Report

RPS

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Flora and vegetation assessment

Ashburton North Strategic Industrial Area (ANSIA) -Phase 2 Area

RPS

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Summary

RPS was commissioned by Landcorp to undertake a botanical survey of the unsurveyed portions of the Stage 2 area within the Ashburton North Strategic Industrial Area (ANSIA) boundary to support the Amendment to the Ashburton North Strategic Industrial Area (ANSIA) Improvement Scheme to re-zone two parcels of land within the ANSIA "Industry Protection Zone" area to "General Industry". The unsurveyed portion of the amendment area in Stage 2 is approximately 2,553 hectare (ha) and is located north and south of the existing "Workforce Accommodation" zoning and adjacent to the existing "General Industry" zone.

Survey objectives and scope of works

This reconnaissance flora and vegetation survey aimed to describe the flora and vegetation values of the survey area and determine the spatial location and conservation significance of these values. The specific objectives were to provide an indication of the vegetation associations and flora taxa present within the survey area, so that potential impacts on the flora values can be adequately managed and assessed.

Specific objectives of the flora and vegetation assessment were as follows:

- Conduct a targeted field search for Threatened and Priority Flora and flora of other conservation significance that may be present within the survey area.
- Compile a vascular flora inventory of all flora species recorded within the survey area (using the current nomenclature of the WA Herbarium) to assess the potential impact of the proposed development on floristic biodiversity values.
- Describe and map the vegetation units and condition in the survey area.

Reconnaissance flora and vegetation survey findings

Flora

A total of 165 vascular flora taxa were recorded for the current survey of which 158 (95.75 %) were native, and seven were naturalised alien (weed) species. The taxa recorded represent 37 families and 100 genera. Of the 165 taxa recorded for the current survey 20 were previously unrecorded for the ANSIA Improvement Scheme Area.

No Threatened Flora (TF) species listed under the BC Act or the EPBC Act were recorded within the survey area for the current survey.

One Priority Flora (PF) species listed by the DBCA was recorded within the survey for the current survey; the Priority 3 taxon *Eremophila forrestii* subsp*. viridis.*

- *E. forrestii* subsp. *viridis* had previously been recorded from three locations in the ANSIA Improvement Scheme Area within sand dune vegetation and several locations near the ANSIA Improvement Scheme Area and wider Onslow locality.
- For the current survey an approximate total of 380 individuals were recorded from five locations within the survey area. These five populations were generally associated with the mid and upper slopes of the linear sand dunes and the gently undulating sand plains. The species was recorded either as isolated individuals or isolated clumps within six of the sand dune and sand plain vegetation associations and as a dominant shrub in two of the sand dune and sand plain vegetation associations.

A total of three additional taxa recorded within the survey area are considered to be conservation significant based on geographic range anomalies; *Stenopetalum pedicellare, Acacia sphaerostachya*, **Indigofera sessiliflora*, all of which represented range extensions.

Seven naturalised alien (weed) species were recorded for the survey area, representing 4.25 % of the total flora taxa recorded. The most widespread and abundant of these were **Cenchrus ciliaris* (buffel grass), and tall shrub species, **Prosopis pallida* (mesquite) and **Vachellia farnesiana* (mimosa bush); all three occurred as dominants throughout areas of the survey area in Degraded condition, which is a reflection of the generally disturbed nature of much of the vegetation in the ANSIA due to long term heavy grazing by livestock.

The Western Australian Organism List (WAOL) database was searched to determine the legal status of each weed recorded, and any control requirements that may apply under the Biosecurity and Agriculture Management (BAM) Act 2007. Of the 7 weed species recorded, one species, **Prosopis pallida,* was determined to be Declared Plant and is also listed as a Weed of National Significance (WONS).

Vegetation

For the current survey a total of 18 vegetation associations were described and mapped for the survey area, belonging to four broad vegetation types which correspond to each of the different landform units represented within the survey area. The vegetation associations were defined from 53 relevés and 20 vegetation mapping sites and were generally well-aligned with those described and mapped by Biota for the wider ANSIA Improvement Scheme Area.

- **Vegetation of tidal mudflats** - Tidal mudflats occurred in the northern portion of the survey area. Two vegetation associations were described for this landform unit; bare or very sparsely vegetated areas subject to regular tidal inundation; and samphire shrublands fringing the tidal mudflats, subject to less frequent inundation comprising low open to closed shrubland of *Tecticornia* spp. This group was characterised by the presence of halophytic (salt adapted) species.
- **Vegetation of claypans and clayey plains** - Claypans and clayey plains occurred on the heavy clay soils in low-lying areas across much of the survey area. Seven units were described for this landform unit which included a range of vegetation types differing in structure (from tall sparse shrublands to low samphire heaths, and grasslands / forblands), and species composition (determined primarily by the degree of salinity of the substrate). Vegetation associations included bare claypans virtually devoid of vegetation, samphire low shrublands in and fringing saline claypans, tall sparse shrublands over mixed grasslands and forblands on and adjacent to the less saline claypans and on broad clayey plains.
- **Vegetation of creek lines** - There was only one defined creek line vegetation unit within the survey area which occurred on the heavy clay soils in the southwest of the survey area.
- **Vegetation of sand dunes and plains** - Sand dunes and sand plains accounted for a large proportion of the survey area. Nine vegetation associations were described and mapped for these areas. All nine had a hummock grassland understorey dominated by *Triodia epactia* but were defined by different shrub species which broadly correlated to landscape position; *Grevillea stenobotrya* generally occurred on the crests and upper slopes of the higher linear dunes, *Acacia stellaticeps* on the crests, upper and mid slopes of dunes, and in dune swales, and *Acacia tetragonophylla* and / or *Acacia synchronicia* on the sand plains and low undulating hills between the higher dunes and the claypans and clayey plains. The Priority 3 taxon *Eremophila forrestii* subsp. *viridis* was associated with eight of these vegetation associations and formed a dominant in two.

Conservation significance of flora within the survey area

In assessing the conservation significance of flora within the survey area, consideration was given to the rarity, biodiversity, endemism and representativeness of the flora in the area.

- Based on the absence of TF within the survey area, the known presence of one Priority 3 flora taxon (*Eremophila forrestii* subsp. *viridis*), and the potential presence of another (*Triumfetta echinata*), as well as the presence of two native species of “other” conservation significance the rarity of the flora is assessed as moderate to high.

- A total of 158 native vascular flora taxa were recorded for the current survey. The ANSIA and Onslow environs are not identified as “known special values”, or areas of “high species and ecosystem diversity” within the subregion; the floristic diversity is therefore assessed as moderate.

Conservation significance of vegetation within the survey area

In assessing the conservation significance of vegetation within the survey area, consideration was given to condition of the vegetation and the rarity of the vegetation.

- **Vegetation condition** - Vegetation condition within the survey area ranged from Excellent to Degraded. The vast majority of the survey area (82.26%) was in Good, Good to Poor, or Poor condition, defined as exhibiting “obvious signs of damage caused by human activity since European settlement, including some obvious impact on the vegetation structure such as that caused by low levels of grazing or slightly aggressive weeds” (Good condition), and / or the vegetation “still retains its basic vegetation structure or ability to regenerate it after very obvious impacts of human activities since European settlement, such as grazing, partial clearing, frequent fires or aggressive weeds” (Poor condition). Most of the disturbance within the survey area relates to long-term grazing by livestock and weed infestation. Weed infestation was more obvious throughout much of the low-lying clayey plain, sandplain and low undulating sand dune vegetation where **Cenchrus ciliaris* was often recorded in the understorey, and **Prosopis pallida,* and **Vachellia farnesiana* were recorded, sometimes as dominants, in the overstorey. The vegetation described and mapped for the linear sand dune crests and upper slopes, the samphire flats, and the bare claypans were generally in the best condition (predominantly Very Good), and the mudflats (Excellent), however, these areas only accounted for 8.91 % of the survey area.
- **Rarity of the vegetation**
  - No TECs listed under the Commonwealth EPBC Act or the Western Australian BC Act occur within the survey area and no PECs listed by the DBCA correlate with any of the vegetation associations described and mapped for the survey area.
  - On a regional scale three Beard (1975) vegetation associations (127; 589 and 670) are mapped for the survey area all of which are widespread in the subregion with over 94% of their pre-European extent remaining. The assessed reservation priority for Vegetation Association 127; 589 and 670 on a bioregional level are High; High; and Low respectively.
  - On a local scale the vegetation associations within the survey area known to support conservation significant flora are considered to have high conservation significance because they are important for the survival / persistence of the priority flora populations in the area. A total of 729.43 ha of conservation significant sand dune and sand plain vegetation is present within the survey area which represents 28.38 % of the total survey area; of this 259.56 ha is in Good or better condition representing 10.1 % of the survey area. The samphire shrubland (and samphire shrubland / grassland mosaic) vegetation fringing the mudflats is also considered to be of moderate to high conservation significance based on the potential presence of PF *Eleocharis papillosa* (although this species was not recorded in the survey area for the current survey). A total of 131.57 ha of this vegetation is present within the survey area most of which (127.27 ha) was in Good or better condition which represents 4.95 % of the total survey area.

RPS

1 Introduction

1.1 Project background

RPS was commissioned by Landcorp to undertake a botanical survey of the unsurveyed portions of the Stage 2 area within the Ashburton North Strategic Industrial Area (ANSIA) boundary to support the Amendment to the Ashburton North Strategic Industrial Area (ANSIA) Improvement Scheme to re-zone two parcels of land within the ANSIA "Industry Protection Zone" area to "General Industry". The unsurveyed portion of the amendment area in Stage 2 (hereafter referred to as "the survey area") is approximately 2,553 hectare (ha) and is located north and south of the existing "Workforce Accommodation" zoning and adjacent to the existing "General Industry" zone.

ANSIA is located at a greenfield site 12 kilometres (km) south-west of Onslow in the Shire of Ashburton (Figure A).

1.2 Key environmental issues

RPS understands (based on OEPA advice and historical ecological assessments) that the key environmental issues relating to flora and vegetation are as follows:

- The proposed amendment area is in the "Industry Protection Zone" which has not been subject to historical biological surveys or EPA assessment.
- Historical vegetation and flora surveys between 2009 to 2013 identified Priority Flora (which have no statutory protection) including *Eleocharis papillosa, Eremophila forrestii* subsp. *viridis, Triumfetta echinata*, and *Atriplex flabelliformis* adjacent to the proposed amendment area, but no Threatened Flora. It was understood that there was a moderate to high likelihood that some of these species" populations may occur within the bounds of the survey area given the presence of them in the areas immediately adjacent to it.

1.3 Guiding principles and legislative framework

Federal and state legislation pertaining to the conservation of native flora and vegetation include the *Environmental Protection and Biodiversity Conservation Act 1999* (EPBC Act), the *Biodiversity Conservation Act 2016* (BC Act) and the *Environmental Protection Act 1986* (EP Act). The EP Act is the primary legislation that governs environmental impact assessment (EIA) and protection in Western Australia. The aim of the Act is "to provide for an Environmental Protection Authority, for the prevention, control and abatement of pollution and environmental harm, for the conservation, preservation, protection, enhancement and management of the environment and for matters incidental to or connected with foregoing".

Section 4A of the EP Act states that the following principles, applicable to native flora and vegetation should be adhered to in order to protect the environment of Western Australia:

1. The Precautionary Principle – Where there are threats of serious or irreversible damage, lack of full scientific certainty should not be used as a reason for postponing measures to prevent environmental degradation.
2. The Principle of Intergenerational Equity – The present generation should ensure that the health, diversity and productivity of the environment is maintained or enhanced for the benefit of future generations.
3. The Principle of the Conservation of Biological Diversity and Ecological Integrity – Conservation of biological diversity and ecological integrity should be a fundamental consideration.

1.3.1 Flora of conservation significance

Within Western Australia Threatened Flora are listed as such if they are considered to be in danger of extinction, rare or otherwise in need of special protection. These taxa are legally protected under the BC Act. The removal of these taxa or impact to their surroundings is not permitted without prior ministerial approval. The Department of Biodiversity Conservation and Attractions (DBCA) maintains a list of Priority Flora species, which may be rare or threatened but for which there are either insufficient survey data to determine accurately their status, or which are rare but not currently considered to be threatened. A Priority Flora taxon is assigned to one of five priority categories. Threatened Flora and Priority Flora categories are defined in (Appendix A, Table A-1).

Many taxa listed as Threatened Flora under the BC Act have additional protection as they are also listed as Threatened Flora under one of six threat categories (Extinct, Extinct in the wild, Critically Endangered, Endangered, Vulnerable or Conservation Dependent) under the EPBC Act. Threatened Flora taxa are defined as Matters of National Environmental Significance (MNES) under the EPBC Act and penalties apply for any damage to individuals, populations or habitats of these flora. EPBC Act conservation category codes are defined in (Appendix A, Table A-2).

1.3.2 Vegetation of conservation significance

Under the BC Act and the EP Act, Threatened Ecological Communities (TECs), classified by DBCA in one of the TEC categories (Appendix A, Table A-3) have limited protection. Other ecological communities are classified by DBCA in the category of Priority Ecological Communities (Appendix A, Table A-4) pending further survey and/or definition. A subset of the DBCA-listed TECs are also listed and protected as MNES under the EPBC Act. EPBC Act threat categories for TECs are defined in (Appendix A, Table A-5).

1.4 Survey objectives and scope of works

This reconnaissance flora and vegetation survey aimed to describe the flora and vegetation values of the survey area and determine the spatial location and conservation significance of these values. The specific objectives were to provide an indication of the vegetation associations and flora taxa present within the survey area, so that potential impacts on the flora values can be adequately managed and assessed.

Specific objectives of the flora and vegetation assessment were as follows:

- Conduct a targeted field search for Threatened and Priority Flora and flora of other conservation significance that may be present within the survey area.
- Compile a vascular flora inventory of all flora species recorded within the survey area (using the current nomenclature of the WA Herbarium) to assess the potential impact of the proposed development on floristic biodiversity values.
- Describe and map the vegetation units and condition in the survey area.

2 Methods

2.1 Desktop assessment

RPS undertook a desktop assessment of flora and vegetation within the survey area in 2014 in support of an Improvement Plan which aimed to provide an effective planning framework for future works within the ANSIA. The methods and outcomes of this assessment were documented in *Flora and Vegetation Review - Ashburton North Strategic Industrial Area* (RPS 2015) (Appendix B).

This desktop assessment was reviewed prior to the field survey to identify environmental values relating to flora and vegetation specifically relevant to the survey area. This incorporated a review of available literature including previous flora survey reports and spatial datasets, and the results of searches of the Commonwealth Government databases for Threatened Flora (TF) and Threatened Ecological Communities (TECs) protected under the EPBC Act, and Department of Biodiversity Conservation and Attractions (DBCA) databases and mapping for TF and Priority Flora (PF). Additionally, preliminary mapping of the vegetation units present across the survey area was extrapolated from mapping of adjacent areas undertaken for previous surveys by Biota (2010a; 2010b).

2.2 Reconnaissance flora and vegetation survey

The reconnaissance survey was undertaken in accordance with *Technical Guidance: Flora and Vegetation Surveys for Environmental Impact Assessment* (EPA 2016) and involved selective sampling of flora and vegetation to produce maps of vegetation units and vegetation condition at an appropriate scale and based on aerial imagery interpretation, preliminary mapping and ground-truthing.

The field survey was undertaken by two experienced and qualified botanists, Carrie Gill and Brian Morgan, in one vehicle over eight days between 27 July and 3 August 2018, and involved traversing the survey area by vehicle and on foot to:

- Verify the data from the desktop survey at a local scale.
- Characterise the vegetation throughout the survey area.
- Identify any constraints and potential impacts of development on local flora and vegetation values, or other environmental features.

