

PROPOSED XYRIS LATERAL

Flora and Vegetation Assessment

AWE LIMITED

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Proposed Xyris Lateral – Flora and Vegetation Assessment

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1 INTRODUCTION

1.1 Project and Assessment Description

AWE Limited (AWE) manages the Waitsia gas fields located in the Mid-West region of Western Australia (WA). AWE is proposing to clear vegetation for the development of a pipeline easement running east from the Xyris Production Facility to the Dampier to Bunbury Natural Gas Pipeline (DBNGP).

The proposed development occurs within an existing pipeline easement, parts of which have been subject to previous flora and vegetation surveys (see section 2.4) as well as recent clearing and rehabilitation as part of PL111 (AWE) and PL1 (APA Group (APA)).

Woodman Environmental Consulting Pty Ltd (Woodman Environmental) was contracted by AWE to undertake a Level 1 flora and vegetation assessment of the proposed pipeline easement, and undertake an assessment of impacts against the 10 Clearing Principles, for the proposed works (as described above).

1.2 Aim and Objectives

The aim of the flora and vegetation assessment was to determine the flora and vegetation values of the Study Area, and to provide baseline information to support a Native Vegetation Clearing Permit application.

The overall objectives of the assessment were to:

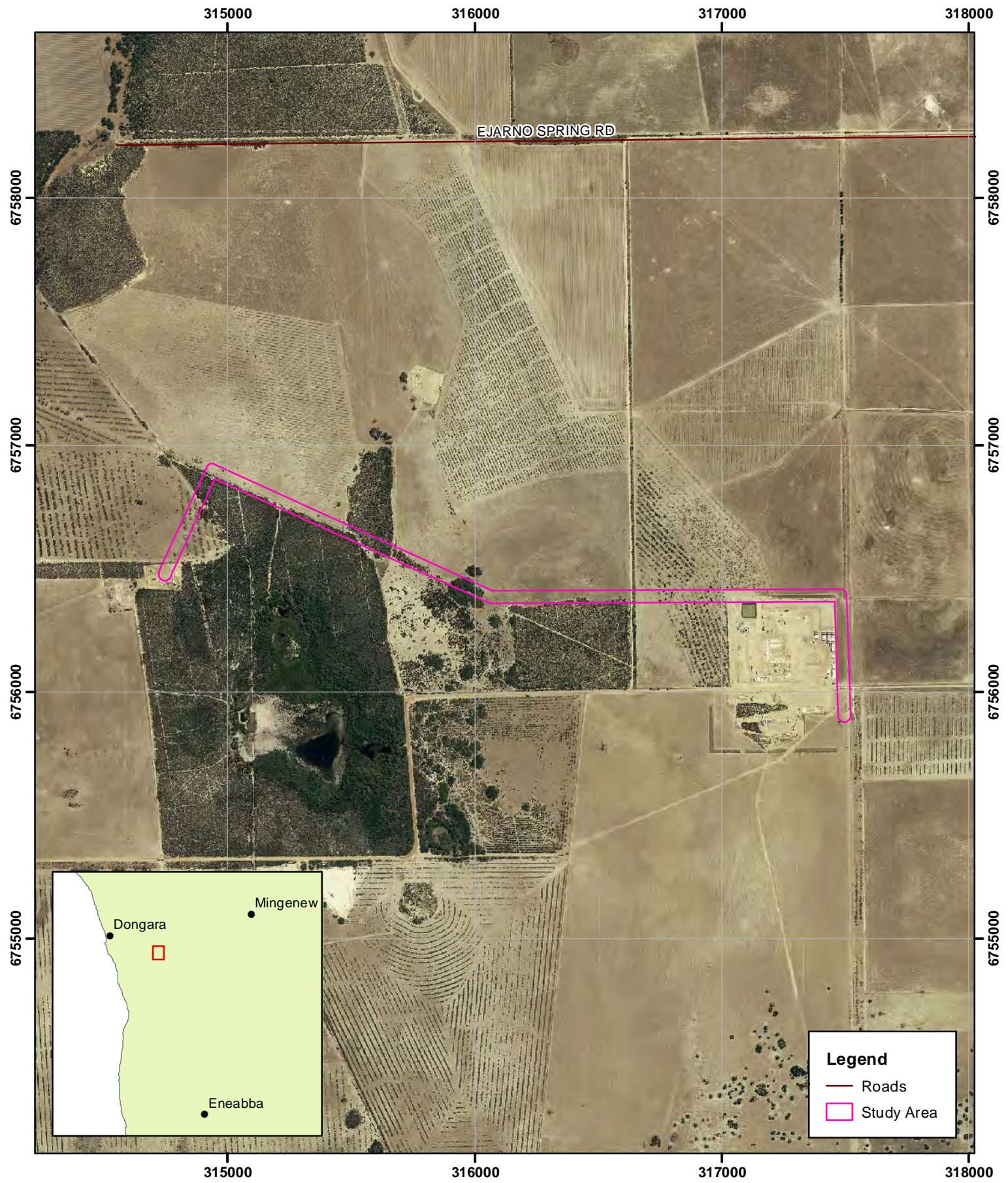
- Conduct a desktop assessment of the Study Area including a literature review and database search;
- Identify flora taxa in the Study Area that are one of the following (hereafter referred to as significant flora taxa):
 - Listed Threatened Species under the *Environment Protection and Biodiversity Conservation Act 1999* (Commonwealth) (EPBC Act);
 - Threatened Flora under the *Wildlife Conservation Act 1950* (WA) (WC Act); and
 - Priority Flora taxa as classified by Department of Parks and Wildlife (DPaW);
 - Other significant flora taxa as defined by the Environmental Protection Agency (EPA) (2016);
- Identify and map the vegetation in the Study Area that are one of the following (hereafter referred to as significant vegetation):
 - Listed Threatened Ecological Communities (TECs) under the EPBC Act;
 - TECs as classified by DPaW and endorsed by the Western Australian Minister for the Environment;
 - Priority Ecological Communities (PECs) as classified by DPaW; and
 - Other significant vegetation as defined by the EPA (2016).
- Determine the impacts of the proposed works against the 10 Clearing Principles (Government of Western Australia, 2014).



1.3 Study Area Definition

Figure 1 presents the location of Study Area, which is located approximately 17 km south-east of Dongara, 300 km north-west of Perth in Western Australia. The Study Area covers a total area of approximately 18.19 ha.

The Study Area is located on privately owned farmland, and consists of:

- Historically cleared tracks and paddocks;
- Recently cleared vegetation (as part of PL111 (AWE) and PL1 (APA); and
- Intact vegetation.



Study Area Location	Author: Alison Saligari	 Figure 1
	WEC Ref: AWE16-58-01	
Filename: AWE16-58-01-f01.mxd		
Scale: 1:20,000 (A4)		
Projection: GDA 1994 MGA Zone 50		
	Revision: A - 12 June 2017	
	<small>This map should only be used in conjunction with WEC report AWE16-58-01.</small>	

2 BACKGROUND

2.1 Climate

The Study Area is located within the Northern Sandplains region in the South-west Province of WA. The Northern Sandplains region is characterised by a dry, warm Mediterranean climate with winter precipitation. There are seven to eight dry months per year, with the region generally receiving between 300 - 500 mm of precipitation annually (Beard 1990). Figure 2 displays average monthly maximum and minimum temperatures for Mingenew (the nearest meteorological station to the Study Area with temperature data), and average monthly rainfall recorded for Irwin House (the nearest long-term meteorological station to the Study Area with rainfall data) (Bureau of Meteorology 2017).

The highest average daily maximum temperature at Mingenew occurs in January (36.4°C) with the lowest average minimum temperature experienced in August (6.9°C). The average annual rainfall for this station is 430.5 mm (data from 1901-2016). Average monthly rainfall peaks from late autumn to winter (May - August), with the highest rainfall on average received in July (93.4 mm). Rainfall received at Irwin House prior to survey being conducted over the winter period in 2016 (May - August), was below the long-term average, with 297.9 mm received compared to the average of 310.8 mm (Bureau of Meteorology 2017).

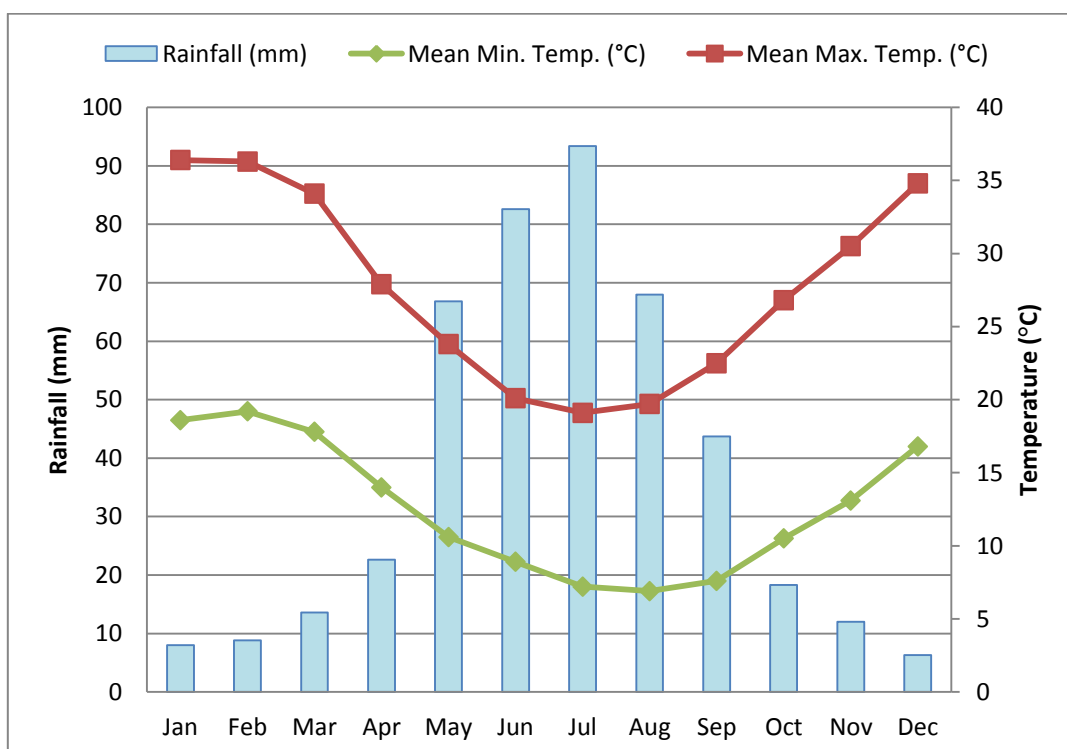


Figure 2: Mean Maximum and Minimum Temperatures (° Celsius) for Mingenew and Mean Rainfall (mm) for Irwin House (Bureau of Meteorology 2017)

2.2 Regional Vegetation

The Study Area is located in the Northern Sandplains Region (Irwin Botanical District) which is somewhat equivalent to the Geraldton Sandplains IBRA (Interim Biogeographic

Regionalisation for Australia) Bioregion (Commonwealth of Australia 2012). The vegetation of this region is described as scrub heath on sandplains near the coast, composed mainly of proteaceous scrub-heaths, rich in endemics, on the sandy earths of an extensive, undulating, lateritic sandplain (Beard 1990, Desmond and Chant 2001).

