla		5	0.1

Taxon	Cons. Code	Height (cm)	% Alive
Lobelia gibbosa			
Lysimachia arvensis	*		
Macrozamia riedlei			
Melaleuca radula		160	0.5
Neurachne alopecuroidea		40	0.2
Patersonia occidentalis		40	0.1
Phyllanthus calycinus		30	6
Pimelea imbricata var. piligera		20	1
Ptilotus manglesii		5	0.2
Sonchus asper		8	0.01
Stackhousia pubescens		30	0.3
Stylidium affine		30	1
Stylidium bulbiferum		10	0.1
Stylidium calcaratum		5	0.4
Trachymene grandis		10	0.1
Trymalium ledifolium		120	4
Xanthorrhoea preissii		200	4
Xanthosia candida		10	0.1

Site No: Ho25	Type: Quadrat	Latitude: -32.0668884	Longitude: 116.0343433

Date: 10/27/2016
Observer: F de Wit, L van Gorp
Topography: Mid Slope
Rocky Type: Laterite
Vegetation Condition: Excellent.

Soil Types: Clay Loam
Soil Colour: Medium Brown
Soil Condition: Dry
Fire History: 10+

Taxon	Cons. Code	Height (cm)	% Alive
Acacia pulchella var. pulchella		100	0.5
Allocasuarina humilis		100	0.5
Astroloma glaucescens		30	0.2
Babingtonia camphorosmae		30	4
Banksia sessilis var. sessilis			
Borya constricta		10	1
Calothamnus rupestris		150	1
Cassytha racemosa forma racemosa			0.1
Diplopeltis huegelii subsp. lehmannii		20	0.3
Drosera glanduligera		6	0.1
Eucalyptus wandoo		900	0.5
Grevillea bipinnatifida subsp. bipinnatifida		60	
Hakea erinacea		100	0.3
Hakea undulata		60	0.2
Hemigenia incana		30	0.1
Hibbertia hypericoides		30	0.5
Hibbertia mylnei		20	0.1
Hibbertia subvaginata		60	8
Isopogon dubius		60	3
Jacksonia alata		20	0.1
Lagenophora huegelii			0.1

Taxon	Cons. Code	Height (cm)	% Alive
Laxmannia squarrosa		15	0.1
Lepidosperma apricola		30	0.1
Leucopogon pulchellus		60	1
Melaleuca holosericea		90	4
Melaleuca parviceps		80	
Microcorys longifolia		100	0.2
Neurachne alopecuroidea		30	0.1
Nuytsia floribunda			
Pimelea imbricata var. piligera		30	0.1
Pterochaeta paniculata		5	0.1
Schoenus armeria		20	0.2
Stylidium brunonianum		30	0.1
Stylidium bulbiferum		10	0.1
Stylidium eriopodum		10	0.1
Stylidium hispidum		10	0.1
Synaphea acutiloba		15	0.2
Trachymene pilosa		5	0.1
Verticordia acerosa var. acerosa		60	1
Verticordia plumosa var. plumosa		80	4
Xanthorrhoea drummondii		189	1

Site No: Ho26	Type: Quadrat	Latitude: -32.0696762251034	Longitude: 116.03552623662701

Date: 10/27/2016
Observer: F de Wit, L van Gorp
Topography: Upper Slope
Rocky Type: Laterite
Vegetation Condition: Excellent.

Soil Types: Loam Clay
Soil Colour: Medium Brown
Soil Condition: Dry
Fire History: 10+

Taxon	Cons. Code	Height (cm)	% Alive
Acacia pulchella var. pulchella		70	Oppo
Acacia teretifolia		60	Oppo
Aira caryophyllea	*	10	0.1
Allocasuarina humilis		110	0.3
Astroloma ciliatum		20	0.1
Astroloma glaucescens		30	4
Babingtonia camphorosmae		30	4
Banksia dallanneyi var. dallanneyi		50	0.2
Banksia squarrosa subsp. squarrosa		80	0.3
Borya constricta		15	0.1
Cassytha racemosa forma racemosa		0	0.1
Chorizema dicksonii		60	0.1
Dampiera alata		15	Oppo
Daviesia decurrens		40	0.1
Drosera macrantha subsp. macrantha		0	Oppo
Gompholobium marginatum		20	0.2
Hakea erinacea		100	1
Hakea incrassata		80	0.3
Hakea stenocarpa		40	0.1
Hakea undulata		100	3