The reconnaissance survey involved the sampling of the full range of flora taxa and vegetation community types observed within the survey area via a total of 53 relevés (unbounded flora survey sites comprising a similar area to a 50 m × 50 m quadrat which is the appropriate site size for the Pilbara region), and an additional 20 vegetation mapping sites. Relevés were labelled ANCR01 to ANCR25 (for the sites recorded by Carrie Gill) and ANBR01 to ANBR28 (for those recorded by Brian Morgan). Vegetation mapping sites were labelled ANCM01 to ANCM07 (for the sites recorded by Carrie Gill) and ANBM01 to ANBM13 (for those recorded by Brian Morgan).

The following parameters were recorded for each relevé and mapping site:

- site code
- location (GDA94 GPS coordinates)
- digital photographs of the vegetation
- landform and soil description
- vegetation description - dominant growth form, height, cover and species for the three traditional strata (upper, mid and ground)
- any other location information that might be useful in vegetation classification including slope, aspect, litter, fire history, vegetation/landform/soil correlations

- assessment of vegetation and description of disturbances
- a comprehensive species list (annuals and perennials), including weeds and their percentage foliar cover.

2.3 Targeted flora search

A Targeted Flora Search was undertaken concurrently with the reconnaissance survey and focused on habitats within the survey area likely to support conservation significant flora identified in the DBCA database searches and / or recorded for previous surveys in the vicinity. Several Priority 3 Flora species (*Eremophila forrestii* subsp. *viridis, Atriplex flabelliformis, Triumfetta echinata* and *Eleocharis papillosa*) were known to occur either within the area, or immediately adjacent to it.

An initial review of vegetation sub-association mapping completed for the Wheatstone study area by Biota (2010a; 2010b) determined that the PF recorded to date in the vicinity of the survey area are restricted to three “Inland Sand Dunes” vegetation sub associations, and to one “Vegetation of Claypans” vegetation sub association - *Tecticornia* spp. low shrubland (as described and mapped by Biota [2010a; 2010b]). These vegetation types throughout the survey area are therefore potentially suitable habitat for the target species and were systematically searched during the survey. The survey aimed to determine the size and extent of all significant flora populations recorded in the survey area.

Botanists walked systematic traverses through potential habitat for the target species. Rare flora locations (and the number of individuals present) were recorded using a handheld GPS (GDA94 datum).

2.4 Data analysis and mapping

2.4.1 Taxonomic determinations and data entry

Flora specimens were identified in the field, or collected, assigned a unique collection number, and identified using the keys, publications and databases of the Western Australian Herbarium. Nomenclature was aligned with the current names in FloraBase (Western Australian Herbarium 2018). Pilbara specialist taxonomist Sharnya Yates undertook the identification of all the collections not identified in the field.

All survey data was entered into RPS’ in-house *Site Species Database*, an access database prepared by Ted Griffin, and commissioned and inspired by Malcolm Trudgen.

2.4.2 Floristic data analysis

Multivariate analysis of floristic survey data is not a requirement of reconnaissance level flora and vegetation assessments and has limited value when performed on non-plot-based data (such as that of the current survey), however the presence / absence data from the 53 relevés sites was analysed using multivariate techniques (via PRIMER v6 software) to classify the vegetation types within the project area purely as an aid to mapping the vegetation. A Hierarchical Cluster Analysis was conducted on the species by site survey data (excluding weeds) in an effort to identify statistically significant clusters based on floristic similarity.

A resemblance matrix of the presence/absence data for the combined dataset was constructed using the Bray Curtis Similarity Coefficient and a Hierarchical Cluster Analysis was carried out on this matrix using the group average linkage method. The outputs from this analysis were illustrated as dendrograms.

2.4.3 Vegetation mapping

Vegetation community mapping was conducted using a combination of aerial photo-interpretation, regional and local vegetation mapping, on-ground confirmation, vegetation structure data, and multivariate analysis results. Vegetation types were described to Association (Level V) in accordance with the National Vegetation Information System (NVIS) (ESCAVI 2003) (Appendix A, Table A-6 and Table A-7).

Vegetation condition mapping was conducted using the recommended EPA (2016) scale for the Eremaean region of Western Australia; that of Trudgen (1988) (Appendix A, Table A-8).

2.4.4 Survey limitations

Botanists who conduct flora and vegetation surveys for environmental impact assessment in Western Australia are obliged to report on the limitations and constraints in such studies. Some potential limitations / constraints on surveys may adversely impact on the scientific rigour, completeness or the validity of the survey results. EPA (2016) identifies standard limitations which can limit and constrain the validity of flora and vegetation surveys. These include:

- availability of contextual information at a regional and local scale
- competency and experience of the field team
- proportion of flora recorded and/or collected, and problems with taxonomic determinations
- the effort and extent of the survey
- access restrictions within the survey area
- survey timing, rainfall, season of survey
- disturbances that may have affected the results of survey such as fire, flood or clearing.

One of these standard limitations, survey effort and extent, applied to the current survey; however this limitation has been mitigated for the reasons discussed below.

2.4.4.1 Survey effort and extent

The reconnaissance-level field survey is a general survey limitation in that it represents a lower level of survey than a detailed survey; however, the EPA (2016) guidance specifically states that "*a reconnaissance survey may be adequate to describe the environmental values for referral of schemes and scheme amendments for consideration for assessment under s48A of the EP Act*". This survey is in support of a scheme amendment and so the level of survey, in this instance, is considered appropriate.

Additionally, the flora and vegetation review (RPS 2015) determined that the combined studies conducted over the ANSIA Improvement Scheme Area in years prior constituted a relatively intensive survey effort in a generally poorly surveyed subregion. This was evident in the total number of taxa recorded for the area as a percentage of the total taxa known for the subregion (44%). The species area curve undertaken by RPS (2015) for the sampling effort undertaken to date within the ANSIA Improvement Scheme Area illustrated that the actual number of flora taxa recorded was approaching the theoretical maximum; and it was concluded that further survey work over the unsurveyed portions of the ANSIA Improvement Scheme Area was unlikely to result in a significant increase in number of taxa recorded. For this reason the current reconnaissance level survey is considered adequate and appropriate.

3 Existing environment

3.1 Interim biogeographical regionalisation of Australia

The IBRA currently recognises 89 bioregions and 419 biological subregions within Australia. The ANSIA Improvement Scheme Area lies within the Cape Range CAR1 subregion of the Carnarvon Region (Environment Australia 2000).

The Cape Range CAR1 subregion is 2,547,911 ha in size and is described by Kendrick and Mau (2002) as "Cape Range and Giralia dune fields form the northern part of Carnarvon Basin. Rugged tertiary limestone and extensive areas of red aeolian dunefield, Quaternary coastal beach dunes and mud flats. Acacia shrublands over Triodia on limestone (Acacia stuartii or A. bivenosa) and red dune fields, Triodia hummock grasslands with sparse Eucalyptus trees and shrubs on the Cape Range. Extensive hummock grasslands (Triodia) on the Cape Range and eastern dune-fields. Tidal mudflats of sheltered embayments of Exmouth Gulf support extensive mangroves. Beach dunes with Spinifex communities. An extensive mosaic of saline alluvial plains with samphire and saltbush low shrublands along the eastern hinterland of Exmouth Gulf. Islands of the Muiron, Barrow, Lowendal and Montebello groups are limestone-based".

3.2 Land systems

Land system mapping of the rangelands of Western Australia by the Department of Agriculture and Food and Department of Land and Surveys defines a map unit or land system as "an area or group of areas throughout which there is a recurring pattern of topography, soils and vegetation". The area was mapped at a scale of 1: 250, 000 and Payne et al. (1988) identified four land systems within the Ashburton River Catchment that coincide with the Stage 2 ANSIA Improvement Scheme Area: Dune; Littoral; Minderoo and Onslow. The land units belonging to these four Land Systems which occur within the survey area are listed and described in Table 1. Land System mapping is shown in Figure B.

Table 1 Land systems represented within the survey area

Land System	Description	
Dune Land System	Dune fields supporting soft spinifex grasslands	
Land form	Soil	Vegetation
Linear and reticulate dunes: up to 15 m high and 2.5 km long by 100 to 200 m apart becoming reticulate, hummocky crests, flanks extending 100 m or so with steeper western sides to 20 per cent.	Dark red sands, loamy sands	Hummock grasslands of *Triodia schinzii* with numerous low shrubs and forbs
Swales: sandy surfaces 50 to 300 m wide between dunes.	Dark red sands, loamy sands	Hummock grasslands of *Triodia epactia* and some *Triodia lanigera*, sparse low shrubs such as *Acacia stellaticeps* and forbs.
Swamps and depressions: low lying areas between dunes, circular or oval up to 500 m in diameter or extent.	Surface cracking reddish brown clay soils	Low open woodland of *Eucalyptus victrix* with *Muehlenbeckia cunninghamii* and perennial grasses such as *Sporobolus mitchellii* and *Eriachne benthamii*.

Land System	Description	
Claypans: bare, circular, oval or elongated surfaces mostly less than 150 m in diameter or length but up to 500 m, up to 1.5 m below adjacent sandplains or swale with abrupt marginal slopes.	Dark red clay soils after with lime or gypsum in profile, sealed, glazed surfaces or crusted surfaces with dessication cracks	No vegetation
Littoral Land System	Bare coastal mudflats with mangroves on seaward fringes, samphire flats, sandy islands, coastal dunes and beaches.	
Land form	Soil	Vegetation
Sandy plains: up to 2 km in extent associated with dunes and on landward margins of samphire fiats.	Loose white calcareous sand, variable depth over limestone, or sand over clay.	Hummock grassland of *Triodia epactia* with *Chrysopogon fallax* and occasional *Atriplex bunburyana*
Marginal slopes to mudflats: up to 0.5 km wide and 6 km long, sloping up to 3 per cent, hummocky micro-relief, intense, short parallel drainage lines incised to 1m.	Loose surfaced reddish brown saline silty clay developed by accumulation of deflation deposits from mudflats	Sparse tall shrubland of *Acacia victoriae* with *A. sclerosperma* with sparse *Atriplex bunburyana*, *Tecticornia halocnemoides*.
Samphire flats: flat plains slightly raised above and adjacent to bare mud flats, up to 2 km long and 0.5 km wide	Hard setting reddish brown gradational soils changing from silty loam to silty clay with depth, calcareous throughout	Low shrubland of *Tecticornia auriculata, T. halocnemoides* and *Maireana amoena*
Mudflats: up to 15 km in extent, bare, near flat surfaces occasionally inundated by sea during peak tides	Saline muds	No vegetation.
Sandy islands: oval or circular, up to 2 km in extent, usually surrounded by bare mudflats	Sandy soils.	Hummock grassland of *Triodia epactia*.
Minderoo land System	Alluvial plains supporting tall shrublands and tussock grasslands and sandy plains supporting hummock grasslands.	
Land form	Soil	Vegetation
Sand dunes: linear, up to 4 km long by 100 m wide and 20 m high, usually less than 1 km apart and mostly trending north-west to south-west, also arcuate dunes around swamps and depressions, slopes mostly less than 7 per cent.	Loose surfaced dark red sand or sandy loam	Hummock grassland of *Triodia schinzii* with an overstorey of *Acacia murrayana, A. stellaticeps, Corchorus walcottii*, and *Grevillea gordoniana* and the grass *Cenchrus ciliaris*, forbs and annual grasses.
Sand plains: up to I km in extent with hummocky micro-relief, slopes up to 4 per cent	Loose surfaced, dark red sand, often over clay	Hummock grassland of *Triodia schinzii* and *Triodia epactia* with an overstorey of *Acacia sclerosperma*, *A. tetragonophylla, A. synchronicia, Eremophila forrestii, Eucalyptus victrix*, and *Rhagodia eremaea*.
Gllgai plains: up to 2 km long and I km wide with slopes less than I in 1000, receiving run off from the through drainage plain	Seasonally cracking, dark reddish brown alkaline light to medium clays	Variable open tussock grassland of *Astrebla elymoides, Chrysopogon fallax* or *Eragrostis xerophila* or Eriachne benthamii or *Sporobolus virginicus* with an open tall shrub overstorey of *Acacia tetragonophylla* and *A. synchronicia*.

Land System	Description	
Claypans: Circular or oval deflation lag depressions, up to 500 m wide and 3 m below the level of the surrounding sandplain.	Dark red clay soils, with glazed or crusted surfaces	Usually bare but occasionally supports *Eriachne gardneri*
Onslow Land System	Undulating sandplains, dunes and level clay plains supporting soft spinifex grasslands and minor tussock grasslands	
Land form	Soil	Vegetation
Undulating sandplain: up to 30 km in extent, low swales, slopes and sandy spurs sloping I to 5 per cent, elevated sand plains up to 20 m above low sections, numerous termite mounds up to 3 m.	Dark reddish brown sands and sandy loam	Hummock grasslands of *Triodia epactia* with very sparse shrubs such as *Acacia stellaticeps*, near coast *Triodia epactia* and *Cenchrus ciliaris* mixtures with buffel dominating in part
Low sandplain: up to 3 km in extent, gradients 1 in 300 or less, hummocky micro~relief up to 2 m, numerous small c1aypans 5 to 40 m in diameter, loose surfaces.	Dark reddish brown sands and sandy loam	Mixed grasslands of *Triodia epactia* and *Cenchrus ciliaris*
Clay plains: sinuous, nearly flat clay surfaces up to 3 km long by I km wide between sand plain, subject to sheet flow and becoming wider with scalded surfaces near the coast.	Reddish brown clay soils, occasionally seasonal cracking	Tussock grasslands of variable density, mostly *Sporobolus virginicus* and *Eriachne benthamii*
Samphire flats: flat saline plains marginal to adjacent Littoral system or between sandplain, mostly less than 1 km in extent but up to 2.5 km	Reddish brown or dark red calcareous clay coils, also inverted soils such as sandy clay loams over sand	Dense low samphire shrublands *Tecticornia halocnemoides, T. auriculata, T.* indica with variable amounts *Sporobolus virginicus* and forbs
Claypans: bare scaled surfaces with steep marginal slopes up to 3 m high to surrounding sand plain; circular, oval or irregularly shaped. mostly less than 50 m in extent but occasionally up to 600m.	Dark red clays	No vegetation

(Source: Payne et al. 1988)

3.3 Flora and vegetation

3.3.1 Regional vegetation mapping

The vegetation of the ANSIA Improvement Scheme Area lies within the Carnarvon Botanical District of the Eremaean Botanical Province of Western Australia. More specifically it is situated in the Cape Yannarie Coastal Plain (CYCP) subdistrict as mapped and described by Beard (1975). Beard described three broad vegetation community types for the CYCP as follows:

- mangroves along the coastline within the intertidal zone, dominated by *Avicennia marina* and *Rhizophora stylosa* to a lesser extent
- behind the intertidal zone, there is a belt of bare hyper-saline mud generally devoid of vegetation but with some samphire (*Tecticornia* spp.)

- behind the saline tidal mud flats, there is low country with numerous bare clay pans, seasonally filled and interspersed with grass plains (clay soil) and sand ridges (sand) with *Triodia* dominant. On higher ground there are extensive plains with patchy vegetation of *Acacia xiphophylla* (snakewood), *A. tetragonophylla, A. bivenosa* and *A. victoriae (A. synchronicia*), grassland including *Triodia basedowii* (*T. lanigera*?), clay pans and bare patches of gravel.

Beard (1975) mapped the vegetation of the Pilbara region at a scale of 1:1,000,000. Shepherd, Beetson and Hopkins (2002) used Beard's existing vegetation mapping to produce 1:250,000 scale vegetation association mapping. The survey area intersects the following three vegetation associations described by Shepherd, Beetson and Hopkins (2002) (Table 2) (Figure C).