The Study Area occurs specifically within the Geraldton Sandplains 3 (Lesueur Sandplain) subregion. The subregion contains shrub-heaths rich in endemics occurring on a mosaic of lateritic mesas, sandplains, coastal sands and limestones, with heath on lateritised sandplains occurring along the subregions north-eastern margins (Desmond and Chant 2001).

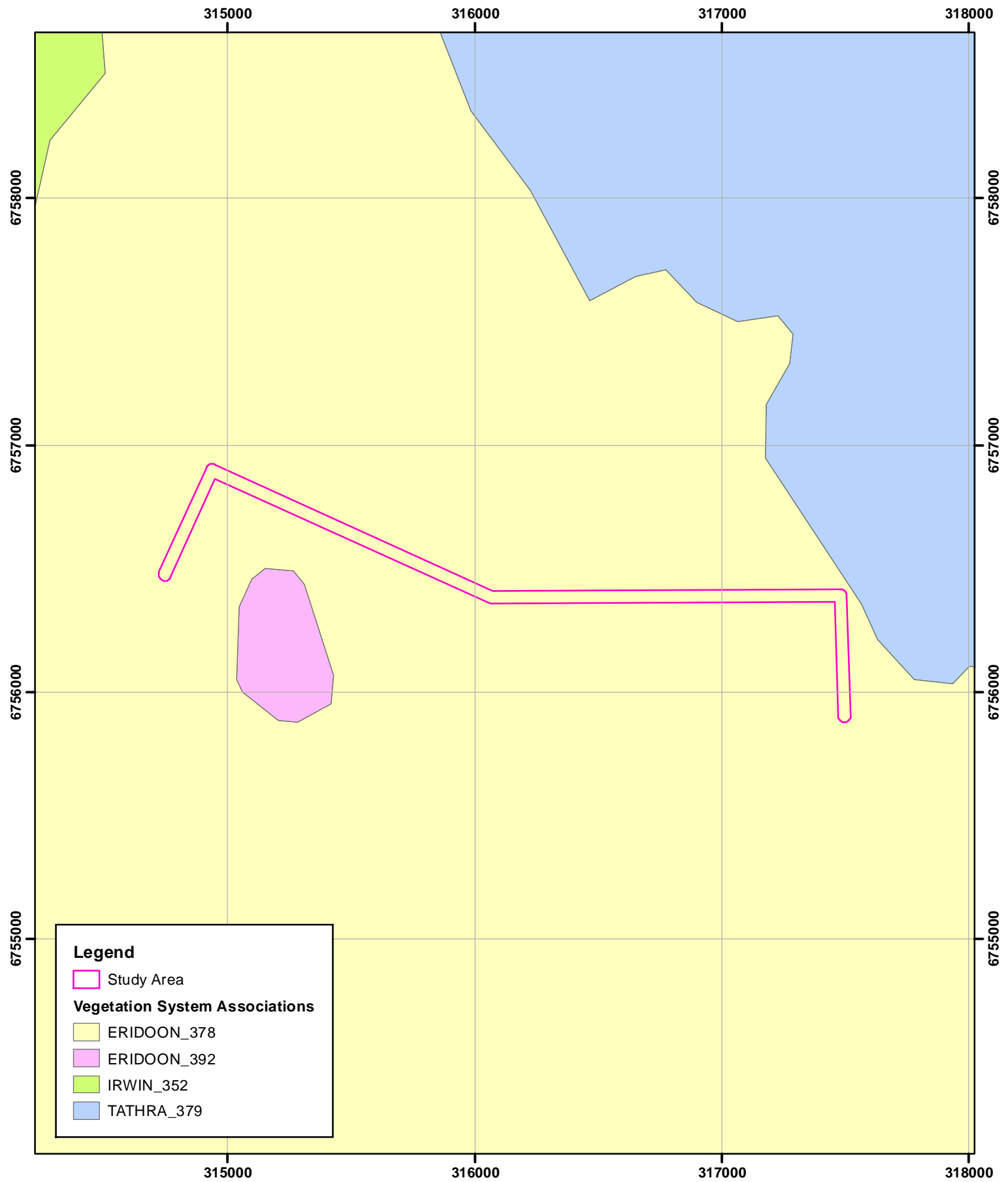
Beard (1976) mapped the vegetation of the Dongara area (including the Study Area) related to physiognomy, at a scale of 1:250,000. The Study Area coincides with one vegetation system described by Beard (1976), being Eridoon. The vegetation mapping by Beard (1976) was used by Shepherd *et al.* (2002) to describe vegetation system associations. Vegetation system associations were also described at a scale of 1:250,000. One vegetation system association occurs in the Study Area (Table 1). There are also two additional vegetation systems located less than 1 km from the Study Area including Eridoon_392 and Tathra_379 (Figure 3).



Table 1 also presents the current extent of each vegetation system association in relation to its pre-European extent (Government of Western Australia 2016), and the percentage of the current extent of each vegetation system association currently protected for conservation (in DPaW-managed land). Eridoon_378 is relatively well represented, with 65 % of the pre-European extent remaining, of which 21.9 % is reserved.

Table 1: Extent of the Vegetation System Association of the Survey Area (Government of Western Australia 2016)

Vegetation System Association	Description	Current Extent (ha)	Percentage of Pre-European Extent Remaining	Percentage of Current Extent Reserved for Conservation *
Eridoon_378	Shrublands; scrub-heath with scattered <i>Banksia</i> spp, <i>Eucalyptus todtiana</i> and <i>Xylomelum angustifolium</i> on deep sandy flats in the Geraldton Sandplain Region	60826.7	65.0	21.9

*Note: proportion of current extent reserved in IUCN classified reserves I - IV



Vegetation System Associations	Author: Alison Saligari	
	WEC Ref: AWE16-58-01	
 WOODMAN ENVIRONMENTAL	Filename: AWE16-58-01-f03.mxd	Figure 3
	Scale: 1:20,000 (A4)	
	Projection: GDA 1994 MGA Zone 50	
	Revision: A - 12 June 2017	
This map should only be used in conjunction with WEC report AWE16-58-01.		

A search of the Commonwealth Department of the Environment and Energy (DoEE) database with regard to Matters of National Environmental Significance (MNES) listed under the EPBC Act was performed for a central point (coordinates -29.30778 115.10528) in the Study Area, with a 5 km buffer (DoEE 2017a). There were no Threatened Ecological Communities returned from the search. The results of this search are presented in Appendix A.

The DPaW *NatureMap* database (DPaW 2017a) was investigated to identify the presence of any DPaW-classified TECs and/or DPaW-classified PECs that occur within the vicinity of the Study Area. The search did not identify any records of TECs or PECs within 15 km of the Study Area (DPaW 2017a). Appendix B presents definitions, categories and criteria for TECs and PECs (Department of Environment and Conservation (DEC) 2013).

2.3 Regional Flora

2.3.1 Significant Flora

The DPaW *NatureMap* database (DPaW 2017a) was investigated to identify records of Threatened and Priority flora taxa that may occur within or in close proximity to, or may be relevant to the Study Area. The search was performed for a central point (coordinates -29.30778 115.10528) in the Study Area, with a 10 km buffer. A total of 17 Priority flora taxa were returned from the search (Table 2). No Threatened flora taxa were returned from the search. Appendix C presents the conservation codes for Western Australian flora and fauna (DPaW 2015).

The search undertaken for MNES (as per Section 2.2) returned a total of 11 Threatened taxa, where the species or species habitat are likely or may occur in or within 5km of the search area (DoEE 2017a) (Table 2).

Table 2: Significance Flora Taxa Known from the Vicinity of Study Area (DoEE 2017a; DPaW 2017a)

Taxon	Status	Source	
		DPaW (2017a)	DoEE (2017a)
<i>Acacia telmica</i>	P3	X	
<i>Anthocercis intricata</i>	P3	X	
<i>Baekkea</i> sp. Walkaway (A.S. George 11249)	P3	X	
<i>Banksia elegans</i>	P4	X	
<i>Comesperma griffinii</i>	P2	X	
<i>Conostylis dielsii</i> subsp. <i>teres</i>	T		X
<i>Conostylis micrantha</i>	T		X
<i>Dampiera tephrea</i>	P2	X	
<i>Eremaea acutifolia</i>	P3	X	
<i>Eucalyptus crispata</i>	T		X
<i>Eucalyptus impensa</i>	T		X
<i>Eucalyptus leprophloia</i>	T		X
<i>Eucalyptus x balanites</i>	T		X
<i>Eucalyptus zopherophloia</i>	P4	X	
<i>Hemiandra gardneri</i>	T		X
<i>Hemiandra</i> sp. Eneabba	P3	X	

Taxon	Status	Source	
		DPaW (2017a)	DoEE (2017a)
<i>Hypocalymma longifolium</i>	T		X
<i>Mesomelaena stygia</i> subsp. <i>deflexa</i>	P3	X	
<i>Paracaleana dixonii</i>	T		X
<i>Persoonia rudis</i>	P3	X	
<i>Schoenus</i> sp. Eneabba (F. Obbens & C. Godden I154)	P2	X	
<i>Scholtzia</i> sp. Dongara (R. Hart 8401)	P1	X	
<i>Stawellia dimorphantha</i>	P4	X	
<i>Thelymitra stellata</i>	T		X
<i>Thryptomene nitida</i>	P3	X	
<i>Verticordia densiflora</i> var. <i>roseostella</i>	P3	X	
<i>Verticordia luteola</i> var. <i>luteola</i>	P3	X	
<i>Wurmbea tubulosa</i>	T		X

2.3.2 Introduced Flora

The DoEE database search returned a total of four significant introduced taxa which may occur, or habitat for which may occur within area including *Asparagus asparagoides*, *Cenchrus ciliaris*, *Lycium ferocissimum* and *Tamarix aphylla* (DoEE 2017a). Of these taxa, it is considered possible that *Cenchrus ciliaris* and *Lycium ferocissimum* could occur in the Study Area, as they are known from within the vicinity (<20 km) of the Study Area (DPaW 2017a) (Table 3). *Asparagus asparagoides* and *Tamarix aphylla* are considered unlikely to occur in the Study Area as the nearest records to the Study Area are over 90 km and 60 km away respectively.