Taxon	Cons. Code	Height (cm)	% Alive
Hibbertia hypericoides		40	3
Hibbertia mylnei		30	0.5
Isopogon asper		40	0.3
Lagenophora huegelii		10	0.1
Lambertia multiflora var. darlingensis		100	Oppo
Laxmannia grandiflora		15	0.1
Lechenaultia biloba		25	Oppo
Leucopogon sprengelioides		80	3
Levenhookia pusilla		5	0.01
Melaleuca parviceps		70	2
Melaleuca parviceps		50	2
Neurachne alopecuroidea		25	0.1
Opercularia vaginata		20	Oppo
Philotheca spicata		30	0.3
Phyllanthus calycinus		40	0.1
Pimelea spectabilis		70	Oppo
Pterochaeta paniculata		5	0.1
Schoenus nanus		4	0.1
Stylidium brunonianum		12	0.2
Stylidium bulbiferum		10	0.1
Stylidium calcaratum		5	0.1
Stylidium eriopodum		10	0.5
Tetraria capillaris		25	0.2
Thelymitra crinita		40	0.01
Trichocline spathulata		30	0.1
Verticordia acerosa var. acerosa		60	20
Xanthorrhoea drummondii		230	10

Site No: Ho27	Type: Quadrat	Latitude: -32.0788323	Longitude: 116.0403803
Date: 10/27/2016		Soil Types: Clay Gravel	
Observer: F de Wit, L van Gorp		Soil Colour: Grey	
Topography: Upper Slope		Soil Condition: Dry	
Rocky Type: Granite		Fire History: 10+	
Vegetation Condition: Excellent.			

Taxon	Cons. Code	Height (cm)	% Alive
Aira caryophyllea	*	10	0.1
Borya constricta		4	0.3
Calytrix variabilis		80	5
Darwinia citriodora		80	4
Dielsia stenostachya		20	0.02
Drosera gigantea		30	5
Drosera glanduligera		4	0.1
Drosera menziesii subsp. menziesii		20	0.01
Goodenia fasciculata		30	0.1
Hakea erinacea		100	2
Hypochaeris glabra	*		0.1
Levenhookia pusilla		2	0.01
Melaleuca holosericea		100	0.2

Taxon	Cons. Code	Height (cm)	% Alive
Parentucellia latifolia		3	0.1
Phyllangium paradoxum		5	0.01
Pterochaeta paniculata		5	0.1
Schoenus nanus		3	0.01
Stylidium bulbiferum		10	2
Stylidium repens		5	0.01
Stylidium thesioides		15	2
Tribonanthes brachypetala		20	0.01
Trymalium ledifolium		20	0.2
Verticordia acerosa var. acerosa		80	2
Verticordia huegelii var. huegelii		60	1
Verticordia plumosa var. plumosa		60	2

Site No: Ho28	Type: Quadrat	Latitude: -32.07928253	Longitude: 116.04049123

Date: 10/27/2016
Observer: F de Wit, L van Gorp
Topography: Upper Slope
Rocky Type: Granite
Vegetation Condition: Excellent.

Soil Types: Loam Clay
Soil Colour: Medium Brown
Soil Condition: Dry
Fire History: 10+




Taxon	Cons. Code	Height (cm)	% Alive
Acacia pulchella var. pulchella		130	1
Astroloma glaucescens		30	0.2
Babingtonia camphorosmae		20	0.5
Banksia squarrosa subsp. squarrosa		120	0.5
Beaufortia purpurea	P3	120	80
Calytrix variabilis		40	0.5
Cassytha racemosa forma racemosa		0	0.1
Conostylis setosa		20	0.01
Darwinia citriodora		80	0.2
Drosera menziesii subsp. menziesii		0	0.01
Gompholobium marginatum		20	0.1

Taxon	Cons. Code	Height (cm)	% Alive
Hemigenia incana		130	0.2
Hibbertia hypericoides		30	2
Lasiopetalum glutinosum subsp. glutinosum	P3	140	0.01
Leucopogon pulchellus		130	0.1
Petrophile squamata subsp. squamata		200	4
Schoenus armeria		30	0.1
Stylidium brunonianum		15	0.1
Stylidium bulbiferum		10	0.1
Stylidium repens		5	0.1
Thysanotus manglesianus		0	0.1
Verticordia acerosa var. acerosa		110	3
Xanthorrhoea drummondii		220	0.5

Site No: Ho29	Type: Releve	Latitude: -32.07966268	Longitude: 116.039890

Date: 10/27/2016
Observer: F de Wit, L van Gorp
Topography: Mid Slope
Rocky Type: Laterite
Vegetation Condition: Excellent.