Table 2 Beard vegetation associations represented within the survey area

Assoc. No.	Beard association description
127	Bare areas: mudflats
589	Mosaic: Short bunch grassland – savannah/grass plain (Pilbara)/hummock grasslands, grass steppe; soft spinifex soft spinifex
670	Hummock grasslands, shrub steppe; scattered shrubs over *Triodia basedowii*.

(Sources: Beard 1975; Shepherd, Beetson and Hopkins 2002)

3.3.2 Reservation priorities of vegetation associations mapped for the ANSIA improvement scheme area

The vegetation associations mapped by Beard (1975) for the survey area are widespread in the subregion with over 94% of their pre-European extent remaining. Kendrick and Mau (2002) assessed the reservation priority for these associations on a bioregional level (Table 3).

Table 3 Current extent and reservation status and priority of beard vegetation associations represented within the survey area

Vegetation association	Pre-European extent	Current extent	% Remaining	% Current extent protected (IUCN I - IV) for conservation (proportion of Pre-European extent)	Reservation priority
127	737,724.05	697,871.38	94.60	8.10	High
589	807,698.58	802,713.40	99.38	1.59	High
670	147,897.10	147,794.60	99.93		Low

(Sources: Government of Western Australia 2017; Kendrick and Mau 2002)

3.3.3 Conservation reserves

The Carnarvon IBRA bioregion has only 3.45% represented in conservation reserve (IUCN I-IV). At a subregional level, Cape Range CARI has 2.2% in reserve (Kendrick and Mau 2002). CAR1 reserves include:

- Cape Range National Park
- Ningaloo Marine Park
- Bundegi Conservation Park

- Jurabi Conservation Park
- Barrow Island Nature Reserve.

There are also numerous small island reserves in the subregion.

The Stage 2 ANSIA Improvement Scheme Area does not occur within, or adjacent to, any conservation reserves. Nor does it intersect any Environmentally Sensitive Areas.

3.3.4 Conservation significant vegetation known from the area

There are two Threatened Ecological Communities (TECs) within the Pilbara region endorsed by the Minister of the Environment (DBCA 2018a), 46. Themeda Grasslands: Themeda grasslands on cracking clays (Hamersley Station, Pilbara) and 78. Ethel Gorge: Ethel Gorge aquifer stygobiont community. Neither of these communities occur near Onslow or are likely to occur within the survey area. Additionally, there are 30 Priority Ecological Communities (PECs) listed for the Pilbara region (DBCA 2018b), however none of these are known to occur in the vicinity of the survey area.

3.3.5 Local vegetation mapping

An amalgamation of survey data from Biota (2010a), Onshore Environmental Consultants (2008), Onshore Environmental Consultants (2009), and Biota (2010b); Outback Ecology Services (2010) resulted in the delineation and description of 33 vegetation sub-associations over the ANSIA Improvement Scheme Area.

The Astron (2009) study mapped and described 39 vegetation sub-associations; however, these were mapped along a corridor approximately 80 km long, which traversed landforms and vegetation types not represented within the Stage 2 ANSIA Improvement Scheme Area. Similarly, the RPS (2009) survey was linear in nature and traversed vegetation not recorded within the Stage 2 ANSIA Improvement Scheme Area.

The 33 vegetation sub-associations mapped for the ANSIA Improvement Scheme Area are shown in Figure 5 of Appendix B.

3.3.6 Regional flora

A total of 1058 flora taxa have been recorded for the Cape Range CARI subregion (FloraBase 2018). Approximately 43% of these belong to five families. The number of taxa for each of these dominant families is presented in Table 4. The numbers in brackets refer to the number of weed species included in each total.

Table 4 Numbers of taxa of the five dominant plant families in the Cape Range subregion

Family	Common name	No. of Taxa
FABACEAE	Peas	131 (8)
POACEAE	Grasses	97 (7)
ASTERACEAE	Daisies	83 (9)
MALVACEAE	Mallows	70 (2)
CHENOPODIACEAE	Goosefoots	55 (1)

A total of 36 Conservation Significant flora taxa are known from the CAR1 subregion (FloraBase 2018), none of these are listed as Threatened or are protected under the BC Act. These comprise four Priority 1; eleven Priority 2; seventeen Priority 3; and four Priority 4 taxa (FloraBase 2018).

Sixty-four alien (weed) taxa are known from the CAR1 subregion (FloraBase 2018). The families with the greatest number of weed species are Asteraceae (nine taxa), Fabaceae (eight taxa), and Poaceae (seven taxa).

According to the Western Australian Organism List (WAOL) (Department of Agriculture and Food Western Australia (DAFWA) 2018), which lists organisms that are declared under the *Biosecurity and Agriculture Management Act 2007*, nine flora species with a status of Declared Pest (s22) are identified within the Shire of Ashburton all belonging to the Control Category C3 – Management. Additionally, the list of Weeds of National Significance names two species occurring within the Shire of Ashburton (Table 6).

Table 5 Declared pests (flora taxa) and weeds of national significance for the Shire of Ashburton

Family	Species	Common Name	Declared Pest	Weed of National Significance
PAPAVERACEAE	*Argemone ochroleuca* Sweet subsp. *ochroleuca*	Mexican poppy	✓	-
SOLANACEAE	*Datura ferox*	Fierce thornapple	✓	-
SOLANACEAE	*Datura inoxia*	-	✓	-
SOLANACEAE	*Datura leichhardtii*	Native thornapple	✓	-
SOLANACEAE	*Datura metel*	Downy thornapple	✓	-
SOLANACEAE	*Datura stramonium*	Common thornapple	✓	-
SOLANACEAE	*Datura wrightii*	Hairy thornapple	✓	-
LAMIACEAE	*Marrubium vulgare*	Horehound	✓	-
FABACEAE	*Parkinsonia aculeata*	Parkinsonia	✓	✓
FABACEAE	*Prosopis pallida*	Mesquite	✓	✓

(Source: DAFWA 2018)

3.3.7 Local flora

A total of 433 native taxa and 13 exotic (weed) taxa have been recorded from the surveys undertaken for the ANSIA to date. These taxa represent 167 genera from 58 families. The floristic data from the surveys undertaken by OEC (2008; 2009), Astron (2009), RPS (2009), Biota (2010a), Biota (2010b) and ENV (2012) was compiled to create the final flora inventory of 446 species. This total of 446 native and weed taxa recorded for the ANSIA to date represents 42% of the total number of 1,058 flora taxa recorded for the Cape Range CARI subregion.

The families and genera with the greatest number of species are presented in Table 6 and Table 7. The numbers in brackets refer to the number of weed species included in each total.

Table 6 Dominant families within the survey area

Family	Common name	No. of Taxa	Proportion of total Taxa in CAR1 subregion (%)
FABACEAE	Peas	80 (4)	59
POACEAE	Grasses	71 (3)	70
CHENOPODIACEAE	Goosefoots	46 (0)	78

Family	Common name	No. of Taxa	Proportion of total Taxa in CAR1 subregion (%)
ASTERACEAE	Daisies	29 (1)	35
MALVACEAE	Mallows	30 (1)	39

Table 7 Dominant genera within the survey area

Genus	Common name	No. of Taxa
Acacia	Wattle	23
Tecticornia	Samphire	18
Ptilotus	Mulla mulla	14
Abutilon	Lantern bush	11
Senna	-	11
Euphorbia	-	12

3.3.8 Conservation significant flora

3.3.8.1 Threatened Flora (EPBC Act) listed for the locality

One taxon, *Eleocharis papillosa*, listed by the Commonwealth as Vulnerable under the EPBC Act, was recorded from the ANSIA Improvement Scheme Area during surveys in 2009 (Biota 2010a). No other species listed under the EPBC Act have been previously recorded from the site, the locality, or are expected to occur in the habitats within the survey area.

3.3.8.2 Threatened Flora (BC Act) listed for the locality

No species listed as Threatened Flora by DBCA and protected under the Western Australian BC Act were recorded from the ANSIA Improvement Scheme Area, or from the 50 km database search area. No Threatened Flora species are expected to occur in the habitats within the survey area.

3.3.8.3 Priority Flora listed for the locality

Four Priority species have been recorded from the ANSIA Improvement Scheme Area to date (Biota 2010a): *Eleocharis papillosa, Eremophila forrestii* subsp. *viridis, Triumfetta echinata*, and *Atriplex flabelliformis* Paul G. Wilson. A description of these species follows. Priority Flora locations recorded for the current survey and previous surveys within the ANSIA Improvement Scheme Area are presented in Figure D.

3.3.8.3.1 *Eleocharis papillosa* – Priority 3 (BC Act), Vulnerable (EPBC Act)

Small annual sedge, this species is not considered Critically Endangered or Endangered but is Vulnerable because it is facing a high risk of extinction in the wild in the medium-term future. The species was assigned P3 status by DPaW as its consideration for Threatened status was probably overlooked (Biota 2010a).

E. papillosa was recorded from one location in a samphire flats vegetation sub-association. The species was considered by Biota (2010a) to be likely to occur throughout this habitat type and may be more widespread. It is known to grow on red clay over granite, open clay flats and clay pans (FloraBase 2018).

3.3.8.3.2 *Eremophila forrestii* subsp. *viridis* – Priority 3 (BC Act)

A perennial shrub to one metre (FloraBase 2018), *E. forrestii* subsp. *viridis* is probably restricted to the Onslow locality despite FloraBase showing records further afield; these have probably been misidentified (Biota 2010a).

E. forrestii subsp. *viridis* was recorded from three locations adjacent to the current survey area by Biota (2010a) within Vegetation of Inland Sand Dunes vegetation sub-associations. The species has also been recorded at other locations near the ANSIA Improvement Scheme Area and wider Onslow locality (OEC 2008; Astron 2009; ENV 2012; Biota unpublished data).

3.3.8.3.3 *Triumfetta echinata* – Priority 3 (BC Act)

A prostrate shrub to 0.3 metres occurring on red sandy soils and sand dunes (FloraBase 2018), *T. echinata* occurs primarily in the Onslow area although there is an outlier population approximately 120 km south in the Gascoyne bioregion.

T. echinata was recorded from numerous (> 30) locations adjacent to the survey area (OEC 2008; OEC 2009; Biota 2010a; RPS 2009) within Vegetation of Inland Sand Dunes vegetation sub-associations.

The species has also been recorded at other locations near the ANSIA Improvement Scheme Area and wider Onslow locality and it appears to be widespread in the locality however; it is relatively rare and restricted to red sand dunes (Biota 2010a).

3.3.8.3.4 *Atriplex flabelliformis* Paul G. Wilson – Priority 3 (BC Act)

A monoecious perennial herb to 0.35 metres occurring on clay loam, loam and saline flats or marshes (FloraBase 2018). *A. flabelliformis* was recorded from five locations adjacent to the current survey area in Vegetation of Clay pans and Clayey Plains vegetation sub-associations.

4 Results

4.1 Desktop study

The results of the desktop study are presented in *Flora and Vegetation Review Ashburton North Strategic Industrial Area* (RPS 2015) (Appendix B), including the results of the DBCA Threatened and Priority Flora database, the WAH Specimen database, and DBCA ecological community database searches. The desktop review also includes an assessment of each species" likelihood of occurrence within the survey area based on proximity to known records and species habitat preference. These results helped guide the targeted search for conservation significant flora within the survey area during the reconnaissance survey.

4.2 Field survey

4.2.1 Flora

4.2.1.1 Flora statistics

A total of 165 vascular flora taxa were recorded for the current survey of which 158 (95.75 %) were native, and 7 were naturalised alien (weed) species. The list of taxa recorded for the survey area is presented in Appendix C.

There were several taxa that could not be identified to species level due to inadequate fruiting or flowering material available at the time of the survey. These taxa are labelled "sp.".

The taxa recorded represent 37 families and 100 genera. The families represented by the greatest number of taxa are presented in Table 8. The genera represented by the greatest number of taxa are presented in Table 9.

Table 8 Dominant families within the survey area

Family	Common name	No. of Taxa
FABACEAE	Wattles and Peas	31
POACEAE	Grasses	29
CHENOPODIACEAE	Goose Foots	18
ASTERACEAE	Daisies	17

Table 9 Dominant genera within the survey area

Genus	Common name	No. of Taxa
Acacia	Wattle	10
Eragrostis	Lovegrass	6
Atriplex	Saltbush	4
Indigofera	Indigo	4
Ptilotus	Mulla-mulla	4
Tecticornia	Samphire	4

Of the 165 taxa recorded for the current survey 20 were previously unrecorded for the ANSIA Improvement Scheme Area (Table 10).

Table 10 Taxa recorded for the current survey not previously recorded for the survey area

Taxon
Abutilon sp. Dioicum (A.A. Mitchell PRP 1618)
Acacia bivenosa x *sclerosperma* subsp. *sclerosperma*
Atriplex cinerea
Bulbostylis barbata
Calandrinia polyandra
Cucumis variabilis
Cynanchum viminale subsp. *australe*
Eragrostis setifolia
Gnephosis brevifolia
Goodenia corynocarpa
Indigofera sessiliflora
Lepidium muelleri-ferdinandii
Lepidium phlebopetalum
Myriocephalus rudallii
Quoya loxocarpa
Roebuckiella cheilocarpa var. *cheilocarpa*
Seringa nephrosperma
Stenopetalum pedicellare
Tephrosia sp. Onslow (K.R. Newbey 10571)
Triodia ? *avenoides*

4.2.1.2 Flora of conservation significance

No Threatened Flora (TF) species listed under the BC Act or the EPBC Act were recorded within the survey area for the current survey.

One Priority Flora (PF) species listed by the DBCA was recorded within the survey for the current survey.

4.2.1.2.1 *Eremophila forrestii subsp. viridis* (P3)

Eremophila forrestii subsp. *viridis* is a perennial much-branched shrub growing to around 1 m high. Flowers are pink to cream and appear in July or August (FloraBase 2018), The subspecies is most likely restricted to the Onslow locality despite FloraBase showing records further afield; these have probably been misidentified (Biota 2010a).

Plate 1 ***Eremophila forrestii*** **subsp.** ***viridis*** **growing on linear red sand dunes in the survey area**

E. forrestii subsp. *viridis* had previously been recorded from three locations in the ANSIA Improvement Scheme Area (Biota 2010a) within their Vegetation of Inland Sand Dunes vegetation. The species had also been recorded at other locations near the ANSIA Improvement Scheme Area and wider Onslow locality (OEC 2008; Astron 2009; and ENV 2012).

For the current survey an approximate total of 380 individuals were recorded from five locations within the survey area (Figure D). These five populations were generally associated with the mid and upper slopes of the linear sand dunes and the gently undulating sand plains (Table 11). The species was recorded either as isolated individuals or isolated clumps within six of the sand dune and sand plain vegetation associations: Te; Ast.Te; Gs.Te; Gs.Ast.Te; Ate.Te; Ate.Asy.Te, and as a dominant shrub in two of the sand dune and sand plain vegetation associations: Ast.Efv.Te; and Ate.Efv.Te.