The DPaW *NatureMap* database search identified a total of 12 introduced flora taxa known from the vicinity of the Study Area as presented in Table 3. Table 3 also presents the ratings for each introduced taxon under the then-Department of Conservation and Land Management's (CALM) (now DPaW) Environmental Weed Strategy for Western Australia (CALM 1999). This strategy assessed and rated environmental weeds in terms of their environmental impact on biodiversity according to invasiveness, distribution and environmental impact, and assigned a score of 'High', 'Moderate', 'Mild' or 'Low'.

Of the weeds known from the vicinity of the Study Area, *Lycium ferocissimum* is a Weed of National Significance (WoNS) (Australian Weeds Committee 2017). None of these are listed as Declared Pests under the *Biosecurity and Agriculture Management Act 2007* (BAM Act) (Department of Agriculture and Food (DAF) 2017). Four of the introduced taxa known from the vicinity of Study Area were ranked as 'High' for environmental impact (Table 3). Appendix D provides descriptions of each rating from CALM (1999).

Table 3: Introduced Flora Taxa Known from the Vicinity of Study Area (DoEE 2017a; DPaW 2017a)

Taxon	Common Name	Source		Comments
		DPaW (2017a)	DoEE (2017a)	
<i>Cenchrus ciliaris</i>	Buffel-grass		X	Environmental impact 'High' (CALM 1999)
<i>Cenchrus echinatus</i>	Burr Grass	X		Environmental impact 'Low' (CALM 1999)
<i>Cenchrus setaceus</i>	Fountain Grass	X		Environmental impact 'Mild' (CALM 1999)
<i>Centaurium tenuiflorum</i>	-	X		Environmental impact 'Low' (CALM 1999)
<i>Euphorbia terracina</i>	Geraldton Carnation Weed	X		Environmental impact 'High' (CALM 1999)
<i>Leontodon rhagadioloides</i>	Cretan Weed	X		Environmental impact 'Mild' (CALM 1999)
<i>Lupinus cosentinii</i>	-	X		Environmental impact 'High' (CALM 1999)
<i>Lycium ferocissimum</i>	African Boxthorn	X	X	WoNS Environmental impact 'High' (CALM 1999)
<i>Reichardia tingitana</i>	False Sowthistle	X		Environmental impact 'Mild' (CALM 1999)
<i>Solanum nigrum</i>	Black Berry Nightshade	X		Environmental impact 'Moderate' (CALM 1999)
<i>Sonchus oleraceus</i>	Common Sowthistle	X		Environmental impact 'Moderate' (CALM 1999)
<i>Verbesina encelioides</i>	-	X		Environmental impact 'Low' (CALM 1999)
<i>Zaluzianskya divaricata</i>	Spreading Night Phlox	X		Environmental impact 'Low' (CALM 1999)

2.4 Local Flora and Vegetation

Several flora and vegetation surveys have been conducted within the vicinity of the Study Area, the results of which are reviewed below.

Woodman Environmental undertook a flora and vegetation assessment of a proposed pipeline (PL64) connecting the Xyris Production Facility to the Parmelia pipeline (Woodman Environmental 2004a). The proposed route was located entirely within cleared paddock, with heavily disturbed vegetation located at the point of contact with the Parmelia pipeline. This disturbed vegetation consisted of *Acacia scirpifolia*, *Acacia saligna* and *Banksia menziesii* individuals, with occasional understorey species such as *Blancoa canescens* and *Cryptandra myriantha*, as well as weed species. Disturbance in this area was due to the construction of the Parmelia pipeline, and through grazing by stock. It was noted that the vegetation of the adjacent remnant vegetation block was in better condition, and consisted of a low woodland of *Banksia menziesii* and *Banksia attenuata*, with an intact although weed infested low heath understorey, on yellow sand. The understorey was noted to be dominated by *Corynotheca micrantha* var. *micrantha*, *Mesomelaena pseudostygia*,

Petrophile macrostachya, *Leptospermum erubescens*, *Melaleuca leuropoma* and *Ecdeiocolea monostachya*. This area had been grazed, and weeds such as *Arctotheca calendula*, *Lupinus* spp. and pasture grasses were present (Woodman Environmental 2004a).

Woodman Environmental undertook a flora and vegetation assessment of the Denison 3D survey area, located to the south, west and north of the Waitsia Gas Project area (Woodman Environmental 2004b). The survey area was large (39,400 ha), incorporating several nature reserves as well as private property. A total of 515 vascular plant taxa were recorded, belonging to 81 plant families, with the most common families being Myrtaceae and Proteaceae. One Declared Plant taxa was recorded (*Stawellia dimorphantha*), which has since been downgraded to P4 status (DPaW 2017b). A total of eight Priority flora taxa were recorded, one of which has been removed from the Priority list (*Hakea polyanthema*):

- *Anthocercis intricata* (P3)
- *Baeckea* sp. Walkaway (A.S. George 11249) (P3)
- *Banksia elegans* (P4),
- *Dampiera tephrea* (P2),
- *Eucalyptus zopherophloia* (P4),
- *Hemigenia saligna* (P3) and
- *Schoenus* sp. Eneabba (F.Obbens & C.Godden 1154) (P2)

A total of 34 plant communities, 7 disturbed communities and 7 mosaic units were mapped over the Denison 3D survey area in 2004, consisting of Forests, Woodlands, Thickets, Scrub, Shrublands and Heaths. This study found that the condition of vegetation within the survey area varied between Very Poor and Excellent. None of the plant communities were representative of TECs, however some areas of locally significant vegetation were described (Woodman Environmental 2004c).

Woodman Environmental Consulting undertook a flora and vegetation assessment the proposed Xyris Area Gas Gathering System (XAGGS) route, linking the existing Xyris Processing Facility (XPF) to the Xyris-South-01, Apium-02 and Hovea-02 Wellheads and Hovea Production Facility (Woodman Environmental 2004c). Approximately 90% of the survey area was in cleared paddocks, with the majority of the native vegetation in a degraded state.

A total of 89 vascular plant species composed of 79 native plant taxa and 10 introduced taxa were recorded within native vegetation areas on the proposed flowline route during the survey, with the relatively high proportion of introduced species reflecting the general degraded nature of the vegetation on the route. The most well represented families were Proteaceae (16 native plant taxa), Myrtaceae (nine native plant taxa) and Papilionaceae (6 native plant taxa). No Threatened taxa, as listed under the WC Act or EPBC were recorded during the survey. One Priority Flora species, as listed by CALM (2004), was recorded in the survey area (Woodman Environmental 2004c), however this taxon, *Hakea polyanthema*, has since been removed from the Priority flora listing (DPaW 2017b). The Declared Pest *Echium plantagineum* (Patterson's curse) was recorded.

No Threatened Ecological Communities (TECs) were identified in the survey area. A total of two plant communities and one disturbance community were mapped on the survey area. Overall, the vegetation was described as being in a disturbed state, with a high level of weed invasion, predominantly pasture grasses. The three plant communities were:

H1: Heath of *Dryandra sessilis* and *Melaleuca ?systema*, over a Low Heath dominated by *Hibbertia hypericoides* on brown sand over limestone on crests;

H1d: Degraded areas of plant community H1; and

W1: Low Woodland of *Banksia attenuata* and *Banksia menziesii* over degraded heath dominated by *Eremaea beaufortioides* on brown sand on mid-slope (Woodman Environmental 2004c).

Maia Environmental Consultancy (Maia) undertook a Level 1 flora and vegetation reconnaissance and targeted flora survey in vegetation in an existing pipeline corridor in AWE's Waitsia Gas Project area in December 2015 (Maia 2015). The Southern Survey Area of this survey partially overlaps the Study Area. A total of five relevés were undertaken for the study, three of which are located within the Study Area.

A total of three vegetation associations were mapped in the Southern Survey Area (described below) with the majority of the Southern Survey Area mapped as BSL:

- **ASL:** Tall Shrubland of *Acacia scirpifolia* with Isolated Sedges of *Mesomelaena pseudostygia*;
- **BSL:** Tall to Mid Open Shrubland of *Banksia attenuata* and / or *B. hookeriana* with a mixed Low Sparse Shrubland (*Melaleuca systema*, *Pileanthus filifolius* and *Baeckea ?sp.* Walkaway (A.S. George 11249) (?P3)) and an Open mixed Sedgeland (*Mesomelaena pseudostygia*, *Chordifex sinuosus* and *Lyginia imberbis*); and
- **DIS:** Disturbed areas with regrowth of a mixed Open Mid Shrubland of (*Grevillea leucopteris*, *Calothamnus glaber* and *Baeckea ?sp.* Walkaway (A.S. George 11249) (?P3)) a mixed Low Sparse Shrubland (*Persoonia acicularis*, *Calytrix strigosa* and *Melaleuca systema*) and a Sparse Sedgeland of *Mesomelaena pseudostygia*.

A total of 67 taxa from 54 genera and 19 families were recorded during the survey by Maia (2015). There were two significant flora taxa recorded during the survey, both of which were found within the Study Area:

- *Baeckea ?sp.* Walkaway (A.S. George 11249) (?P3); and
- *Banksia elegans* (P4).

Baeckea ?sp. Walkaway (A.S. George 11249) (?P3) was recorded at a number of locations within undisturbed vegetation as well as in regrowth areas, whilst *Banksia elegans* (P4) was recorded at one location within remnant vegetation (Maia 2015). A number of these locations have since been cleared prior to survey by Woodman Environmental (discussed further in section 5.1.2).

A total of six introduced flora taxa were recorded during the survey including *Avena barbata*, *Ehrharta calycina*, *Lupinus cosentinii*, *Rumex hypogaeus*, *Trifolium arvense* var. *arvense* and *Ursinia anthemoides*. Of these, *Rumex hypogaeus* is a declared pest under the BAM Act in for the South West Land Division but is not declared for the Midwest region (where the Study Area is located) (Maia 2015).

3 METHODS

3.1 Personnel and Licensing

Table 4 lists the personnel involved in both fieldwork and plant identifications for the assessment of the Study Area. The field team leader has had 18 years previous field experience in similar areas to the Study Area, with personnel involved in plant identifications having several years of taxonomic experience with the flora of the Geraldton Sandplains. All plant material was collected under the scientific licences pursuant to the WC Act Section 23C and Section 23F as listed in Table 4.