Soil Types: Loam Clay
Soil Colour:
Soil Condition: Dry
Fire History:

Taxon	Cons. Code	Height (cm)	% Alive
Allocasuarina humilis		80	0.5
Astroloma glaucescens		40	0.2
Babingtonia camphorosmae		50	0.5
Beaufortia purpurea	P3	100	80
Calytrix variabilis		90	1
Drosera menziesii subsp. menziesii		0	0.01
Hakea trifurcata		270	3
Hemigenia incana		80	0.3
Isopogon dubius		150	1
Leucopogon sprengelioides		60	0.1
Petrophile squamata subsp. squamata		200	3
Pimelea imbricata var. piligera		15	0.01
Stylidium repens		5	0.1

Taxon	Cons. Code	Height (cm)	% Alive
Thysanotus manglesianus		0	0.01
Verticordia acerosa var. acerosa		140	4
Verticordia insignis subsp. insignis		110	0.6
Verticordia plumosa var. plumosa		80	0.4
Xanthorrhoea drummondii		300	1

Site No: Ho30	Type: Quadrat	Latitude: -32.0776484	Longitude: 116.034717

Date: 10/27/2016
Observer: F de Wit, L van Gorp
Topography: Upper Slope
Rocky Type: Granite
Vegetation Condition: Excellent.

Soil Types: Loam Clay
Soil Colour: Medium Brown
Soil Condition:
Fire History: 10+

Taxon	Cons. Code	Height (cm)	% Alive
Acacia pulchella var. pulchella		160	0.5
Babingtonia camphorosmae		50	1
Banksia dallanneyi var. dallanneyi			
Beaufortia purpurea	P3	70	14
Borya constricta		5	1
Calytrix variabilis		70	0.5
Cassytha racemosa forma racemosa			0.5
Dampiera alata			
Desmocladus flexuosus		10	0.1
Drosera glanduligera		4	0.1
Drosera menziesii subsp. menziesii			0.1
Grevillea bipinnatifida subsp. bipinnatifida		110	0.5
Hakea erinacea		100	5
Hakea trifurcata		200	8
Hakea undulata		60	2
Hibbertia hypericoides		30	1
Hypocalymma angustifolium		50	0.5
Lepidosperma leptostachyum		30	0.2
Leucopogon sprengelioides		80	1
Melaleuca parviceps		80	2
Neurachne alopecuroidea		10	0.5

Taxon	Cons. Code	Height (cm)	% Alive
Paragonis grandiflora		60	2
Patersonia occidentalis		30	0.5
Petrophile squamata subsp. squamata		200	2
Phyllangium paradoxum		5	0.1
Pimelea imbricata var. piligera			
Pultenaea ericifolia		40	0.05
Schoenus nanus		5	0.1
Siloxerus filifolius			
Stylidium bulbiferum		15	4
Stylidium calcaratum		4	0.1
Stylidium repens			0.2
Stylidium thesioides		15	2
Tetraria octandra		30	0.3
Thysanotus manglesianus			0.1
Verticordia acerosa var. acerosa		100	20
Verticordia huegelii var. huegelii		20	0.2
Verticordia insignis subsp. insignis		40	0.2
Xanthorrhoea drummondii		230	5

Site No: Ho31	Type: Releve	Latitude: -32.07718088	Longitude: 116.0335957

Date: 10/27/2016
Observer: F de Wit, L van Gorp
Topography: Upper Slope
Rocky Type: Granite
Vegetation Condition: Excellent.

Soil Types: Loam Clay
Soil Colour: Medium Brown
Soil Condition: Dry
Fire History: 10+


Taxon	Cons. Code	Height (cm)	% Alive
Acacia pulchella var. pulchella		30	0.1
Asteridea gracilis	P3	10	0.02
Astroloma ciliatum		15	0.1
Banksia armata var. armata		100	1
Banksia dallanneyi var. dallanneyi		50	0.3
Briza maxima	*	30	0.1
Burchardia congesta		40	0.1
Cassytha racemosa forma racemosa			0.2
Corymbia calophylla		800	4
Dampiera linearis		15	0.01
Daviesia horrida			
Eucalyptus wandoo		700	10
Hakea erinacea		160	70
Hakea lissocarpha		100	0.5
Hakea undulata		70	1
Hemigenia incana		40	0.2
Hibbertia commutata		30	2
Hibbertia hypericoides		50	1
Hypocalymma angustifolium		80	0.2
Macrozamia riedlei			
Melaleuca radula		200	15