Table 11 Records of *Eremophila forrestii* subsp. *viridis* within the survey area

No. of individuals	Abundance range	Latitude	Longitide
1	1-5	-21.781746	114.992201
3	1-5	-21.780896	114.998639
5	1-5	-21.780041	114.999032
1	1-5	-21.779832	114.999121
3	1-5	-21.812024	115.056902
1	1-5	-21.812032	115.056823
1	1-5	-21.811979	115.056826
1	1-5	-21.811905	115.056768
1	1-5	-21.811914	115.056839
1	1-5	-21.811927	115.056820
1	1-5	-21.811942	115.056912
1	1-5	-21.811898	115.057002
1	1-5	-21.811935	115.057080

No. of individuals	Abundance range	Latitude	Longitide
1	1-5	-21.811926	115.057116
2	1-5	-21.811926	115.057155
1	1-5	-21.811819	115.057191
1	1-5	-21.811763	115.057186
2	1-5	-21.811518	115.056553
1	1-5	-21.810179	115.056622
2	1-5	-21.810077	115.056498
1	1-5	-21.809016	115.058405
2	1-5	-21.809864	115.059046
1	1-5	-21.782598	115.059447
1	1-5	-21.782681	115.059346
2	1-5	-21.782778	115.059307
1	1-5	-21.754992	115.057467
1	1-5	-21.755186	115.057530
2	1-5	-21.755389	115.057492
1	1-5	-21.755552	115.057523
3	1-5	-21.756770	115.058852
1	1-5	-21.756830	115.058927
1	1-5	-21.756780	115.058696
1	1-5	-21.757037	115.058711
2	1-5	-21.757565	115.058929
1	1-5	-21.757634	115.058820
1	1-5	-21.757659	115.058884
1	1-5	-21.757676	115.058936
1	1-5	-21.757698	115.058970
1	1-5	-21.757955	115.059051
1	1-5	-21.758102	115.059055
1	1-5	-21.758239	115.059055
1	1-5	-21.758227	115.059144
2	1-5	-21.758304	115.059113
2	1-5	-21.758394	115.059047
4	1-5	-21.758467	115.059168
2	1-5	-21.758515	115.059168

No. of individuals	Abundance range	Latitude	Longitide
1	1-5	-21.755992	115.059952
3	1-5	-21.755888	115.059799
1	1-5	-21.755744	115.059423
2	1-5	-21.750388	115.024508
2	1-5	-21.750814	115.022975
1	1-5	-21.749044	115.010535
1	1-5	-21.750133	115.009405
10	>5-10	-21.811881	115.057090
7	>5-10	-21.811318	115.056607
9	>5-10	-21.809877	115.056508
6	>5-10	-21.755486	115.057602
6	>5-10	-21.755618	115.057620
9	>5-10	-21.751341	115.023545
11	>10-20	-21.810371	115.056567
16	>10-20	-21.809980	115.056565
20	>10-20	-21.808386	115.057730
30	>20-50	-21.808347	115.058124
11	>10-20	-21.755116	115.057765
13	>10-20	-21.750917	115.023270
100	>50-100	-21.808179	115.057338

4.2.1.3 Flora of other conservation significance

There are a number of other criteria (apart from the federal and Western Australian criteria of Threatened Flora and Priority Species) under which flora taxa (i.e. species, sub-species and varieties) may have high conservation significance (EPA 2016).

These taxa include those that are confined to scarce or refugial habitats; form uncommon, regionally significant populations; have significant geographical ranges; and undescribed taxonomic entities. EPA (2016) refers to such taxa as “other taxa of conservation significance” and these are required to be assessed in Environmental Impact Assessment.

A total of three additional taxa recorded within the survey area are considered to be conservation significant based on geographic range anomalies (Table 12).

Table 12 Other significant flora in the survey area

Taxon	BC Act status*	Other significance	Location within the survey area
Stenopetalum pedicellare	-	Range Extension	Opportunistic collection
Acacia sphaerostachya	-	Range Extension	Opportunistic collection
**Indigofera sessiliflora*	-	Range Extension	ANCBR03

4.2.1.4 Introduced flora (weeds)

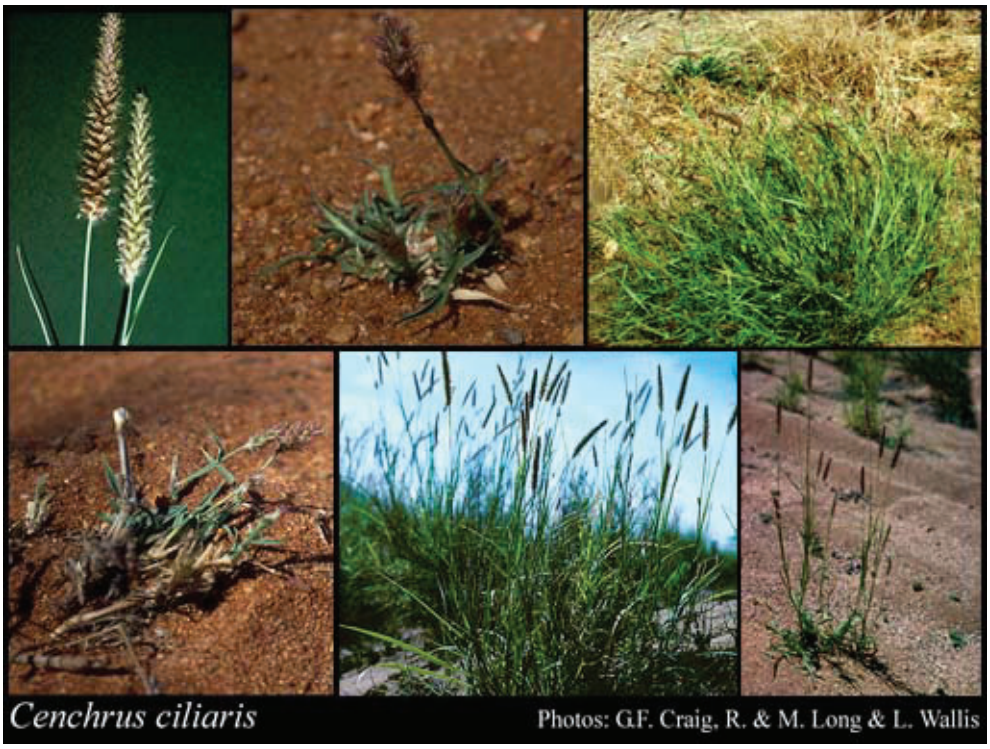
Seven naturalised alien (weed) species were recorded for the survey area, representing 4.25 % of the total flora taxa recorded. The most widespread and abundant of these were **Cenchrus ciliaris* (buffel grass), and tall shrub species, **Prosopis pallida* (mesquite) and **Vachellia farnesiana* (mimosa bush); all three occurred as dominants throughout areas of the survey area in Degraded condition, which is a reflection of the generally disturbed nature of much of the vegetation in the ANSIA due to long term heavy grazing by livestock.

It should be noted that the vegetation units described for the current study were not defined by weed species dominants (unlike Biota's (2010a; 2010b) vegetation sub-association descriptions), as their presence is an indication of condition rather than vegetation community type.

4.2.1.4.1 ***Cenchrus ciliaris* (buffel grass)**

**Cenchrus ciliaris* is a tufted sometimes stoloniferous perennial grass growing 0.2 to1.5 metres high. Purple flowers appear between February and October (FloraBase 2018) (Plate 2).

**Cenchrus ciliaris* occurred within the survey area throughout a broad range of habitat types including the crests and slopes of the inland sand dunes and the low-lying claypans, clayey plains, sand plains and along the banks of drainage lines.



(Source: FloraBase 2018)

Plate 2 **Cenchrus ciliaris* (buffel grass)

4.2.1.4.2 **Prosopis pallida* (mesquite)

A spiny tree or shrub growing between four and ten metres high; leaves are bipinnate and the leaflets are two to four times as long as they are wide; the pods are glabrous. Green-yellow flowers appear in February or between July and September (FloraBase 2018) (Plate 3).

**Prosopis pallida*, like all species in this genus, is listed as a Declared Plant under the *Biosecurity and Agriculture Management Act 2007* (BAM Act) and it is also a Weed of National Significance (WONS).

Within the survey area **Prosopis pallida* was generally restricted to the margins of claypans, across the clayey plains and low-lying sand plains, and the banks of drainage lines.

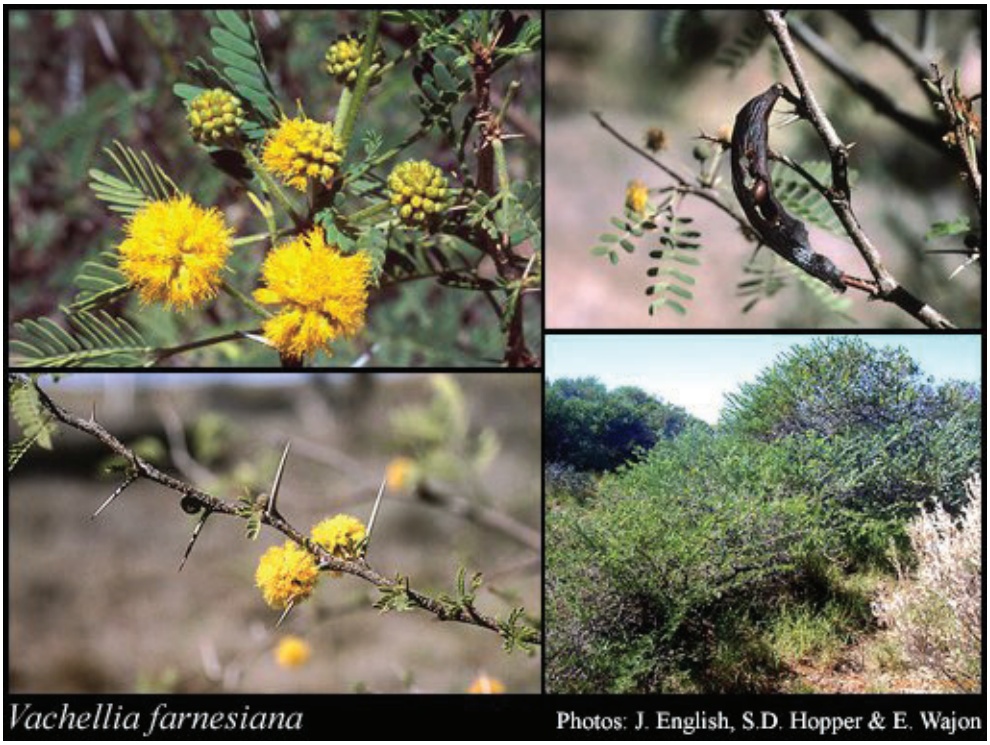
(Source: DPIRD 2018)

Plate 3 **Prosopis pallida* (mesquite)

4.2.1.4.3 **Vachellia farnesiana* (mimosa bush)

An erect, spreading, thicket-forming, thorny tree or shrub growing to four meters high, the bark is dark grey and rough and stems and branchlets are covered with conspicuous white lenticels; leaves are pinnate. Yellow flowers appear between June and August (FloraBase 2018) (Plate 4).

**Vachellia farnesiana* was generally restricted to the margins of claypans, across the clayey plains and low-lying sand plains, and the banks of drainage lines within the survey area.



(Source: FloraBase 2018)

Plate 4 *_Vachellia farnesiana_ (mimosa bush)

4.2.2 Vegetation associations

For the current survey a total of 18 vegetation associations were described and mapped for the survey area, belonging to four broad vegetation types which correspond to each of the different landform units represented within the survey area; these were:

- vegetation of claypans and clayey plains
- vegetation of creek lines
- vegetation of tidal mudflats
- vegetation of inland sand dunes.

The vegetation units were defined from 53 relevés and 20 vegetation mapping sites. The vegetation association mapping is presented in Figure E-1 to E-4.

The vegetation associations defined for the current survey were generally well-aligned with those described and mapped by Biota (2010a; 2010b) for the wider ANSIA Improvement Scheme Area. It should be noted however, that Biota defined many of their units by weed species (**Prosopis pallida, *Vachellia farnesiana* and **Cenchrus ciliaris*) where they occurred as dominants, however for the current study RPS has not included the weed species in the vegetation association descriptions as their presence is considered an

indication of condition rather than vegetation community type. Following are descriptions of the 18 vegetation associations within the survey area.

4.2.2.1 Vegetation of tidal mudflats

Tidal mudflats occurred in the northern portion of the survey area. Two units were described for this landform unit; bare or very sparsely vegetated areas subject to regular tidal inundation; and samphire shrublands fringing the tidal mudflats, subject to less frequent inundation comprising low open to closed shrubland of *Tecticornia* spp. (Table 13). This group was characterised by the presence of halophytic (salt adapted) species.

Table 13 Vegetation of tidal mudflats

Vegetation unit	Description	Sampling sites	Biota 2010 equivalent
MF	**Bare tidal mudflats**	**None**	**mf**
This unit was mapped for the bare mudflats in the northern portion of the survey area where the vegetation, if present, comprised only scattered samphire shrubs.			
TECspp.	***Tecticornia* spp. Low Open to Low Samphire Shrublands on and fringing mudflats**	**ANBR19 ANBR26 ANBR10 ANBR27 ANCR19 ANCR20 ANCR22**	**TECspp**
This vegetation occurred on the fringes of the mudflats and comprised low sparse shrublands to low shrublands dominated by samphires (*Tecticornia* spp.) in areas subject to more frequent inundation (highly saline areas), and with samphires and other chenopods over a sparse tussock grassland / forbland in areas less-frequently inundated (moderately saline areas) (Plates 5 and 6). This vegetation was generally in Good (Trudgen 1988) condition. Associated species included *Eragrostis pergracilis, Tecticornia indica* subsp. *leiostachya, Tecticornia auriculata, Lawrencia viridigrisea, Cyperus ? bulbosus, Sporobolus virginicus, Angianthus ? acrohyalinus, Rhodanthe psammophila, Swainsona pterostylis, Frankenia ambita, Neobassia astrocarpa, Rhodanthe stricta, Dactyloctenium radulans, Cullen cinereum,* and *Calotis plumulifera.*			

Plate 5 TECspp. vegetation association fringing mudflats (ANCR19)

Plate 6 TECspp. vegetation association fringing mudflats (ANCR20)

4.2.2.2 Vegetation of claypans and clayey plains

Claypans and clayey plains occurred on the heavy clay soils in low-lying areas across much of the survey area. Seven units were described for this landform unit which included a range of vegetation types differing in structure (from tall sparse shrublands to low samphire heaths, and grasslands / herblands), and species composition (determined primarily by the degree of salinity of the substrate). Vegetation associations included bare claypans virtually devoid of vegetation, samphire low shrublands in and fringing saline claypans, tall sparse shrublands over mixed grasslands and forblands on and adjacent to the less saline claypans and on broad clayey plains (Table 14). The SIMPER (Similarity of Percentages) analysis conducted on the floristic data in PRIMER v6 determined that the native species that contributed most to the floristic similarity of the group of non-saline claypan and clay plains vegetation associations were *Sporobolus mitchellii, Acacia tetragonophylla, Eriachne benthamii, Calotis plumulifera, Scaevola spinescens, Acacia synchronicia, Eulalia aurea, Cullen cinereum, Vachellia farnesiana* and *Ptilotus macrocephalus.* The analysis confirmed that the native species that characterised the saline claypans and clayey plains vegetation were *Eragrostis pergracilis, Tecticornia indica* subsp*. leiostachya, Lawrencia viridigrisea, Cyperus ? bulbosus, Angianthus ? acrohyalinus, Rhodanthe psammophila, Frankenia ambita, Neobassia astrocarpa, Rhodanthe stricta* and *Dactyloctenium radulans.*