Table 4: Personnel and Licensing Information

Personnel	Role	Qualifications	Flora Collecting Permit (WC Act (WA))
Beth Loudon	Project Management; Team Leader; field survey; plant identifications	BSc (Biology)	SL011773 (Section 23C) 123-1516 (Section 23F)
Emalyn Loudon	Field survey	BAgrib (Agriculture) (Hons)	-

3.2 Field Survey

A Level 1 reconnaissance/targeted survey was undertaken, as per the guidelines prepared by the EPA and DPaW (2015) which has since been updated by the EPA (2016).

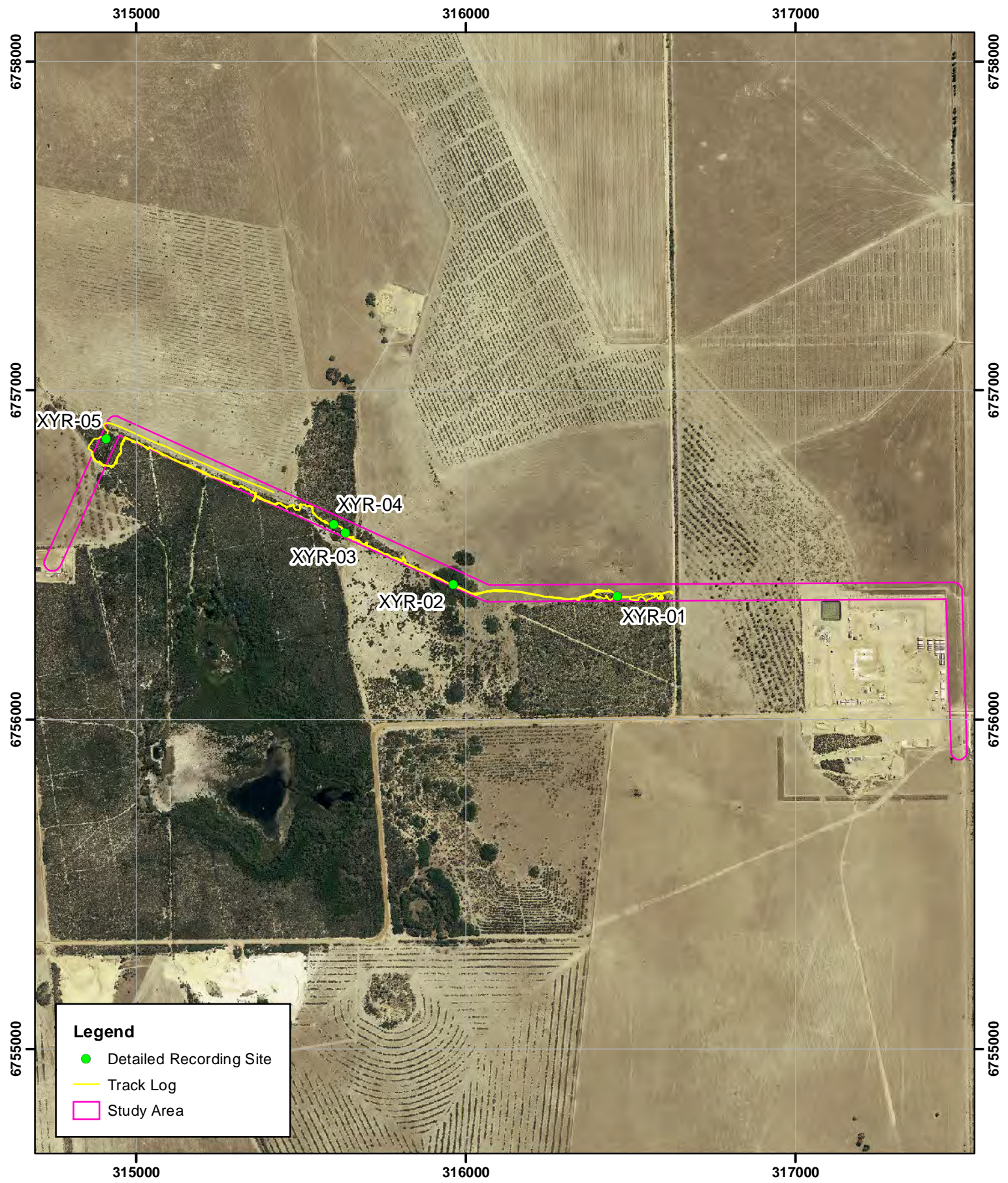
The field survey was undertaken on the 9th of December 2015. The timing of the survey is just outside the most appropriate time to survey in the Geraldton Sandplains Bioregion (Spring). Access to the Study Area was achieved on foot.



A total of five non-permanent relevés were assessed during the survey (Figure 4). The relevés were located in all vegetation types discernible through aerial photography interpretation, in combination with on-ground inspection. The following information was recorded within a 20 m radius of each relevé:

- Date;
- Field personnel;
- GPS location (GDA 94);
- Representative photograph;
- Topography;
- Soils (type and colour);
- Condition (vegetation condition scale – Table 3 of EPA and DPaW (2016));
- Disturbance factors in the area (including time since fire); and
- Vascular plant species – including height and approximate foliage cover.

Additional flora taxa were recorded opportunistically in the survey areas via a search around the general vicinity of each relevé, and during traverses on foot between relevés. Mapping notes of vegetation type boundaries and distribution were taken while traversing on foot and by vehicle.

Targeted searching for significant flora taxa known from the vicinity of the Study Area was undertaken as part of the survey. All area of native vegetation within the Study Area was traversed with transects undertaken at a spacing of approximately 10 m (Figure 4).



Study Area Relevé Locations and Track Logs	Author: Alison Saligari	 Figure 4
	WEC Ref: AWE16-58-01	
Filename: AWE16-58-01-f04.mxd		
Scale: 1:15,000 (A4)		
Projection: GDA 1994 MGA Zone 50		
 This map should only be used in conjunction with WEC report AWE16-58-01.	Revision: A - 12 June 2017	

3.3 Plant Specimen Collection and Identification and Data Management

Specimens of any unknown taxa that were collected were pressed for later identification at the WA Herbarium. Identifications were undertaken by experienced botanists Bethea Loudon and David Coultas. External experts of particular families or genera were consulted for any specimens considered to be difficult to identify or of taxonomic interest.

Taxon nomenclature generally follows *FloraBase* (DPaW 2017b) with all names checked against the current DPaW Max database to ensure their validity. However, in cases where names of plant taxa have been published recently in scientific literature but have not been adopted on *FloraBase* (DPaW 2017b), nomenclature in the published literature is followed. The conservation status of each taxon was checked against *FloraBase*, which provides the most up-to-date information regarding the conservation status of flora taxa in Western Australia.

Specimens of interest, including significant flora taxa, range extensions of taxa and potential new taxa, will be sent to the WA Herbarium for consideration for vouchering as soon as practicable. However, this process is via donation, and the WA Herbarium may not voucher all specimens, in accordance with its own requirements. The specimen vouchering will be supported by completed Threatened and Priority Flora Report Forms submitted to DPaW (Species and Communities Branch) in the case of listed significant flora (e.g. Threatened and Priority flora taxa).

All data was entered into the Woodman Environmental bespoke database VegMonitor, which allows processing of the data for appendices.

3.4 Vegetation Mapping

The vegetation was assessed through site relevés as well as observations recorded while traversing the Study Area. Species composition, density and occurrence in structural layers were used to identify and describe the structural vegetation types (VT) present. Aerial photography interpretation and field notes taken during the survey were used to develop VT polygon boundaries within the Study Area. These were then digitised using Geographic Information System (GIS) software and displayed on figures.

The VT descriptions have been adapted from the National Vegetation Information System (NVIS) Australian Vegetation Attribute Manual Version 6.0 (ESCAVI 2003), a system of describing structural vegetation units preferred by the DPaW. This model follows nationally-agreed guidelines to describe and represent vegetation types, so that comparable and consistent data is produced nation-wide. For the purposes of this report, it is considered that a VT is equivalent to a NVIS sub-association as described in ESCAVI (2003).

3.5 Vegetation Condition

Vegetation condition was recorded at relevés, and opportunistically within the Study Area where significant areas of disturbance to vegetation were noted (e.g. weed infestations, areas of clearing, soil disturbance). Vegetation condition was described using the

Vegetation Condition Scale for the South-West Botanical Province (EPA 2016; adapted from Keighery 1994) (Table 5).

Table 5: Vegetation Condition Scale for the South-West and Interzone Botanical Provinces (EPA 2016; adapted from Keighery 1994)

Condition Ranking	Description
Pristine	Pristine or nearly so, no obvious signs of disturbance or damage caused by human activities since European settlement.
Excellent	Vegetation structure intact, disturbance affecting individual species and weeds are non-aggressive species. Damage to trees caused by fire, the presence of non-aggressive weeds and occasional vehicle tracks.
Very Good	Vegetation structure altered, obvious signs of disturbance. 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. Disturbance to vegetation structure caused by very frequent fires, the presence of very aggressive weeds, 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. Disturbance to vegetation structure caused by very frequent fires, the presence of very aggressive weeds at high density, 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 and shrubs.

4 LIMITATIONS OF SURVEY

Table 6 presents the limitations of the flora and vegetation survey of the Study Area in accordance with EPA Guidance Statement No. 51 (EPA 2016).

Table 6: Limitations of the Flora and Vegetation Assessment of the Study Area

Potential Limitation	Limitation of Survey	Comment
Availability of contextual information at a regional and local scale	No	Sources of information used included government databases (DPaW, DoE) and several reports and unpublished data from the vicinity of the Study Area. Good contextual information for the Study Area was available prior to the survey
Competency/experience of the team carrying out the survey, including experience in the bioregion surveyed	No	Senior botanist with extensive experience undertaking flora and vegetation surveys, in particular on the Geraldton Sandplain, conducted the survey and undertook plant identifications
Proportion of flora recorded and/or collected, any identification issues	No	Moderate proportion of perennial vascular taxa recorded base on complexity of vegetation and level of survey/survey method. Vascular taxa recorded that were not known to the botanists had at least one reference specimen collected, with specimens identified at the WAHerb.
Was the appropriate area fully surveyed (effort and extent)	No	The Study Area was searched adequately with the entire site traversed on foot. The survey intensity was considered adequate to identify flora taxa present.
Access restrictions within the survey area	No	Entire site was accessible on foot, with no restrictions to any areas
Survey timing, rainfall, season of survey	Potential minor	The survey was undertaken in December, just outside the optimal flowering period for flora in the Geraldton Sandplains (Spring), and below average rainfall was recorded prior to the survey (section 2.1). However, sufficient features (e.g. fruit) were present to accurately identify the majority of taxa present
Disturbance that may have affected the results of survey such as fire, flood or clearing	Potential minor	A section of vegetation in the west of the Study Area (the Southern Survey Area surveyed by Maia 2015) had been recently cleared and rehabilitated, therefore mapping/searching of this area could not be undertaken. There were also areas of vegetation which were 'Degraded' which may have affected mapping reliability.