Taxon	Cons. Code	Height (cm)	% Alive
Neurachne alopecuroidea		40	0.5
Orthrosanthus laxus var. laxus		40	2
Petrophile squamata subsp. squamata		200	1
Phyllanthus calycinus		40	1
Pimelea imbricata var. piligera		30	0.1
Stylidium affine		20	3
Stylidium brunonianum		20	0.1
Stylidium bulbiferum		10	3
Stylidium calcaratum		5	0.1
Trymalium ledifolium		40	1
Xanthorrhoea preissii		100	2

Site No: Ho32	Type: Quadrat	Latitude: -32.081620	Longitude: 116.040042

Date: 10/27/2016
Observer: F de Wit, L van Gorp
Topography: Mid Slope
Rocky Type:
Vegetation Condition: Excellent.

Soil Types: Loam Clay
Soil Colour: Dark Brown
Soil Condition: Moist
Fire History: 10+

Taxon	Cons. Code	Height (cm)	% Alive
Acacia pulchella var. pulchella		120	0.2
Amphipogon amphipogonoides		60	0.1
Astroloma pallidum			
Bossiaea ornata		50	3
Burchardia congesta		40	0.1
Caesia micrantha		50	1
Corymbia calophylla		1700	70
Desmocladus flexuosus		10	0.1
Eucalyptus marginata subsp. thalassica		1900	10
Gompholobium polymorphum		20	0.5
Hakea lissocarpha		40	0.2
Hakea trifurcata		200	1
Hakea undulata		300	5
Hibbertia hypericoides			
Lechenaultia biloba		5	0.01
Lepidosperma leptostachyum		60	30
Leucopogon capitellatus		30	1
Mesomelaena tetragona			
Pentapeltis peltigera		10	2
Scaevola calliptera		20	0.3
Synaphea petiolaris subsp. petiolaris		20	0.1

Taxon	Cons. Code	Height (cm)	% Alive
Tetraria capillaris			
Tetrarrhena laevis		15	1
Thelymitra sp.			0.1
Xanthorrhoea preissii		100	0.1

Site No: Ho33	Type: Quadrat	Latitude: -32.0716289	Longitude: 116.0405528

Date: 10/27/2016
Observer: F de Wit, L van Gorp
Topography: Upper Slope
Rocky Type: Laterite
Vegetation Condition: Excellent.

Soil Types: Loam Sand
Soil Colour: Red
Soil Condition: Dry
Fire History: 10+


Taxon	Cons. Code	Height (cm)	% Alive
Acacia barbinervis subsp. barbinervis		30	0.2
Acacia lateriticola		40	0.2
Aira caryophyllea	*	10	0.1
Allocasuarina fraseriana		1400	4
Astroloma pallidum		15	0.1
Banksia dallanneyi var. dallanneyi		15	2
Banksia sessilis var. sessilis		400	20
Boronia ovata		30	0.2
Bossiaea ornata		30	0.2
Burchardia congesta		70	0.1
Conostylis setosa		20	0.01
Drosera gigantea		10	0.1
Eucalyptus marginata subsp. thalassica		2000	10
Grevillea synaphea subsp. synaphea		20	0.1
Grevillea wilsonii		110	2
Hakea lissocarpha		60	0.3
Hakea trifurcata		350	2
Hibbertia commutata		30	1
Hibbertia hypericoides		50	10
Hovea chorizemifolia		25	
Isopogon dubius		50	0.2

Taxon	Cons. Code	Height (cm)	% Alive
Lepidosperma leptostachyum		40	0.2
Levenhookia dubia		2	0.1
Lomandra caespitosa		40	0.5
Orthrosanthus laxus var. laxus		25	4
Pterochaeta paniculata		5	0.1
Stylidium affine		20	1
Stylidium calcaratum		4	0.2
Stylidium eriopodum		10	0.1
Stylidium piliferum		8	0.01
Tetraria capillaris		30	0.1
Tetrarrhena laevis		20	0.1
Thysanotus manglesianus			0.1
Trachymene pilosa		4	0.1
Trichocline spathulata		6	0.1
Trymalium ledifolium		40	1.5
Xanthosia candida		5	0.1