Table 14 Vegetation of claypans and clayey plains

Vegetation unit	Description	Sampling sites	Biota 2010 equivalent
CP	**Bare clay pans with only scattered annual grasses and forbs**	**None**	**cp**
There were numerous claypans throughout the survey area, which were typically either bare, or comprised isolated samphire and chenopod low shrubs over isolated or sparse annual grasses and / or forbs depending on time since inundation. The claypans were generally in Very Good (Trudgen 1988) condition. Associated species included *Tecticornia indica* subsp. *leiostachya, Sclerolaena recurvicuspis, Lawrencia viridigrisea, Calotis plumulifera, Eragrostis pergracilis, *Cenchrus ciliaris, Angianthus ? acrohyalinus, Atriplex codonocarpa*, *A. semilunaris, Neobassia astrocarpa, Calandrinia ptychosperma, Cyperus bulbosus, Dactyloctenium radulans,* and *Roebuckiella cheilocarpa* var. *cheilocarpa.*			
TECspp.	***Tecticornia* spp Low Open to Low Samphire Shrublands on and fringing saline claypans**	**ANCR23 ANCR25**	**TECspp**
This vegetation occurred on the fringes of the saline claypans and comprised low sparse shrublands to low shrublands dominated by samphires (*Tecticornia* spp.) and other chenopods over a sparse tussock grassland / forbland (Plates 7 and 8). This vegetation was generally in Good (Trudgen 1988) condition. Associated species included *Eragrostis pergracilis, Tecticornia indica subsp. leiostachya, Tecticornia auriculata, Lawrencia viridigrisea, Cyperus ? bulbosus, Sporobolus virginicus, Angianthus ? acrohyalinus, Rhodanthe psammophila, Swainsona pterostylis, Frankenia ambita, Neobassia astrocarpa, Rhodanthe stricta, Dactyloctenium radulans, Cullen cinereum,* and *Calotis plumulifera.*			
CP/Ea/Sm/Eb/Es	**Mosaic of bare clay flats and *Eulalia aurea* / *Sporobolus mitchellii* / *Eriachne benthamii* / *Eragrostis setifolia* Open Tussock Grassland**	**ANBR01 ANCR07 ANBR04**	**SPmERIbEUa**
This vegetation formed a mosaic of bare claypans and grasslands which were variously dominated by *Eulalia aurea, Sporobolus mitchellii, Eriachne benthamii* and *Eragrostis setifolia.* These grass species typically fringed the (less saline) claypans, or occurred in patches, or sparsely across them (Plates 9 and 10). This vegetation generally ranged in condition from Good to Poor or Degraded (Trudgen 1988). Associated species included *Atriplex codonocarpa, Calotis plumulifera, *Cenchrus ciliaris, Chloris pectinata, Cullen cinereum , Cyperus bulbosus, Dactyloctenium radulans, Dichanthium sericeum subsp. humilius, Dysphania rhadinostachya subsp. inflata, Eragrostis dielsii, Eragrostis setifolia, Eriachne benthamii, Erodium cygnorum, Eulalia aurea, Goodenia corynocarpa, Iseilema dolichotrichum, Lepidium phlebopetalum, Marsilea ? exarata, Myriocephalus*			

Vegetation unit	Description	Sampling sites	Biota 2010 equivalent
rudallii, Neptunia dimorphantha, Prosopis pallida, Ptilotus gomphrenoides, Sporobolus mitchellii, Swainsona kingii and *Swainsona pterostylis.*			
Ate.Ea/Sm/Eb/Es	***Acacia tetragonophylla* Tall Isolated Shrubs to Sparse Shrubland over *Eulalia aurea* / *Sporobolus mitchellii* / *Eriachne benthamii* / *Eragrostis setifolia* Open Tussock Grassland over *Calotis plumulifera* Sparse Forbland**	**ANBR07 ANBR16 ANBR17 ANBR18 ANCR01 ANCR03 ANCR05 ANCR16 ANBR14**	**PRpAteVfEUaCHfSPm**
This vegetation association occurred on the clayey plains within the survey area and consisted of a tall shrub stratum of *Acacia tetragonophylla* which occurred either as tall isolated shrubs or a tall sparse shrubland over grasslands which were variously dominated by *Eulalia aurea, Sporobolus mitchellii, Eriachne benthamii* and *Eragrostis setifolia* (Plates 11 and 12). Tall shrub weed species **Prosopis pallida* (mesquite) often occurred as a dominant in this vegetation type in areas of Degraded condition. This vegetation generally ranged in condition from Good to Poor or Degraded (Trudgen 1988). Associated species include *Acacia synchronicia, Acacia tetragonophylla, Calotis plumulifera, *Cenchrus ciliaris, *Cenchrus setiger, Chloris pectinata, Cullen cinereum, Eragrostis setifolia, Eriachne benthamii, Eulalia aurea, Goodenia corynocarpa, Neptunia dimorphantha, *Prosopis pallida, Ptilotus macrocephalus, Scaevola spinescens, Sporobolus mitchellii* , *Swainsona pterostylis* and **Vachellia farnesiana.*			
Eb/Sm	***Eriachne benthamii* and *Sporobolus mitchellii* Tussock Grassland**	**ANBR13 ANCR24**	**SPmERlbEUa**
This grassland unit occurred on some of the less saline clay plains and in patches surrounded by bare claypans (Plates 13 and 14). Tall shrub weed species **Prosopis pallida* (mesquite) and **Vachellia farnesiana* (mimosa bush) often occurred as isolated tall shrubs in this vegetation type in areas of Degraded condition. This vegetation generally ranged in condition from Good to Poor (Trudgen 1988). Associated species included *Eriachne benthamii, Goodenia corynocarpa, Ptilotus macrocephalus, Calotis plumulifera, Acacia tetragonophylla, *Vachellia farnesiana, *Prosopis pallida, Acacia synchronicia, Sporobolus mitchellii, Dysphania rhadinostachya subsp. inflata, Cullen cinereum* and *Quoya loxocarpa.*			
Ass/Ate.Es/Cf/Ea	***Acacia sclerosperma* subsp. *sclerosperma* and *A. tetragonophylla* Tall Open Shrubland over *Eragrostis setifolia, Chrysopogon fallax* and *Eulalia aurea* Sparse Tussock Grassland**	**ANBR15**	**PRpAteVfEUaCHfSPm**
This vegetation occurred in one clay depression between low dunes in the south-east of the survey area (Plate 15). This vegetation was in Good (Trudgen 1988) condition. Associated species included *Acacia sclerosperma subsp. sclerosperma, Acacia tetragonophylla, Calotis plumulifera, *Cenchrus ciliaris, *Cenchrus setiger, Chrysopogon fallax, Eragrostis setifolia, Eriachne benthamii, Eulalia aurea, *Prosopis pallida, Scaevola spinescens, Sclerolaena costata, Senna artemisioides subsp. oligophylla* and *Sporobolus mitchellii.*			
Ate.Asp/Mt	***Acacia tetragonophylla* Tall Sparse Shrubland over *Atriplex* sp. and *Maireana tomentosa* Low Open Chenopod Shrubland**	**ANBR21**	**None**
This vegetation association occurred in the north east portion of the survey area on the saline clay flats adjacent to samphire flats (Plate 16). This vegetation was in Good to Poor (Trudgen 1988) condition. Associated species included *Acacia tetragonophylla, Atriplex codonocarpa, Atriplex sp., Calotis plumulifera, *Cenchrus ciliaris, Enchylaena tomentosa, Eriachne benthamii, Maireana tomentosa, Prosopis pallida, Sclerolaena recurvicuspis, Sclerolaena uniflora* and *Trianthema turgidifolia.*			

Plate 7 TECspp. vegetation association fringing saline claypans (ANCR23)

Plate 8 TECspp. vegetation association fringing saline claypans (ANCR25)

Plate 9 CP/Ea/Sm/Eb/Es vegetation association on clayey plains (ANBR01)

Plate 10 CP/Ea/Sm/Eb/Es vegetation association on clayey plains (ANBR04)

Plate 11 Ate.Ea/Sm/Eb/Es vegetation association on clayey plains (ANBR07)

Plate 12 Ate.Ea/Sm/Eb/Es vegetation association on clayey plains (ANBR16)

Plate 13 Eb/Sm vegetation association on clayey plains (ANBR13)

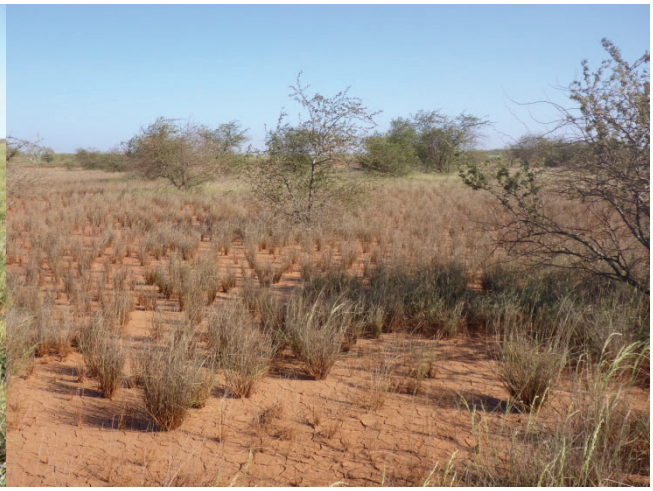


Plate 14 Eb/Sm vegetation association on clayey plains (ANCR24)

Plate 15 Ass/Ate.Es/Cf/Ea vegetation association in a clay depression (ANBR15)

Plate 16 Ate.Asp/Mt vegetation association on clay flat (ANBR21)

4.2.2.3 Vegetation of creek lines

There was only one defined creek line vegetation unit within the survey area which occurred on the heavy clay soils in the south-west of the survey area (Table 15).

Table 15 Vegetation of creek lines

Vegetation unit	Description	Sampling sites	Biota 2010 equivalent
Ev.Ate/Asy.Sm/Eb	***Eucalyptus victrix* Mid Open Woodland over *Acacia tetragonophylla* and *A. synchronicia* Mid Isolated Shrubs over *Sporobolus mitchellii* and *Eriachne benthamii* Tussock Grassland**	**ANCR12**	**None**
This vegetation association occurred in a broad creek line on brown silty clay (Plates 17 and 18). This vegetation generally ranged in condition from Good to Very Good (Trudgen 1988). Associated species included *Acacia synchronicia, Acacia tetragonophylla, Angianthus acrohyalinus, Calotis plumulifera, *Cenchrus ciliaris, Dysphania rhadinostachya subsp. inflata*, *Eremophila longifolia, Eriachne benthamii, Eucalyptus victrix, Eulalia aurea, *Prosopis pallida, Roebuckiella cheilocarpa var. cheilocarpa, Scaevola spinescens, Sporobolus mitchellii, *Vachellia farnesiana*			

Plate 17 Ev.Ate/Asy.Sm/Eb vegetation association in creek line (ANCR12)

Plate 18 Ev.Ate/Asy.Sm/Eb vegetation association in creek line (ANCR12)

4.2.2.4 Vegetation of sand dunes and plains

Sand dunes and sand plains accounted for a large proportion of the survey area. Nine vegetation associations were described and mapped for these areas (Table 16). All nine had a hummock grassland understorey dominated by *Triodia epactia* but were defined by different shrub species which broadly correlated to landscape position; *Grevillea stenobotrya* generally occurred on the crests and upper slopes of the higher linear dunes, *Acacia stellaticeps* on the crests, upper and mid slopes of dunes, and in dune swales, and *Acacia tetragonophylla* and / or *Acacia synchronicia* on the sand plains and low undulating hills between the higher dunes and the claypans and clayey plains. The Priority 3 taxon *Eremophila forrestii* subsp. *viridis* was associated with eight of these vegetation associations and formed a dominant in two.

The SIMPER analysis conducted on the floristic data in PRIMER v6 determined that the native species that contributed most to the floristic similarity of the group of sand dune and sand plain vegetation associations were *Triodia epactia, Solanum lasiophyllum, Acacia stellaticeps, Alyogyne pinoniana, Grevillea stenobotrya, Ptilotus polystachyus, Evolvulus alsinoides* var. *decumbens, Bonamia erecta, Trachymene pilbarensis, Abutilon* sp. Dioicum (A.A. Mitchell PRP 1618), *Adriana tomentosa* var. *tomentosa, Scaevola spinescens* and *Euphorbia myrtoides.*

Table 16 Vegetation of sand dunes and plains

Vegetation unit	Description	Sampling sites	Biota 2010 equivalent
Te	***Triodia epactia* Hummock Grassland**	**ANBR09 ANBR28**	**None**
This vegetation association occurred on some of the lower linear dunes in the western portion of the survey area (Plates 19 and 20). It comprised *Triodia epactia* Hummock Grassland (at around 50 % cover) with no consistent or dominant shrub overstorey, but isolated / scattered occurrences of the shrub and forb species included in the associated species list below. This vegetation generally ranged in condition from Good to Very Good (Trudgen 1988). Associated species included *Abutilon* sp. Dioicum (A.A. Mitchell PRP 1618), *Adriana tomentosa* var. *tomentosa, Alyogyne pinoniana, Calandrinia ? polyandra, Calandrinia ptychosperma, Cassytha capillaris, *Cenchrus ciliaris, Crotalaria cunninghamii, Euphorbia myrtoides, Evolvulus alsinoides* var. *decumbens, Eremophila forrestii* subsp. *viridis, Ptilotus polystachyus, Quoya loxocarpa, Scaevola spinescens, Solanum lasiophyllum, Tephrosia* sp. Onslow (K.R. Newbey 10571), *Trachymene pilbarensis, Trichodesma zeylanicum* var. ?, *Triodia ? avenoides* and *Triodia epactia*		