5 RESULTS

5.1 Flora

5.1.1 Vascular Flora Census

A total of 97 discrete native vascular flora taxa were recorded within the survey area, including 76 native taxa, and 21 introduced taxa. These taxa represent 35 families and 80 genera. The most well-represented families were Myrtaceae, Poaceae and Proteaceae. Appendix E presents a list of taxa recorded in the Study Area. Appendix F presents the relevé data.

5.1.2 Significant Flora

A total of two significant flora taxa were recorded within the Study Area; *Banksia elegans* (P4) and *Baeckea* sp. Walkaway (A.S. George 11249) (P3) (Table 7). These locations are in addition to those recorded by Maia (2015). Locations of significant flora taxa are presented in Appendix G and Figure 5.

Table 7: Summary of Significant Flora Taxa Recorded within the Study Area (Woodman Environmental)

Taxon	Status	Total Number of Point Locations Recorded in Study Area	Total Number of Individuals Recorded in Study Area	Vegetation Types
<i>Banksia elegans</i>	P4	7	33	1; 2
<i>Baeckea</i> sp. Walkaway (A.S. George 11249)	P3	3	4	2

Banksia elegans (P4) is a shrub growing up to 4 m high (Plate 1) occurring on sandplains and low consolidated dunes on yellow, white or red sand (DPaW 2017b). This taxon has a range of approximately 170 km, from east of Jurien Bay in the south to east of Geraldton in the north (DPaW 2017a). Regionally, it is known from 39 records, a number of which occur within conservation reserves including Beekeepers Nature Reserve, Eradu Nature Reserve, Lake Logue Nature Reserve and Yardanogo Nature Reserve (DPaW 2017a).

Banksia elegans was recorded at seven locations comprising of 33 individuals within the Study Area, occurring within VT 1 and 2. In addition, seven locations comprising of 66 individuals of *Banksia elegans* were recorded outside the Study Area during this survey (Figure 5.1, Appendix G). The location of *Banksia elegans* (P4), previously recorded by Maia (2015) (consisting of five individuals) from within the Study Area boundary, was cleared by AWE as part of PL111 prior to survey by Woodman Environmental (Figure 5.1).



Plate 1: *Banksia elegans* (P4) (Photo: Woodman Environmental)

Baeckea sp. Walkaway (A.S. George 11249) (P3) is a dense, multi-stemmed shrub growing up to 2 m high (Plate 2) occurring on undulating plains and hillslopes on yellow/brown or white sand (DPaW 2017b). It has a range of approximately 120 km from north-west of Geraldton in the west to north of Morawa in the east (DPaW 2017a). This taxon is known from 39 records. A number of these records occur within conservation reserves including Burma Road Nature Reserve and Yandanogo Nature Reserve (DPaW 2017a).

Baeckea sp. Walkaway (A.S. George 11249) (P3) was recorded at three locations within the Study Area during this survey (Figure 5.1; 5.2; Appendix G), with a total of four individuals recorded. All of these locations were recorded in VT 2. In addition, Maia (2015) recorded three locations of *Baeckea* ?sp. Walkaway (A.S. George 11249) (P3) (consisting of six individuals) within the Study Area; all of these locations occur in VT 1 as mapped by Woodman Environmental. One additional location (consisting of two individuals) was also located by Maia (2015) outside the Study Area.

Seven locations (consisting of 48 individuals), recorded by Maia (2015) from within the Study Area boundary, have or potentially have been cleared by AWE as part of PL111 prior to the survey conducted by Woodman Environmental (Figure 5.1).



Plate 2: *Baeckea* sp. Walkaway (A.S. George 11249) (P3) (Photo: Woodman Environmental (scanned specimen))

5.1.3 Introduced Taxa

A total of 21 introduced flora taxa were recorded during the survey of the Study Area. Table 8 presents a list of the introduced flora taxa recorded in the Study Area, together with location information, and ratings for each introduced taxon under the Environmental Weed Strategy for Western Australia (CALM 1999). There were no Declared Pests under the BAM Act (WA) or WoNS recorded within the Study Area (DAF 2017, AWC 2017). Although *Echium plantagineum* (Patersons Curse) and *Rumex hypogaeus* (Doublegee) are Declared Pests, there are no applicable control management requirements within the Shire of Irwin (DAF 2017).

Table 8: Summary of Introduced Taxa Recorded from within the Study Area

Taxon	Comments
<i>Arctotheca calendula</i>	Environmental impact 'Moderate' (CALM 1999)
<i>Avena fatua</i>	Environmental impact 'Moderate' (CALM 1999)
<i>Bromus diandrus</i>	Environmental impact 'High' (CALM 1999)
<i>Chamaecytisus palmensis</i>	Environmental impact 'Mild' (CALM 1999)
<i>Chloris gayana</i>	Environmental impact 'Low' (CALM 1999)
<i>Dischisma capitatum</i>	Environmental impact not rated (CALM 1999)
<i>Echium plantagineum</i>	Environmental impact not rated (CALM 1999)
<i>Ehrharta longiflora</i>	Environmental impact 'Moderate' (CALM 1999)
<i>Rumex hypogaeus</i> (formerly <i>Emex australis</i>)	Environmental impact 'Low' (CALM 1999)
<i>Hypochaeris glabra</i>	Environmental impact 'Moderate' (CALM 1999)
<i>Lolium rigidum</i>	Environmental impact 'Moderate' (CALM 1999)
<i>Lupinus cosentinii</i>	Environmental impact 'High' (CALM 1999)
<i>Orobanche minor</i>	Environmental impact 'Moderate' (CALM 1999)
<i>Pentameris airoides</i>	Environmental impact 'Moderate' (CALM 1999)
<i>Raphanus raphanistrum</i>	Environmental impact 'Mild' (CALM 1999)
<i>Solanum nigrum</i>	Environmental impact 'Moderate' (CALM 1999)
<i>Trifolium arvense</i>	Environmental impact 'Moderate' (CALM 1999)
<i>Urospermum picroides</i>	Environmental impact 'Moderate' (CALM 1999)
<i>Ursinia anthemoides</i>	Environmental impact 'Moderate' (CALM 1999)
<i>Vulpia myuros</i>	Environmental impact 'Moderate' (CALM 1999)
<i>Wahlenbergia capensis</i>	Environmental impact 'Moderate' (CALM 1999)

5.2 Vegetation

A total of 3.16 ha of native vegetation were mapped in the Study Area (17.37% of the Study Area), consisting of three Vegetation Types (VTs) as described below:

VT 1: Low Woodland of *Banksia menziesii* over Low open Shrubland dominated by *Banksia attenuata* over Low Open Shrubland dominated by *Melaleuca leuropoma*, *Petrophile macrostachya* and *Pileanthus filifolius* over Mid Sedgeland dominated by *Mesomelaena pseudostygia* and *Chordifex sinuosus* on lower slopes on yellow sand (0.35 ha; Plate 3).



Plate 3: Vegetation Representative of VT 1 (Photo: Woodman Environmental)

VT 2: Low Woodland of *Banksia menziesii*, *Banksia prionotes* and *Eucalyptus todtiana* over Tall Sparse Shrubland dominated by *Acacia scirpifolia* and *Banksia attenuata* over Mid Open Shrubland dominated by *Eremaea beaufortioides* and *Baeckea* sp. Walkaway (A.S. George 11249) (P3) over Mid Sedgeland dominated by *Desmocladus asper* and *Mesomelaena pseudostygia* on mid to upper slopes on yellow sand (1.98 ha; Plate 4).



Plate 4: Vegetation Representative of VT 2 (Photo: Woodman Environmental)

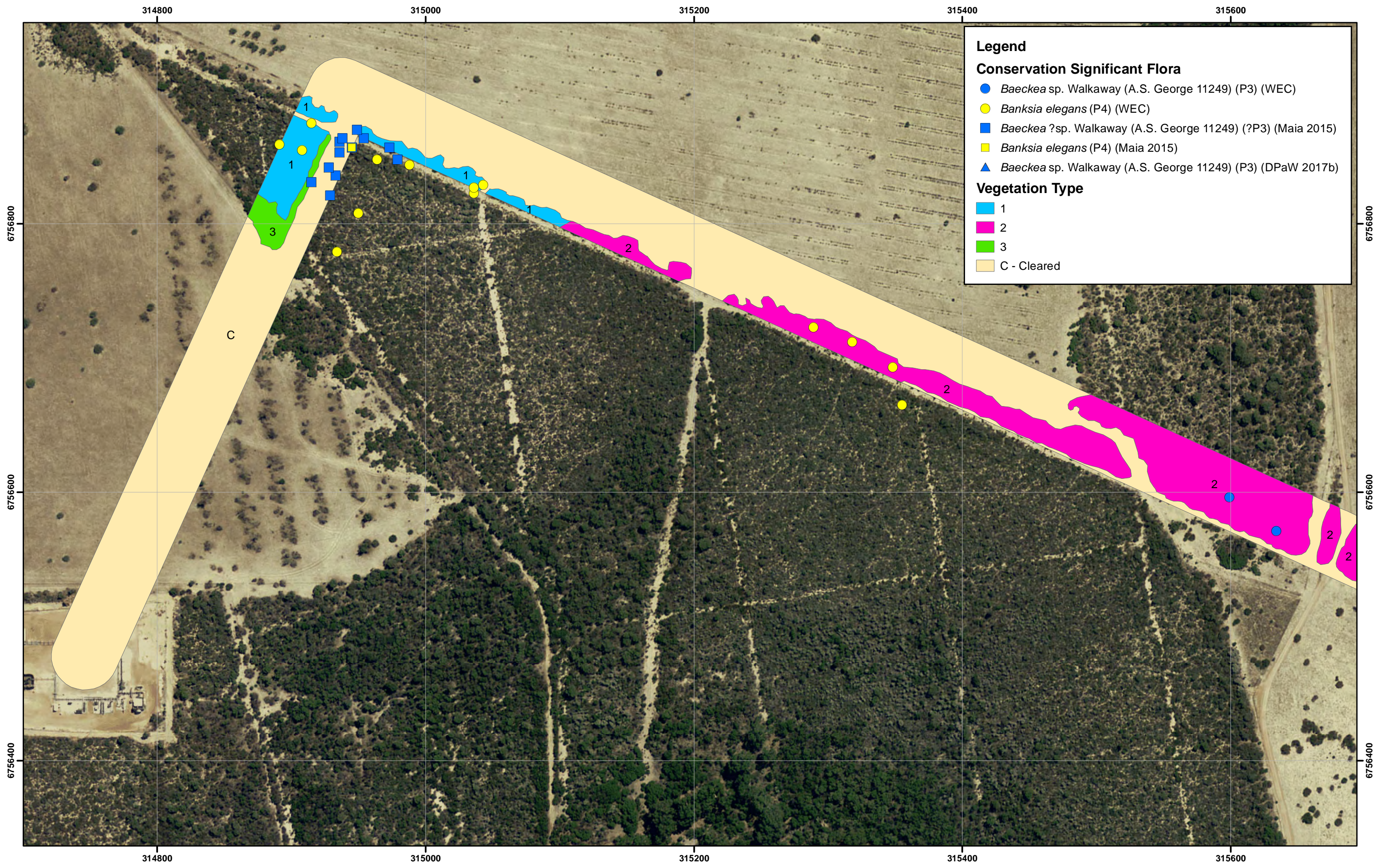
VT 3: Tall Closed Shrubland of *Acacia rostellifera* over Mid Closed Grassland dominated by **Bromus diandrus* and **Ehrharta longiflora* on lower slopes and open depressions on yellow sand (0.82 ha; Plate 5).



Plate 5: Vegetation Representative of VT 3 (Photo: Woodman Environmental)

Figure 5 presents the distribution of these VTs in the Study Area.

None of the VTs mapped in the Study Area are considered to represent any TECs as classified by DPaW and endorsed by the Western Australian Minister for Environment (DPaW 2016a), or as listed under the EPBC Act (DoEE 2017a, b). None of the VTs mapped in the Study Area are considered to represent any DPaW-classified PECs (DPaW 2016b). As previously mentioned, no known locations of any DPaW-classified TECs, TECs listed under the EPBC Act, or DPaW-classified PECs, coincide with the Study Area (DoEE 2017a; DPaW 2017a). The VTs described and mapped are not considered in any other way to be otherwise of significance, in a local or regional context.



Legend

Conservation Significant Flora

- *Baeckea* sp. Walkaway (A.S. George 11249) (P3) (WEC)
- *Banksia elegans* (P4) (WEC)
- *Baeckea* ?sp. Walkaway (A.S. George 11249) (?P3) (Maia 2015)
- *Banksia elegans* (P4) (Maia 2015)
- ▲ *Baeckea* sp. Walkaway (A.S. George 11249) (P3) (DPaW 2017b)

Vegetation Type

- 1
- 2
- 3
- C - Cleared



**Study Area Vegetation Type Mapping
and Conservation Significant Flora Locations**

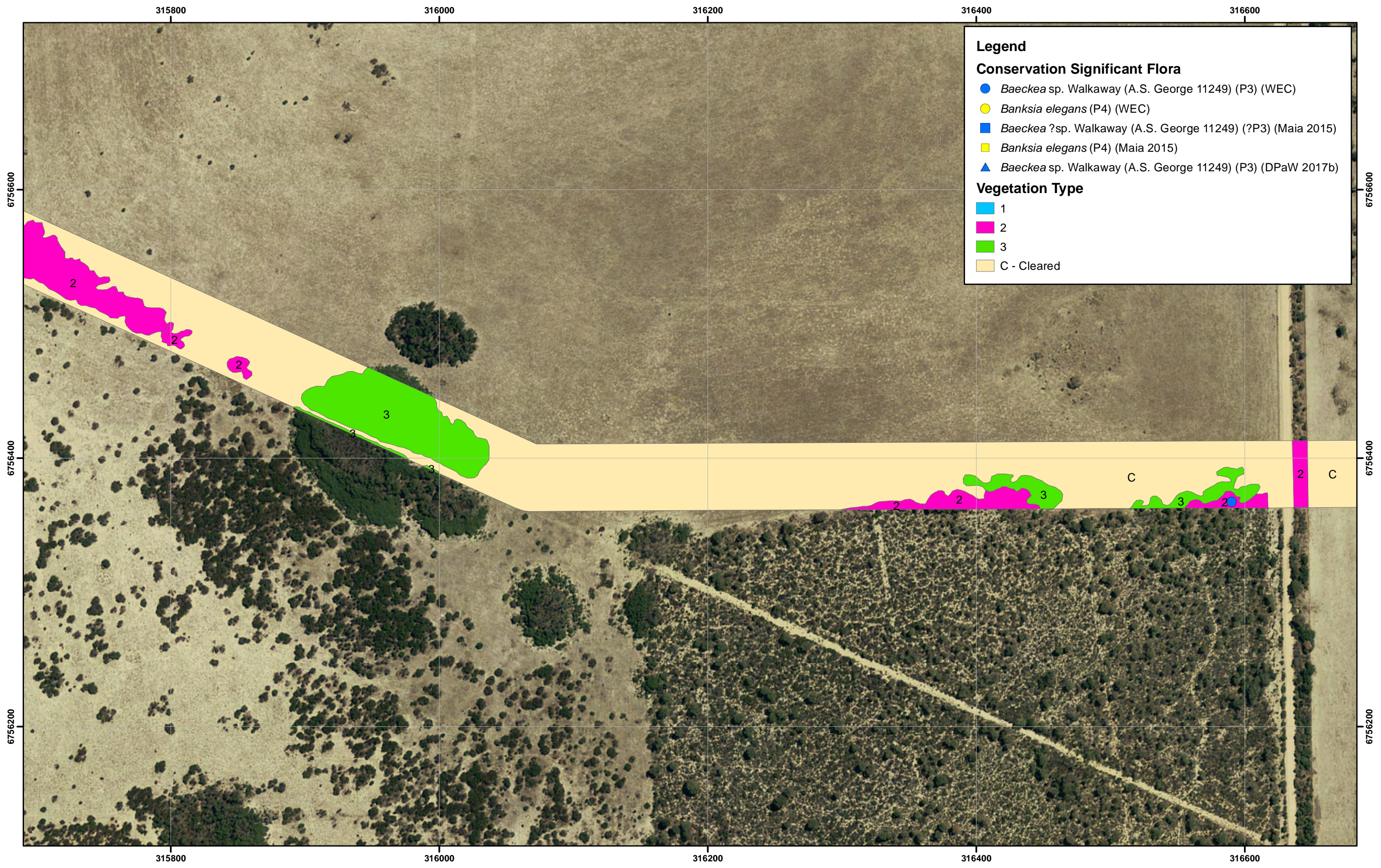
Revision: B - 06 July 2017

Scale: 1:2,500 (A3)

Author: Bethea Loudon
 WEC Ref: AWE16-58
 Filename: AWE16-58-01-f05.mxd
 Projection: GDA 1994 MGA Zone 50

Figure
5.1

This map should only be used in conjunction with WEC report AWE16-58-01.



Legend

Conservation Significant Flora

- *Baeckea* sp. Walkaway (A.S. George 11249) (P3) (WEC)
- *Banksia elegans* (P4) (WEC)
- *Baeckea* ?sp. Walkaway (A.S. George 11249) (?P3) (Maia 2015)
- *Banksia elegans* (P4) (Maia 2015)
- ▲ *Baeckea* sp. Walkaway (A.S. George 11249) (P3) (DPaW 2017b)

Vegetation Type

- 1
- 2
- 3
- C - Cleared



This map should only be used in conjunction with WEC report AWE16-58-01.

**Study Area Vegetation Type Mapping
and Conservation Significant Flora Locations**

Revision: B - 06 July 2017

Scale: 1:2,500 (A3)

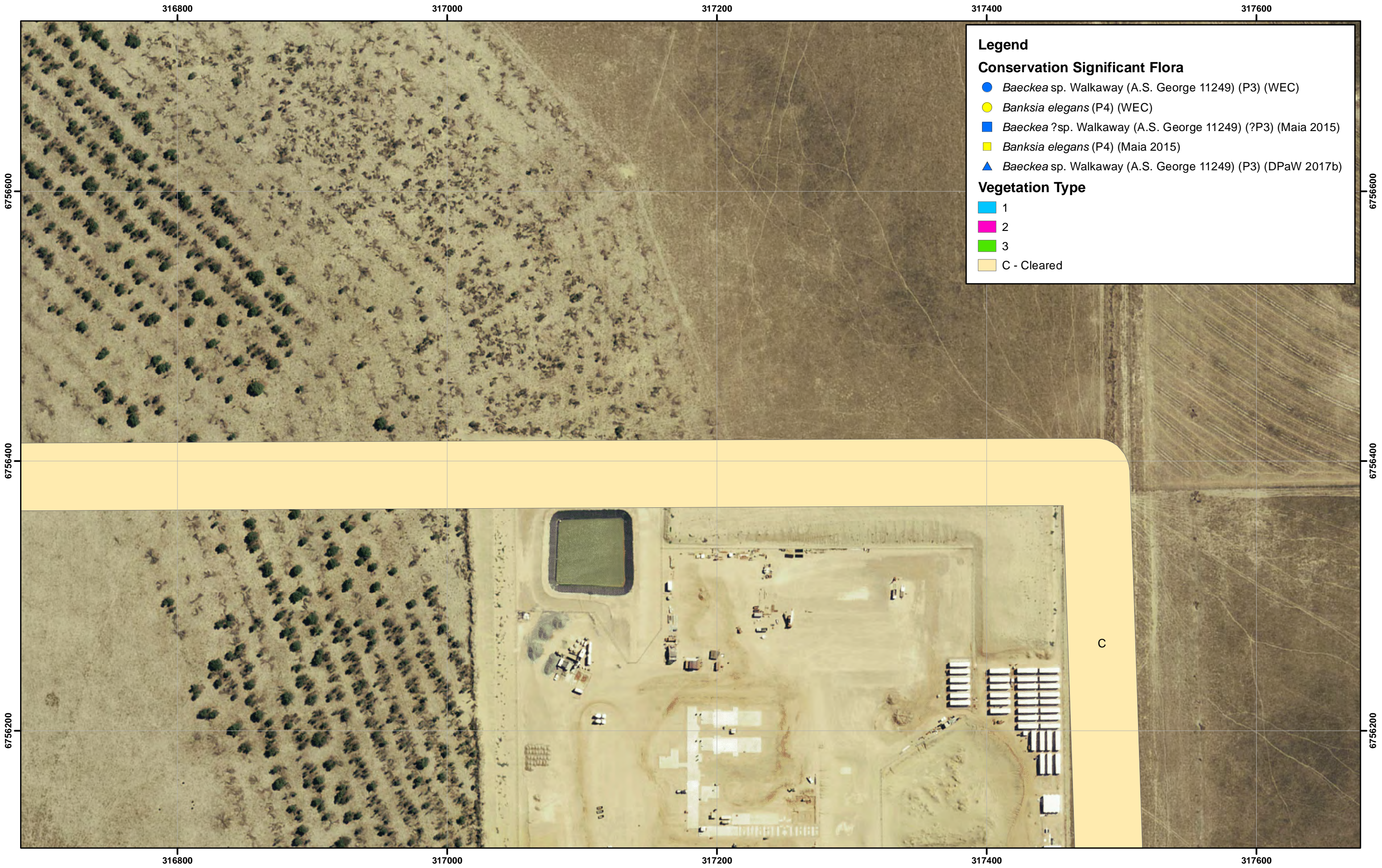
Author: Bethea Loudon

WEC Ref: AWE16-58

Filename: AWE16-58-01-f05.mxd

Projection: GDA 1994 MGA Zone 50

Figure
5.2



This map should only be used in conjunction with WEC report AWE16-58-01.