Vegetation unit	Description	Sampling sites	Biota 2010 equivalent
Ast.Te	***Acacia stellaticeps* Mid Sparse Shrubland over *Triodia epactia* Hummock Grassland**	**ANBR02 ANBR06 ANCR04 ANCR08**	**AstTe**
This vegetation association was recorded for the crests, and upper and mid slopes of dunes, and in dune swales on red sand (Plates 21 and 22). This vegetation was in Good (Trudgen 1988) condition. Associated species included *Abutilon* sp. Dioicum (A.A. Mitchell PRP 1618), *Acacia stellaticeps, Adriana tomentosa* var. *tomentosa, Alyogyne pinoniana, Bonamia erecta, Bulbostylis barbata, Calandrinia polyandra, Cassytha capillaris, *Cenchrus ciliaris, Decazesia hecatocephala, Erodium cygnorum, Euphorbia myrtoides, Evolvulus alsinoides var. decumbens, Eremophila forrestii* subsp. *viridis, Goodenia forrestii, Grevillea eriostachya, Grevillea stenobotrya, Heliotropium crispatum, Hibiscus ? sturtii* var. *campylochlamys, Indigofera ? linifolia, Ipomoea muelleri, Pterocaulon sphacelatum, Ptilotus latifolius, Ptilotus polystachyus, Rhodanthe psammophila, Roebuckiella cheilocarpa* var. *cheilocarpa, Scaevola spinescens, Solanum lasiophyllum, Trachymene pilbarensis, Trianthema pilosa, Trichodesma zeylanicum* var. ?, and *Triodia epactia*			
Ast.Efv.Te	***Acacia stellaticeps, Eremophila forrestii* subsp. *viridis* and *Scaevola spinescens* Mid Isolated Shrubs over *Triodia epactia* Hummock Grassland**	**ANCR13**	**AstTe**
This vegetation association was recorded at one location within the survey area; on the crest of a tall dune in the western portion of the survey area (Plate 23). This association is a variation of the above described unit Ast.Te but was mapped separately because of the dominance of the Priority 3 species *Eremophila forrestii* subsp. *viridis.* This vegetation generally ranged in condition from Good to Very Good (Trudgen 1988). Associated species included *Acacia stellaticeps, Scaevola spinescens, Adriana tomentosa* var. *tomentosa, Quoya loxocarpa, Eremophila forrestii* subsp. *viridis, Triodia epactia, Ptilotus polystachyus, Ptilotus latifolius, Ipomoea muelleri, Trianthema pilosa, Calandrinia polyandra, Calandrinia ptychosperma, Bonamia erecta, Solanum lasiophyllum, Cenchrus ciliaris* and *Tephrosia rosea* var. *clementii.*			
Gs.Te	***Grevillea stenobotrya* Tall Open Shrubland over *Triodia epactia* Hummock Grassland**	**ANBR22 ANBR24**	**GsCRcTRzTe**
This vegetation association was recorded at three locations within the survey area; on the crests of tall dunes and was generally in Very Good (Trudgen 1988) condition (Plate 24). This vegetation generally ranged in condition from Good to Very Good (Trudgen 1988). Associated species included *Abutilon* sp. Dioicum (A.A. Mitchell PRP 1618), *Acacia tetragonophylla, Alyogyne pinoniana, Atriplex sp., Bonamia erecta, *Cenchrus ciliaris, Crotalaria cunninghamii*, *Evolvulus alsinoides* var. *decumbens, Eremophila forrestii* subsp. *viridis, Grevillea eriostachya, Grevillea stenobotrya, Hakea stenophylla subsp. stenophylla, Ptilotus polystachyus, Seringa nephrosperma, Solanum lasiophyllum, Stylobasium spathulatum, Trachymene pilbarensis, Trichodesma zeylanicum var. ?* and *Triodia epactia.*			
Gs.Ast.Te	***Grevillea stenobotrya* Tall Sparse Shrubland over *Acacia stellaticeps* Mid Sparse Shrubland over *Triodia epactia* Hummock Grassland**	**ANBR12 ANCR11 ANCR15 ANCR17**	**GsCRcTRzTe**
This vegetation association was recorded for the majority of the linear dune crests throughout the survey area and was generally in Very Good (Trudgen 1988) condition (Plates 25 and 26). Associated species included *Abutilon* sp. Dioicum (A.A. Mitchell PRP 1618), *Acacia coriacea* subsp. *coriacea, Acacia sclerosperma* subsp. *sclerosperma, Acacia stellaticeps, Adriana tomentosa* var. *tomentosa, Alyogyne pinoniana, Bonamia erecta, Calandrinia polyandra, *Cenchrus ciliaris, Corynotheca pungens, Crotalaria cunninghamii, Eremophila forrestii* subsp. *viridis, Euphorbia boophthona, Euphorbia myrtoides, Evolvulus alsinoides* var. *decumbens, Grevillea eriostachya, Grevillea stenobotrya, Indigofera colutea, Ptilotus polystachyus, Scaevola spinescens, Senna glutinosa* subsp. *chatelainiana, Solanum lasiophyllum, Tephrosia* sp. Onslow (K.R. Newbey 10571*), Trachymene pilbarensis, Trianthema pilosa, Trichodesma zeylanicum* var. ?, *Triodia ? avenoides, Triodia epactia* and *Verticordia forrestii.*			

Vegetation unit	Description	Sampling sites	Biota 2010 equivalent
Ate.Te	***Acacia tetragonophylla* Tall to Mid Open Shrubland to Isolated Shrubs over *Triodia epactia* Open Hummock Grassland to Hummock Grassland**	**ANCR18 ANCR09 ANCR06 ANCR21 ANBR05 ANBR11 ANBR03**	**AteTe**

This vegetation association dominated on the lower dune slopes and undulating sand plains throughout much of the survey area between the larger linear dunes and the claypans and clayey plains, sometimes forming a mosaic with the tussock grasslands on the clay flats (Plates 27 and 28). This vegetation generally ranged in condition from Good to Poor or Degraded (Trudgen 1988), with **Cenchrus ciliaris* (buffel grass) occurring as a dominant in the more disturbed areas. **Prosopis pallida* (mesquite) and **Vachellia farnesiana* (mimosa bush) also occurred as isolated tall shrubs throughout the vegetation association.

Associated species included *Acacia bivenosa, Acacia bivenosa x sclerosperma* subsp. *sclerosperma, Acacia sclerosperma* subsp. *sclerosperma, Acacia stellaticeps, Acacia tetragonophylla, Atriplex cinerea, Bulbostylis barbata, Calandrinia ptychosperma, Calotis plumulifera, *Cenchrus ciliaris, *Cenchrus setiger, Chrysopogon fallax, Dysphania rhadinostachya* subsp. *inflata, Eremophila forrestii* subsp. *viridis, Erodium cygnorum, Eulalia aurea, Goodenia forrestii, Haloragis gossei* var. *?, Indigofera colutea, Indigofera sessiliflora, Neobassia astrocarpa, Paraneurachne muelleri, *Prosopis pallida, Rhodanthe stricta, Roebuckiella cheilocarpa* var. *cheilocarpa, Salsola australis, Scaevola spinescens, Senna artemisioides* subsp. *oligophylla x?, Solanum lasiophyllum, Stemodia* sp. Onslow (A.A. Mitchell 76/148*), Swainsona pterostylis, Trachymene pilbarensis, Trianthema turgidifolia, Triodia epactia, *Vachellia farnesiana* and *Wahlenbergia tumidifructa.*

Ate.Asp.Te	***Acacia tetragonophylla* Mid Isolated Shrubs over *Atriplex* spp. Low Sparse Chenopod Shrubland over *Triodia epactia* Sparse Hummock Grassland to Hummock Grassland**	**ANBR20 ANCR14**	**None**

This vegetation association occurred on the gently undulating sand plains in the north east of the survey area adjacent to the samphire dominated saline claypans and clayey plains (Plate 29).). This vegetation generally ranged in condition from Good to Poor or Degraded (Trudgen 1988), with **Cenchrus ciliaris* (buffel grass) occurring as a dominant in the more disturbed areas.

Associated species included *Acacia tetragonophylla, Angianthus ? acrohyalinus, Atriplex semilunaris, Calotis plumulifera, *Cenchrus ciliaris, Cynanchum viminale* subsp. *australe, Cyperus bulbosus, Dactyloctenium radulans*, *Eragrostis ? falcata, Lawrencia viridigrisea, *Prosopis pallida, Ptilotus polystachyus, Rhodanthe humboldtiana, Sclerolaena uniflora, Trachymene pilbarensis, Trianthema turgidifolia* and *Triodia epactia.*

Ate.Asy.Te	***Acacia tetragonophylla* and *A. synchronicia* Mid to Tall Sparse Shrubland over *Triodia epactia* Sparse Hummock Grassland to Hummock Grassland**	**ANBR25 ANCR10 ANCR02 ANBR08**	**PRpAteAsyTeCEc**

Similar to Ate.Te, this vegetation association occurred on the lower dune slopes and undulating sand plains throughout much of the survey area between the larger linear dunes and the claypans and clayey plains (Plates 30 and 31). This vegetation generally ranged in condition from Good to Poor or Degraded (Trudgen 1988), with **Cenchrus ciliaris* (buffel grass) occurring as a dominant in the more disturbed areas and **Prosopis pallida* (mesquite) and **Vachellia farnesiana* (mimosa bush) also occurred as isolated tall shrubs.

Associated species included *Acacia coriacea subsp. coriacea, Acacia stellaticeps, Acacia synchronicia, Acacia tetragonophylla, Bulbostylis barbata, Calandrinia ? polyandra, *Cenchrus ciliaris, Eulalia aurea, Eremophila forrestii* subsp. *viridis, Goodenia forrestii, Heliotropium crispatum, Indigofera ? linifolia, Indigofera boviperda subsp. boviperda, Indigofera colutea, Polygala isingii, Portulaca oleracea, *Prosopis pallida, Ptilotus polystachyus, Roebuckiella cheilocarpa var. cheilocarpa, Scaevola spinescens, Swainsona pterostylis, Trachymene pilbarensis, Triodia epactia* and **Vachellia farnesiana.*

Vegetation unit	Description	Sampling sites	Biota 2010 equivalent
Ate.Efv.Te	***Acacia tetragonophylla* Tall Sparse Shrubland over *Eremophila forrestii* subsp. *viridis* Mid Sparse Shrubland over *Triodia epactia* Hummock Grassland**	**ANBR23**	**AteTe**

This vegetation association was recorded at two locations within the survey area; in a swale between the crests of taller dunes, and on the mid to upper slope of another tall dune (Plates 32 and 33). This association is a variation of the above described unit Ate.Te but was mapped separately because of the dominance of the Priority 3 species *Eremophila forrestii* subsp. *viridis*. This vegetation ranged in condition from Good to Very Good (Trudgen 1988).

Associated species included *Acacia coriacea* subsp. *coriacea, Acacia synchronicia, Acacia tetragonophylla, Acacia trachycarpa, *Cenchrus ciliaris, Eremophila forrestii* subsp. *viridis, Eulalia aurea, Grevillea eriostachya, Ptilotus polystachyus, Scaevola spinescens, Solanum lasiophyllum, Trachymene pilbarensis* and *Triodia epactia.*

Plate 19 **Te. vegetation association on low sand dunes (ANBR09)**

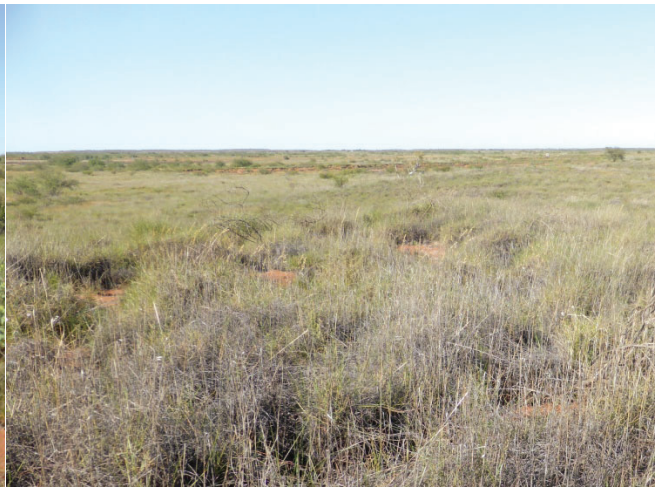


Plate 20 **Te. vegetation association on low sand dunes (ANBR09)**

Plate 21 **Ast.Te vegetation association on dune crest (ANBR06)**

Plate 22 **Ast.Te vegetation association on dune crest (ANCR08)**

Plate 23 Ast.Efv.Te vegetation association on dune crest (ANCR13)

Plate 24 Gs.Te vegetation association on dune crest (ANBR24)

Plate 25 Gs.Ast.Te vegetation association on linear dune crest (ANCR11)

Plate 26 Gs.Ast.Te vegetation association on linear dune crest (ANCR15)

Plate 27 Ate.Te vegetation association on undulating sandy plain, in Good condition (ANBR05)

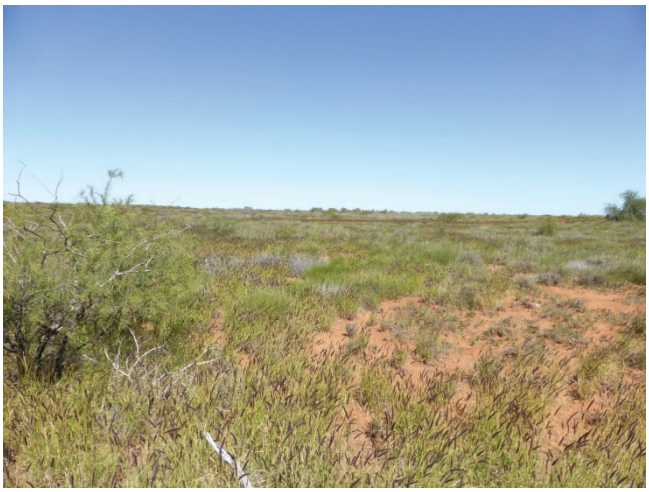


Plate 28 Ate.Te vegetation association on undulating sandy plain, in Poor Condition (ANBR03)

Plate 29 Ate.Asp.Te vegetation association on gently undulating sandy plain (ANBR20)

Plate 30 Ate.Asy.Te vegetation association on gently undulating sandy plain (ANBR08)

Plate 31 Ate.Asy.Te vegetation association on gently undulating sandy plain (ANCR10)

Plate 32 Ate.Efv.Te vegetation association in a dune swale (ANBR23)

Plate 33 Ate.Efv.Te vegetation association on the mid slope of a tall dune (MNC02)

5 Discussion

5.1 Conservation significance of flora within the survey area

In assessing the conservation significance of flora within the survey area, consideration was given to the rarity, biodiversity, endemism and representativeness of the flora in the area.

5.1.1 Rarity of the flora

The rarity of the flora was assessed via the various categories of TF (protected under the BC Act and under the EPBC Act) and PF (listed by DBCA) (See Appendix A).

No TF were recorded within the survey area for the current survey.

One PF species as currently listed by DBCA was recorded within the survey area - *Eremophila forrestii subsp. viridis* (P3). For the current survey an approximate total of 380 individuals were recorded from five locations within the survey area. These five populations were generally associated with the mid and upper slopes of the inland sand dunes; three individuals were also recorded at three other locations on lower slopes and the crests of low undulating dunes in the north east section of the survey area. The species was associated with eight of the sand dune and sand plain vegetation associations: Te; Ast.Te; Gs.Te; Gs.Ast.Te; Ate.Te; Ate.Asy.Te; Ast.Efv.Te; and Ate.Efv.Te.

Triumfetta echinata (P3) was not recorded for the current survey despite having been recorded at numerous (> 30) locations adjacent to the survey area in previous years by Onshore Environmental Consultants (OEC) (2008; 2009), Biota (2010a), and RPS (2009) within the sand dune vegetation. It should be noted, that *Triumfetta echinata* is often absent in vegetation that has not been recently burnt because it requires fire for germination of the seed (Chevron n.d.) and all these records within the Stage 2 ANSIA Improvement Scheme Area were observed regenerating from the burnt base of the parent plants after a fire which went through the area in 2011. It is possible therefore that the species would be evident after another fire in the area.

Two native taxa considered to be of “other” conservation significance, based on geographic range extensions, were recorded for the current survey: *Stenopetalum pedicellare;* and *Acacia sphaerostachya.*

Based on the absence of TF within the survey area, the known presence of one Priority 3 flora taxon (*Eremophila forrestii* subsp. *viridis*), and the potential presence of another (*Triumfetta echinata*), as well as the presence of two species of “other” conservation significance the rarity of the flora is assessed as moderate to high.

5.1.2 Biodiversity of the flora

A total of 158 native vascular flora taxa were recorded for the current survey. The ANSIA and Onslow environs were not identified by Kendrick and Mau (2002) as “known special values”, or areas of “high species and ecosystem diversity” within the subregion; the area in the Cape Range CARI subregion of particular note in terms of plant biodiversity is the Cape Range caves and gorges which has particularly high species richness for an arid area (Keighery and Gibson 1993).

The floristic diversity is assessed as moderate.

5.1.3 Endemism and representativeness of the flora

A total of 473 native taxa and 13 exotic (weed) taxa have been recorded from the surveys undertaken for the ANSIA to date including the current survey. This total of 486 native and weed taxa recorded for the ANSIA to date represents 45.9% of the total number of 1,058 flora taxa recorded for the Cape Range CARI subregion. A total of 165 vascular flora taxa were recorded for the current survey of which 20 were previously

unrecorded for the ANSIA Improvement Scheme Area; none of these additional species however are of conservation significance.

5.2 Conservation significance of vegetation within the survey area

In assessing the conservation significance of vegetation within the survey area, consideration was given to condition of the vegetation and the rarity of the vegetation.