**Study Area Vegetation Type Mapping
and Conservation Significant Flora Locations**

Revision: B - 06 July 2017

Scale: 1:2,500 (A3)

Author: Bethea Loudon

WEC Ref: AWE16-58

Filename: AWE16-58-01-f05.mxd

Projection: GDA 1994 MGA Zone 50

Figure

5.3




Legend

Conservation Significant Flora

- *Baeckea* sp. Walkaway (A.S. George 11249) (P3) (WEC)
- *Banksia elegans* (P4) (WEC)
- *Baeckea* ?sp. Walkaway (A.S. George 11249) (?P3) (Maia 2015)
- *Banksia elegans* (P4) (Maia 2015)
- ▲ *Baeckea* sp. Walkaway (A.S. George 11249) (P3) (DPaW 2017b)

Vegetation Type

- 1
- 2
- 3
- C - Cleared



This map should only be used in conjunction with WEC report AWE16-58-01.

**Study Area Vegetation Type Mapping
and Conservation Significant Flora Locations**

Revision: B - 06 July 2017

Scale: 1:2,500 (A3)

Author: Bethea Loudon

WEC Ref: AWE16-58

Filename: AWE16-58-01-f05.mxd

Projection: GDA 1994 MGA Zone 50

Figure
5.4

5.3 Vegetation Condition

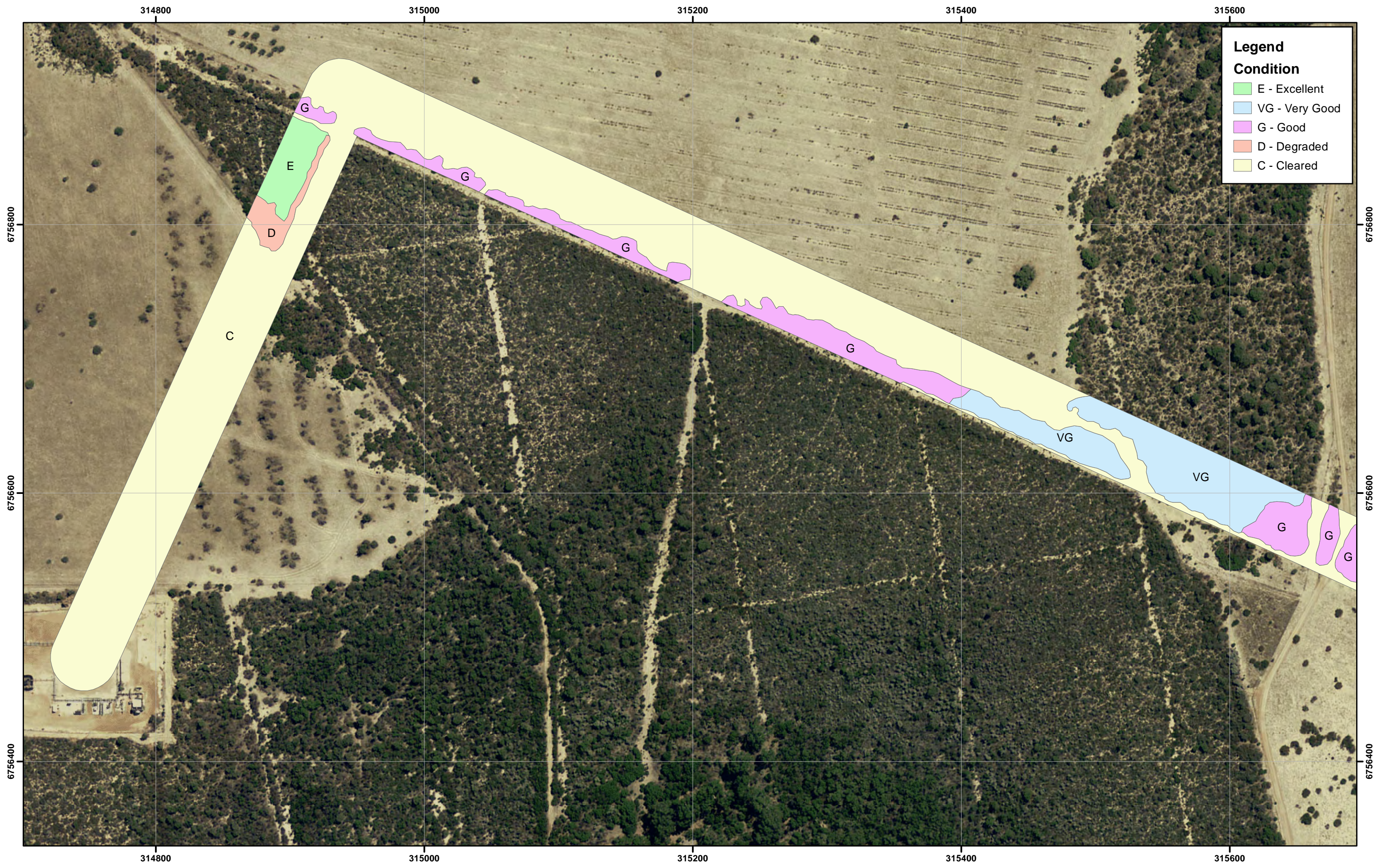
The vegetation condition of areas mapped as native vegetation in the Study Area varied from 'Excellent' to 'Degraded', depending on the levels of grazing, weed infestation and historical clearing. Vegetation condition mapping polygons are displayed on Figure 6. The condition rankings of native vegetation mapped and associated areas are presented in Table 9.

Table 9: Extent of Vegetation Condition Rankings Mapped in the Study Area with reference to Native Vegetation

Condition Ranking	Area mapped (ha)	Percentage of Study Area	Percentage of Native Vegetation mapped
Excellent	0.19	1.0	6.0
Very Good	0.82	4.5	25.9
Good	1.2	6.5	37.6
Degraded	0.97	5.31	30.6

The majority of the native vegetation in the Study Area was considered to be in 'Good' condition (EPA 2016) (Table 9), with evidence of some disturbance including grazing and weed infestation.

Areas where no vegetation occurred because of human disturbance were mapped as 'Cleared Land' (C) (Figure 5 and 6). This included obvious access tracks and cleared paddocks. A total of 15.0 ha of 'Cleared Land' were mapped, representing 82.6 % of the Study Area.



Legend

Condition

- E - Excellent
- VG - Very Good
- G - Good
- D - Degraded
- C - Cleared



This map should only be used in conjunction with WEC report AWE16-58-01.

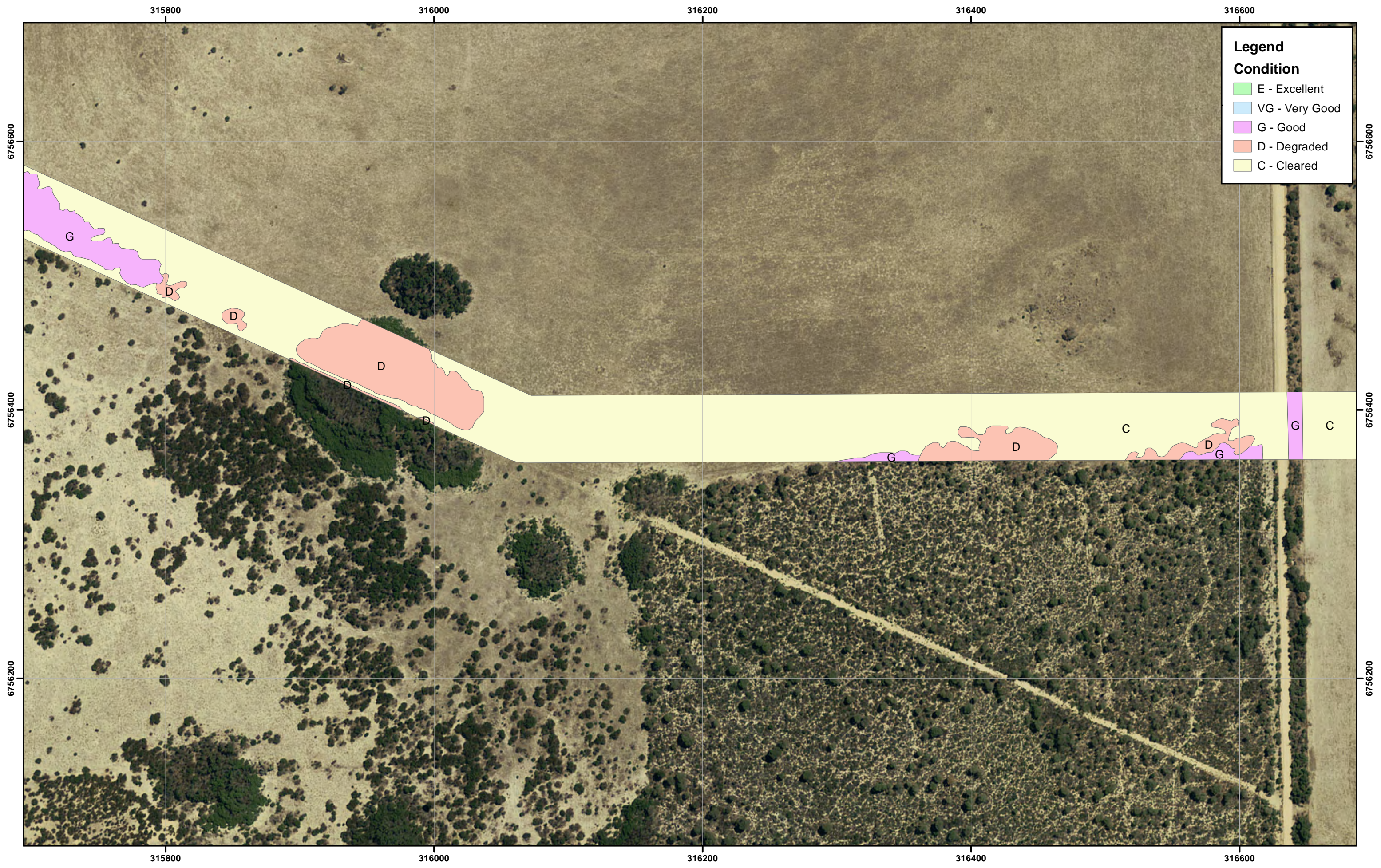
Study Area Vegetation Condition Mapping

Revision: A - 16 June 2017

Scale: 1:2,500 (A3)

Author: Bethea Loudon
 WEC Ref: AWE16-58
 Filename: AWE16-58-01-f06.mxd
 Projection: GDA 1994 MGA Zone 50

Figure
6.1



Legend

Condition

- E - Excellent
- VG - Very Good
- G - Good
- D - Degraded
- C - Cleared



WOODMAN ENVIRONMENTAL

This map should only be used in conjunction with WEC report AWE16-58-01.

Study Area Vegetation Condition Mapping

Revision: A - 16 June 2017

Scale: 1:2,500 (A3)

Author: Bethea Loudon

WEC Ref: AWE16-58

Filename: AWE16-58-01-f06.mxd

Projection: GDA 1994 MGA Zone 50

Figure

6.2



This map should only be used in conjunction with WEC report AWE16-58-01.



Study Area Vegetation Condition Mapping

Revision: A - 16 June 2017

Scale: 1:2,500 (A3)

Author: Bethea Loudon

WEC Ref: AWE16-58

Filename: AWE16-58-01-f06.mxd

Projection: GDA 1994 MGA Zone 50

Figure

6.3



Legend

Condition

- E - Excellent
- VG - Very Good
- G - Good
- D - Degraded
- C - Cleared



This map should only be used in conjunction with WEC report AWE16-58-01.

Study Area Vegetation Condition Mapping

Revision: A - 16 June 2017

Scale: 1:2,500 (A3)

Author: Bethea Loudon
 WEC Ref: AWE16-58
 Filename: AWE16-58-01-f06.mxd
 Projection: GDA 1994 MGA Zone 50

Figure
6.4

6 DISCUSSION AND CONCLUSIONS

The Level 1 flora and vegetation assessment of the proposed Xyris Lateral easement recorded a total of 97 discrete native vascular flora taxa, including 76 native taxa, and 21 introduced taxa. This is considered to represent average floristic diversity based on the previous flora and vegetation assessment undertaken in the vicinity of the Study Area (Maia 2015).

A total of two significant flora taxa were recorded within the Study Area, being *Banksia elegans* (P4) and *Baeckea* sp. Walkaway (A.S. George 11249) (P3). These taxa are both known from numerous records within the Geraldton Bioregion and have ranges of over 120 km. These taxa also have known records within the vicinity of the Study Area including records within Yandanogo Nature Reserve (DPaW 2017a). No Threatened Flora taxa (as listed under EPBC or WC Act) were recorded within the Study Area.

A total of three VTs were mapped within the Study Area. This includes two *Banksia* woodland VTs and one *Acacia rostellifera* dominated VT. These VTs are not considered to represent any TECs or PECs (DoEE 2017b; DPaW 2016a, 2016b). The area of native vegetation within the Study Area is relatively small in size (3.2 ha), with the majority of the Study Area comprising of historically cleared farmland or tracks. The majority of the vegetation present within the Study Area has been impacted by disturbances including grazing, weed infestation and historical clearing, and is located adjacent to a previously cleared track/farmland.

Overall, the findings of the study indicate that the proposed clearing is not likely to be at variance with the 10 clearing principles (see Section 7).

7 ASSESSMENT AGAINST THE 10 CLEARING PRINCIPLES

AWE is proposing to clear vegetation for the development of a pipeline easement running east from the Xyris Production Facility to the Dampier to Bunbury Natural Gas Pipeline (DBNGP). The proposal requires an application for a Native Vegetation Clearing Permit (NVCP). This Assessment against the Ten Clearing Principles (Government of Western Australia 2014) supports the application for an NVCP.

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

The Study Area is located in the South-West Botanical Province, specifically in the Geraldton Sandplains IBRA Bioregion and the Lesueur Sandplain IBRA subregion (Commonwealth of Australia 2012). It encompasses 3.2 ha of native vegetation and contains three vegetation types, with 76 native (including two conservation-significant taxa) and 21 introduced discrete vascular plant taxa recorded. Based on previous local flora studies undertaken in the vicinity of the Study Area (Woodman Environmental 2004a; b; c; Maia 2015), the number of taxa is likely to represent average floristic diversity. The Study Area is characterised by the Eridoon_378 vegetation system association (described by Shepherd *et al.* 2002), with a current extent of 60826.7 ha (equivalent to 65.0 % of pre-European extent remaining). The Study Area does not contain any listed PECs or TECs, and is not otherwise of significance.

The proposed clearing is not likely to be at variance with Principle (a).

Principle (b): *Native vegetation should not be cleared if it comprises the whole or a part of, or is necessary for the maintenance of, a significant habitat for fauna indigenous to Western Australia.*

Not considered part of the scope of this survey.

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

A total of 17 significant flora taxa have the potential to occur within the Study Area based on a *NatureMap* database search of records within 10 km of the Study Area which includes 17 DPaW-classified Priority Flora taxa (DPaW 2017a). No Threatened Flora taxa (as listed under EPBC 1999 or WC Act) are known to occur within, or in the vicinity of the Study Area.

Two significant flora taxa, *Banksia elegans* (P4) and *Baeckea* sp. Walkaway (A.S. George 11249) (P3) were recorded to occur within the Study Area as a result of the survey. These two taxa are known from numerous locations and records within the Geraldton Sandplains Bioregion (as well as the Avon Wheatbelt Bioregion), and impact to the locations within the Study Area will not comprise the continued existence of rare flora, as both of these taxa are known to occur in at least two areas reserved for conservation.

It is unlikely that any additional significant flora occur within the Study Area.

The proposed clearing is not likely to be at variance with Principle (c).

Principle (d): *Native vegetation comprises the whole or a part of, or is necessary for the maintenance of, a threatened ecological community.*

There are no records of TECs under the EPBC Act or endorsed by the Western Australian Minister for the Environment or PECs as classified by DPaW within or in the vicinity of the Study Area based on the *NatureMap* database search and the DoEE database search (DoEE 2017a, DPaW 2017a).

Assessment of the VTs mapped within the Study Area against the description of TECs and PECs as listed or otherwise endorsed at both State and Federal level found that they do not represent any TECs or PECs.

The proposed clearing is not likely to be at variance with Principle (d).

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

The Study Area is characterised by the Eridoon_378 vegetation system association (described by Shepherd *et al.* 2002), with a current extent of 60826.7 ha (equivalent to 65.0 % of pre-European extent remaining) (Government of Western Australia 2016). The Study Area occurs within the Intensive Land Use zone where remnant vegetation has been extensively cleared and is partially located on a relatively small area of vegetation surrounded by historically cleared farmland. The proposed clearing includes a small area (3.2 ha) of native vegetation occurring largely along the northern boundary of this area of vegetation and running adjacent to an existing track, with the condition of this vegetation mapped as Excellent, Very Good, Good and Degraded. This section of the vegetation proposed to be cleared is not considered to be significant as a remnant of native vegetation.

The proposed clearing by itself is not likely to be at variance with Principle (e).

Principle (f): *Native vegetation should not be cleared if it is growing in, or in association with, an environment associated with a watercourse or wetland.*

The Study Area does not contain any major watercourses or wetlands, and does not support groundwater dependent ecosystems (GDEs) typically fringing permanent or ephemeral watercourses and lakes. Likewise, the VTs mapped in the Study Area are not associated with watercourses or wetlands. A wetland area is present within the remnant vegetation along which the proposed clearing will occur, however the wetland vegetation itself is not expected to be impacted by the proposal with the closest clearing area approximately 300m to the north of the edge of the wetland vegetation.

The proposed clearing is not likely to be at variance with Principle (f).

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

The majority of the vegetation within the Study Area has been impacted by human disturbances such as grazing, historical clearing and weed infestation, with the majority of the Study Area being mapped as Cleared (82.6% of the area), and a further 5.3% mapped as Degraded. The majority of vegetation proposed to be cleared occurs along the edge of previously cleared paddocks/tracks and will not increase fragmentation to the area or any existing corridors. Some land degradation may occur if appropriate construction and rehabilitation techniques are not undertaken, however the extent of such land degradation is likely to be minor given the scale of the clearing however requires management during construction.

The proposed clearing is not likely to be at variance with Principle (g).

Principle (h): *Native vegetation should not be cleared if the clearing of the vegetation is likely to have an impact on the environmental values of any adjacent or nearby conservation area.*

The nearest conservation area to the Study Area is Yandanogo Nature Reserve, occurring approximately 3.5 km south of the Study Area. There is an area of previously cleared farmland (approximately 1 - 2 km wide) between the area of vegetation in which the Study Area is located and the Nature Reserve. Therefore there it is not likely that the small amount of clearing proposed will have an impact of the environmental values of Yandanogo Nature Reserve. There are no other conservation areas within 10 km of the Study Area.

The proposed clearing is not likely to be at variance with Principle (h).

Principle (i): *Native vegetation should not be cleared if the clearing of the vegetation is likely to cause deterioration in the quality of surface or groundwater.*

There are no permanent water bodies or watercourses within the Study Area. The clearing of native vegetation is not likely to have a significant impact on the quality of the groundwater or surface water in the local area, and there is unlikely to be impact to the wetland located to the south of the Study Area.

The proposed clearing is not likely to be at variance with Principle (i).

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

The Study Area is located within the Northern Sandplains region in the South-west Province. The region is characterised by a dry, warm Mediterranean climate with winter precipitation, with the region generally receiving between 300 - 500 mm of precipitation annually. The incidence of waterlogging (and flooding) in this area is unlikely given the free draining nature of sandy soils. In addition, the area of vegetation proposed to be cleared is relatively small and occurring along an existing track.

The proposed clearing is not likely to be at variance with Principle (j).

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