5.2.1 Condition of the vegetation

Vegetation condition within the survey area ranged from Excellent to Degraded (Figures F-1 to F-4, and Table 17). The vast majority of the survey area (82.26%) was in Good, Good to Poor, or Poor condition, which Trudgen (1988) defined as exhibiting "obvious signs of damage caused by human activity since European settlement, including some obvious impact on the vegetation structure such as that caused by low levels of grazing or slightly aggressive weeds" (Good condition), and / or the vegetation "still retains its basic vegetation structure or ability to regenerate it after very obvious impacts of human activities since European settlement, such as grazing, partial clearing, frequent fires or aggressive weeds" (Poor condition). Most of the disturbance within the survey area relates to long-term grazing by livestock and weed infestation. Weed infestation was more obvious throughout much of the low-lying clayey plain, sandplain and low undulating sand dune vegetation where **Cenchrus ciliaris* was often recorded in the understorey, and **Prosopis pallida,* and **Vachellia farnesiana* were recorded, sometimes as dominants, in the overstorey.

The vegetation described and mapped for the linear sand dune crests and upper slopes, the samphire flats, and the bare claypans were generally in the best condition (predominantly Very Good), and the mudflats (Excellent), however, these areas only accounted for 8.91 % of the survey area.

Table 17 Vegetation condition within the survey area

Vegetation condition*		Survey area	
		Hectares (ha)	Percentage (%)
E	Excellent	55.91	2.18
VG	Very Good	173.08	6.73
G-VG	Good to Very Good	10.29	0.40
G	Good	602.96	23.46
G-P	Good to Poor	1,414.31	55.03
P	Poor	96.98	3.77
P-D	Poor to Degraded	125.00	4.86
D	Degraded	91.76	3.57

*Trudgen (1988) vegetation condition scale

5.2.2 Rarity of the vegetation

No TECs listed under the Commonwealth EPBC Act or the Western Australian BC Act occur within the survey area.

No PECs listed by the DBCA correlate with any of the vegetation associations described and mapped for the survey area.

On a regional scale three Beard (1975) vegetation associations (127; 589 and 670) are mapped for the survey area. These vegetation associations are widespread in the subregion with over 94% of their pre-European extent remaining. Kendrick and Mau (2002) assessed the reservation priority for Vegetation Association 127; 589 and 670 on a bioregional level as High; High; and Low respectively.

On a local scale the vegetation associations within the survey area known to support conservation significant flora are considered to have high conservation significance because they are important for the survival / persistence of the priority flora populations in the area. Eight of the nine vegetation association described and mapped for the sand dune and sand plain vegetation within the survey area supported populations or scattered individuals of *Eremophila forrestii* subsp. *viridis* (P3). The total area (ha) of each of these vegetation associations within the survey area, and the area (ha) of each in Good or better condition (considered therefore to have higher conservation significance) are presented in Table 18. A total of 729.43 ha of conservation significant sand dune and sand plain vegetation is present within the survey area which represents 28.38 % of the total survey area; of this 259.56 ha is in Good or better condition representing 10.1 % of the survey area. These dune and sand plain vegetation associations are also known to support *Triumfetta echinata* (P3) populations in the area, which, as discussed above, may be present within the survey area in another survey season or year following fire.

The samphire shrubland vegetation association (TECspp.), and mosaic unit (TECspp. / CP/Ea/Sm/Eb/Es) fringing the mudflats and occurring in some of the more saline claypans within the survey area are also considered to be of moderate to high conservation significance based on the potential presence of PF *Eleocharis papillosa* (although this species was not recorded in the survey area for the current survey). A total of 131.57 ha of these vegetation associations is present within the survey area (Table 18) most of which (127.27 ha) was in Good or better condition which represents 4.95 % of the total survey area.

Table 18 Vegetation associations of conservation significance within the survey area

Vegetation associations		Area (ha) within the survey area	Area (ha) in good or better condition	Area (ha) in good or better condition as a proportion of total survey area (%)
Vegetation of Sand Dunes and Plains				
Te	*Triodia epactia* Hummock Grassland	15.40	15.40	0.60
Ast.Te	*Acacia stellaticeps* Mid Sparse Shrubland over *Triodia epactia* Hummock Grassland	109.40	99.41	3.87
Ast.Efv.Te	*Acacia stellaticeps, Eremophila forrestii* subsp. *viridis* and *Scaevola spinescens* Mid Isolated Shrubs over *Triodia epactia* Hummock Grassland	1.63	1.63	0.06
Gs.Te	*Grevillea stenobotrya* Tall Open Shrubland over *Triodia epactia* Hummock Grassland	6.76	6.76	0.26
Gs.Ast.Te	*Grevillea stenobotrya* Tall Sparse Shrubland over *Acacia stellaticeps* Mid Sparse Shrubland over *Triodia epactia* Hummock Grassland	33.99	32.69	1.27
Ate.Te	*Acacia tetragonophylla* Tall to Mid Open Shrubland to Isolated Shrubs over *Triodia epactia* Open Hummock Grassland to Hummock Grassland	456.66	45.31	1.76

	Vegetation associations	Area (ha) within the survey area	Area (ha) in good or better condition	Area (ha) in good or better condition as a proportion of total survey area (%)
Ate.Asy.Te	*Acacia tetragonophylla* and *A. synchronicia* Mid to Tall Sparse Shrubland over *Triodia epactia* Sparse Hummock Grassland to Hummock Grassland	103.87	56.62	2.20
Ate.Efv.Te	Acacia tetragonophylla Tall Sparse Shrubland over Eremophila forrestii subsp. viridis Mid Sparse Shrubland over Triodia epactia Hummock Grassland	1.74	1.74	0.07
	TOTAL	**729.43**	**259.56**	**10.10**
Samphire Shrublands				
TECspp.	Tecticornia spp Low Open to Low Samphire Shrublands on and fringing saline claypans and mudflats	84.98	84.98	3.31
TECspp. / CP/Ea/Sm/Eb/Es	Mosaic of bare clay flats, samphire shrubland and *Eulalia aurea / Sporobolus mitchelii / Eriachne benthamii / Eragrostis setifolia* Open Tussock Grassland	46.59	42.29	1.65
	TOTAL	131.57	127.27	4.95

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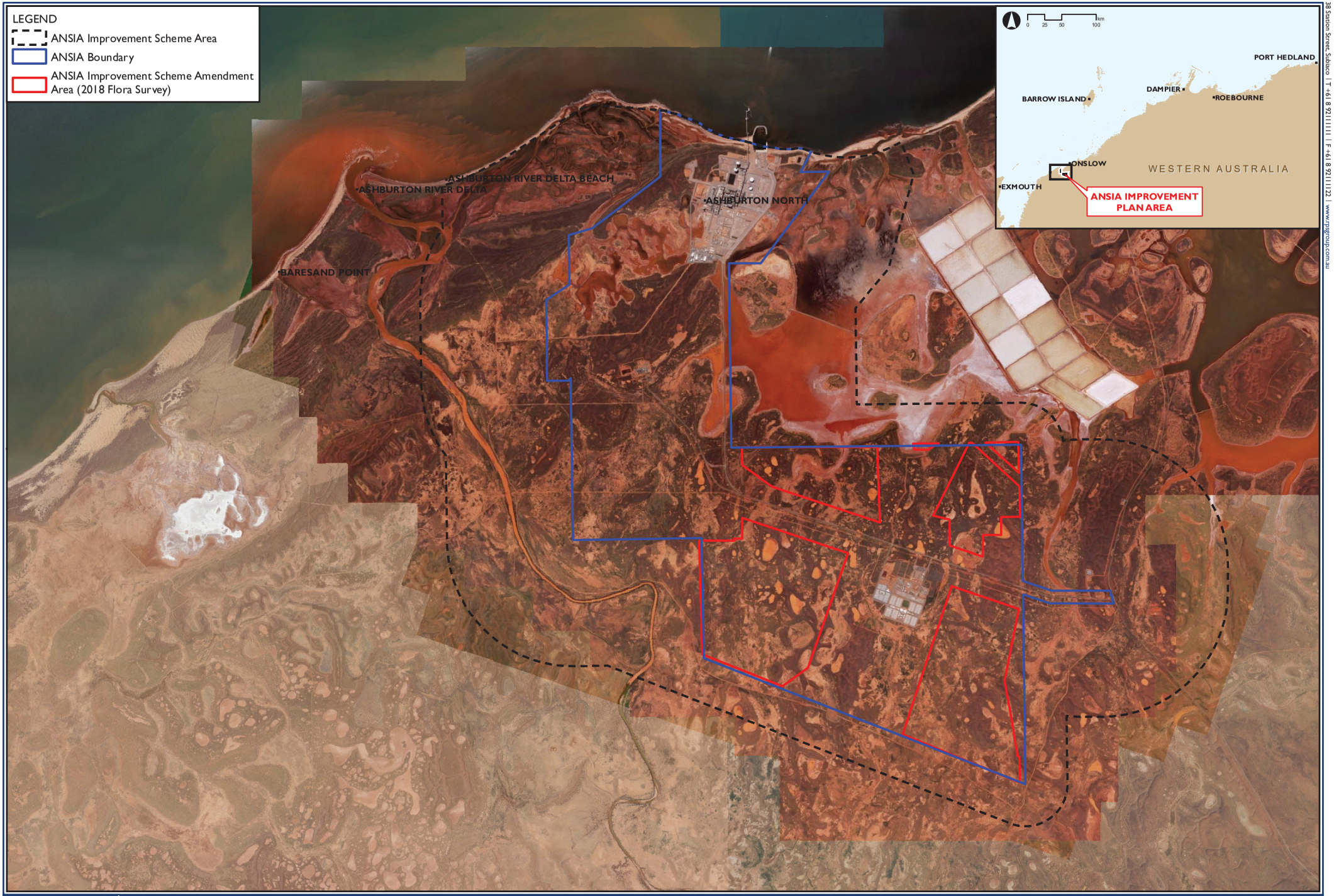
Figures



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GDA 1994 MGA Zone 50

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Figure A
ANSIA Improvement Scheme Amendment Area (2018 Flora Survey)
Site Location Plan

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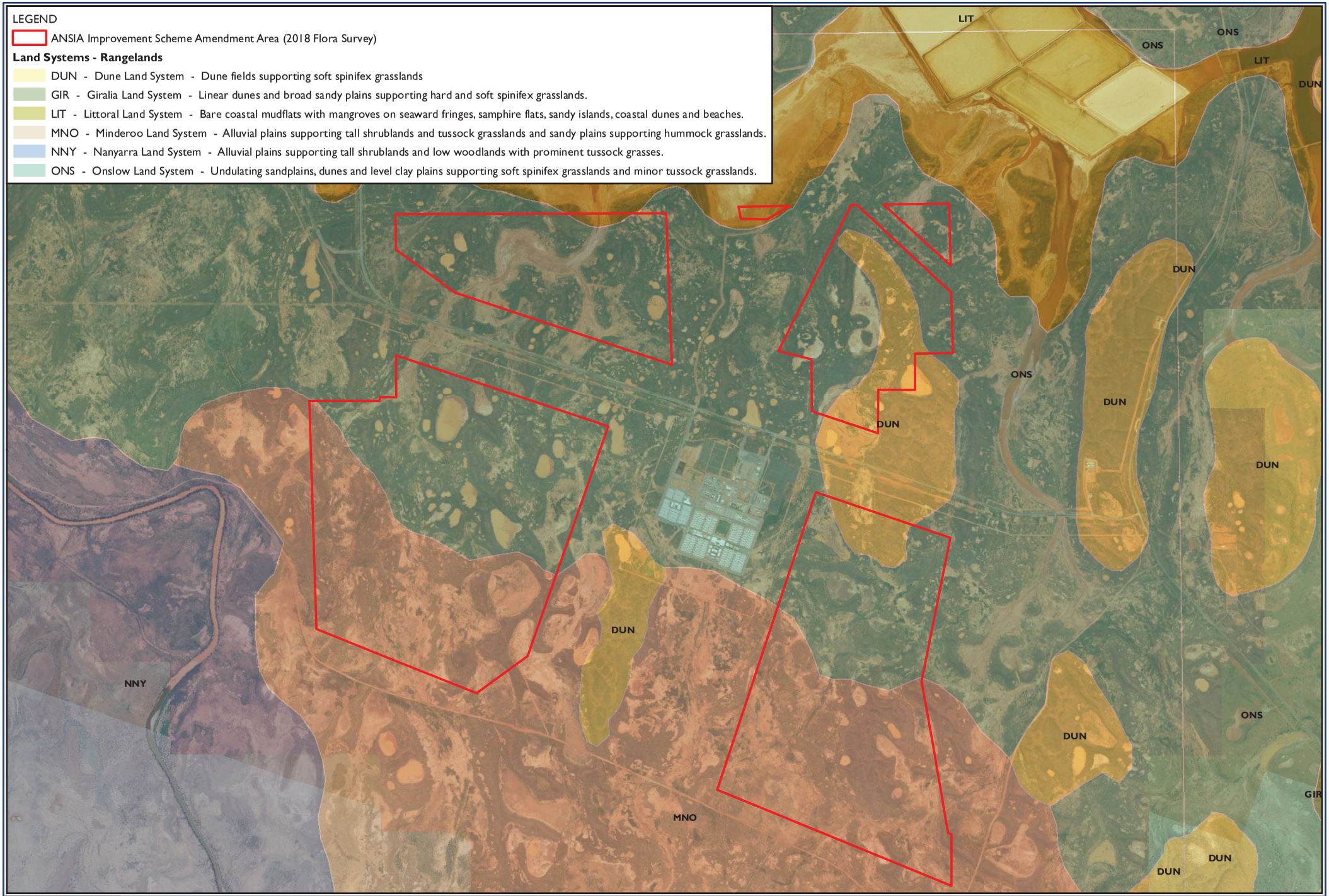

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Figure B
ANSIA Improvement Scheme Amendment Area (2018 Flora Survey)
Land Systems

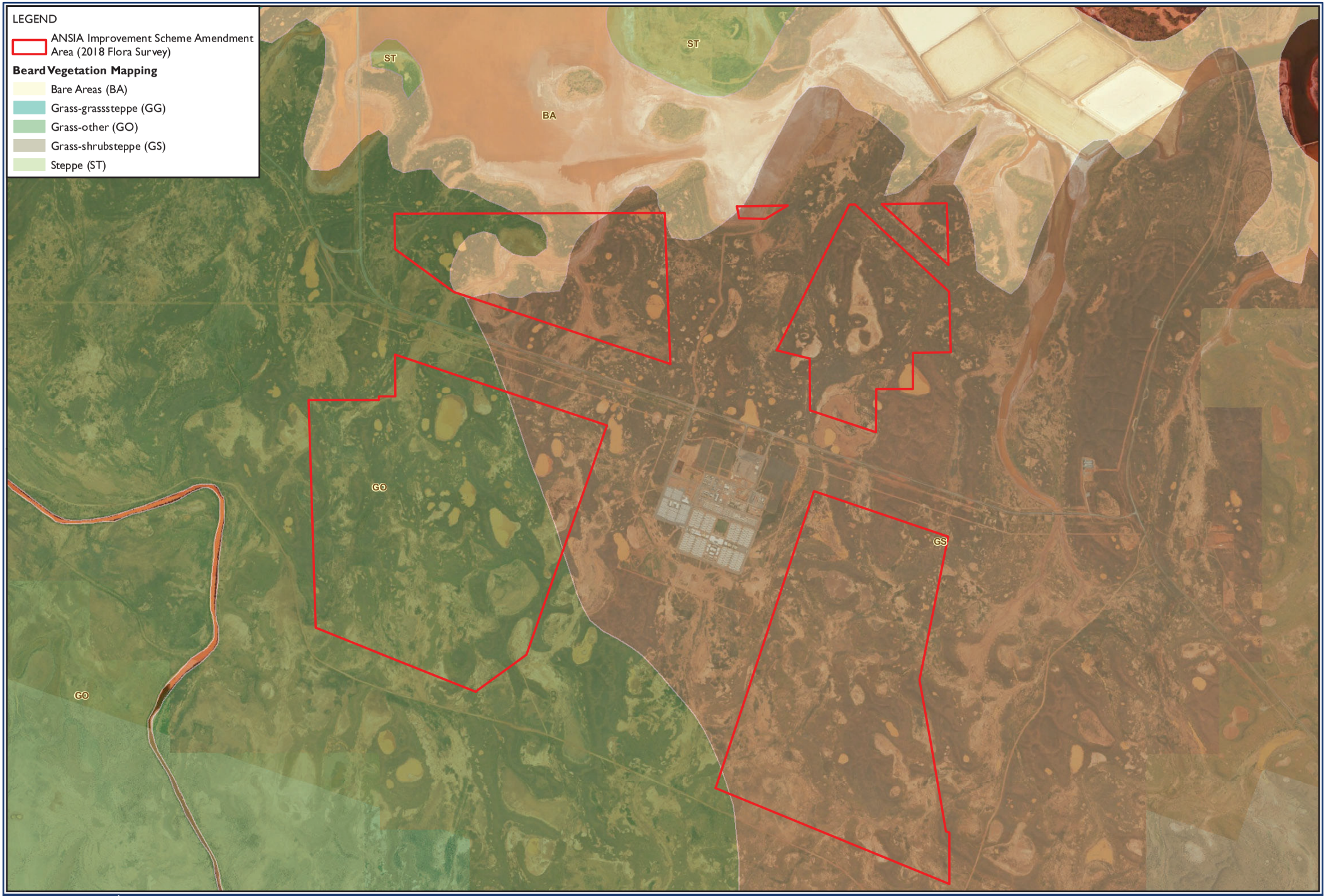

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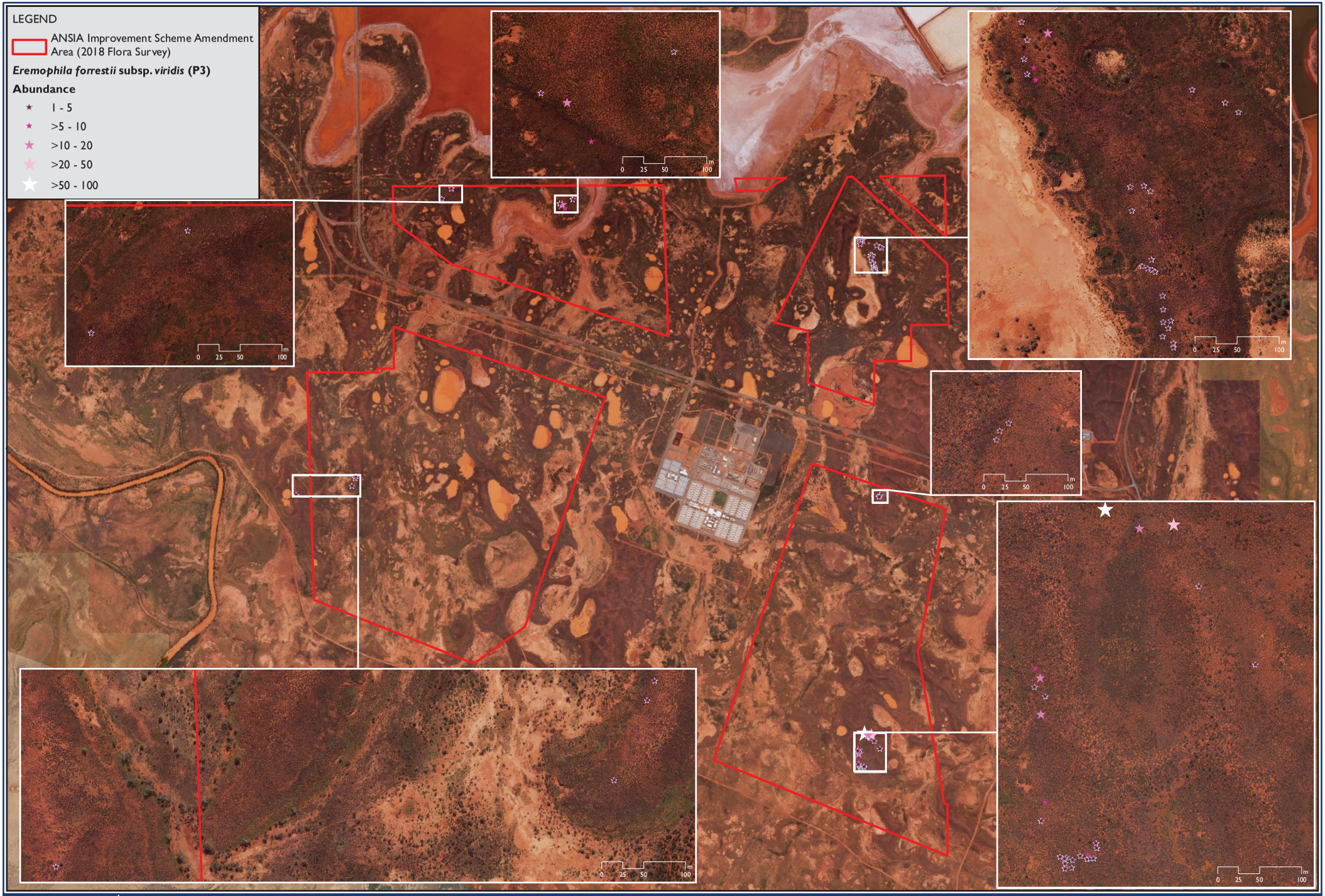
Figure C
ANSIA Improvement Scheme Amendment Area (2018 Flora Survey)
Beard Vegetation Associations



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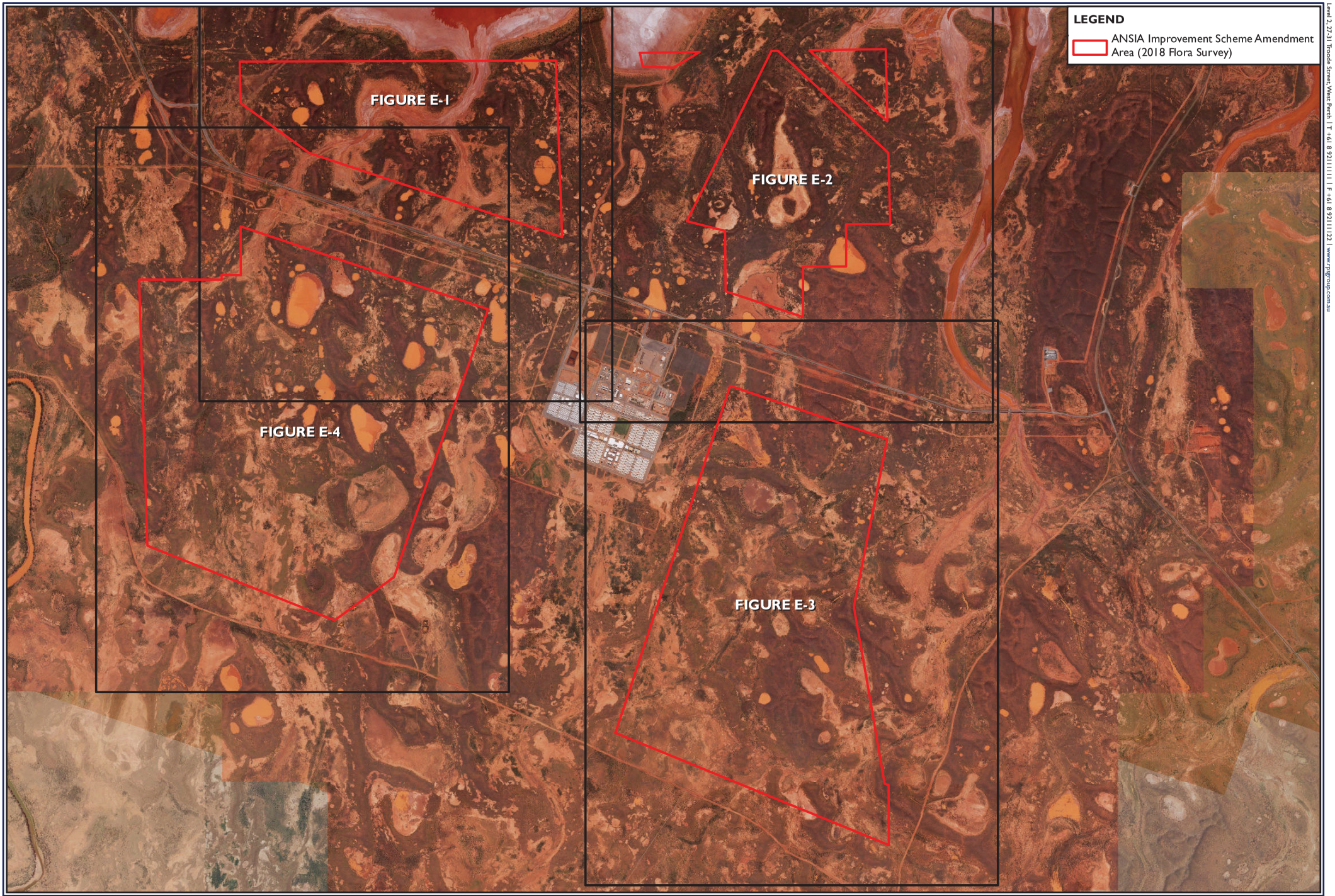
GDA 1994 MGA Zone 50

Figure D
ANSIA Improvement Scheme Amendment Area (2018 Flora Survey)
Conservation Significant Flora Locations



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GDA 1994 MGA Zone 50

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Figure E
ANSIA Improvement Scheme Amendment Area (2018 Flora Survey)
Vegetation Mapping Index

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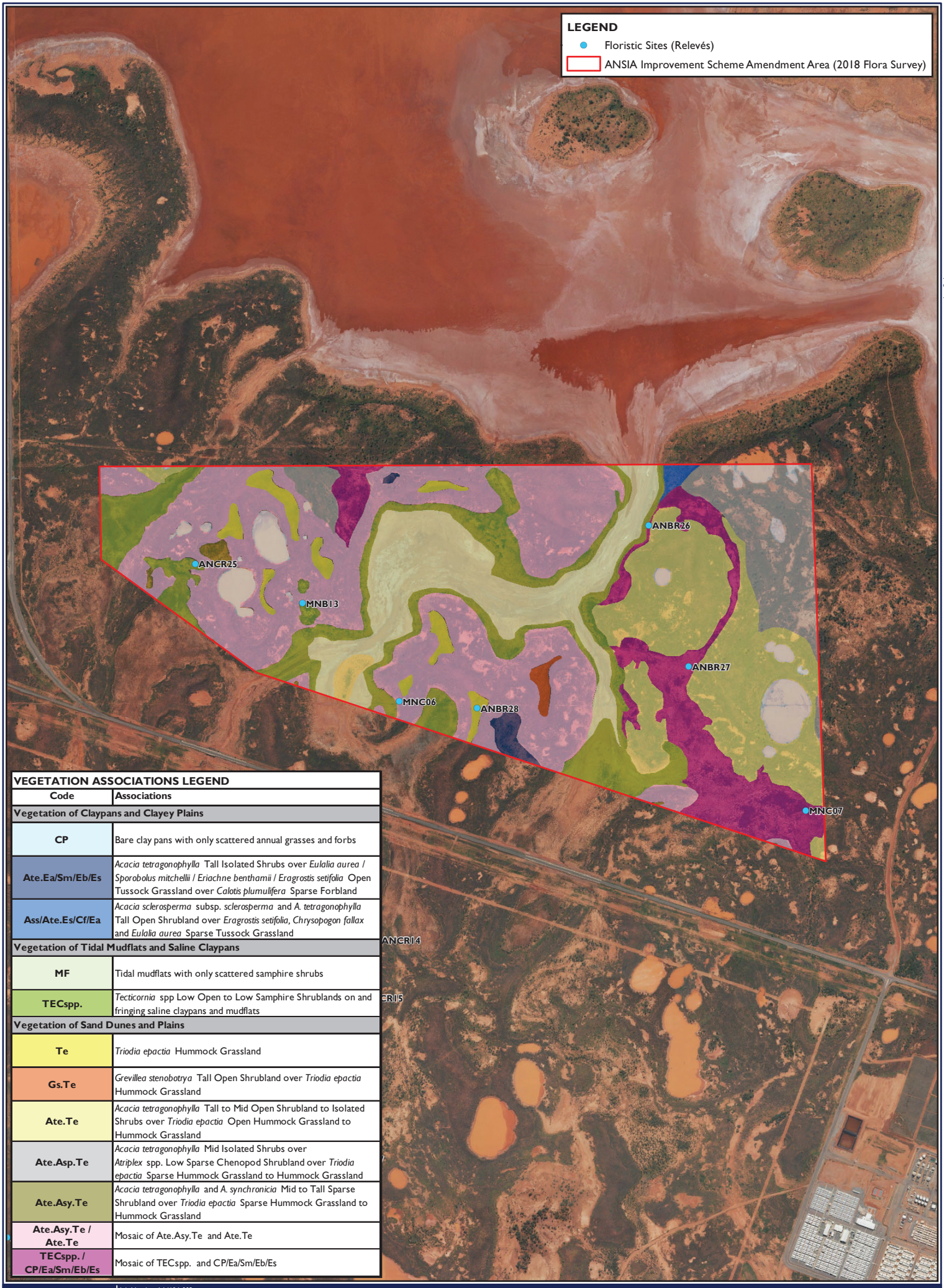

VEGETATION ASSOCIATIONS LEGEND	
Code	**Associations**
Vegetation of Claypans and Clayey Plains	
CP	Bare clay pans with only scattered annual grasses and forbs
Ate.Ea/Sm/Eb/Es	*Acacia tetragonophylla* Tall Isolated Shrubs over *Eulalia aurea* / *Sporobolus mitchellii* / *Eriachne benthamii* / *Eragrostis setifolia* Open Tussock Grassland over *Calotis plumulifera* Sparse Forbland
Ass/Ate.Es/Cf/Ea	*Acacia sclerosperma* subsp. *sclerosperma* and *A. tetragonophylla* Tall Open Shrubland over *Eragrostis setifolia*, *Chrysopogon fallax* and *Eulalia aurea* Sparse Tussock Grassland
Vegetation of Tidal Mudflats and Saline Claypans	
MF	Tidal mudflats with only scattered samphire shrubs
TECspp.	*Tecticornia* spp Low Open to Low Samphire Shrublands on and fringing saline claypans and mudflats
Vegetation of Sand Dunes and Plains	
Te	*Triodia epactia* Hummock Grassland
Gs.Te	*Grevillea stenobotrya* Tall Open Shrubland over *Triodia epactia* Hummock Grassland
Ate.Te	*Acacia tetragonophylla* Tall to Mid Open Shrubland to Isolated Shrubs over *Triodia epactia* Open Hummock Grassland to Hummock Grassland
Ate.Asp.Te	*Acacia tetragonophylla* Mid Isolated Shrubs over *Atriplex* spp. Low Sparse Chenopod Shrubland over *Triodia epactia* Sparse Hummock Grassland to Hummock Grassland
Ate.Asy.Te	*Acacia tetragonophylla* and *A. synchronicia* Mid to Tall Sparse Shrubland over *Triodia epactia* Sparse Hummock Grassland to Hummock Grassland
Ate.Asy.Te / Ate.Te	Mosaic of Ate.Asy.Te and Ate.Te
TECspp. / CP/Ea/Sm/Eb/Es	Mosaic of TECspp. and CP/Ea/Sm/Eb/Es

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Figure E-1 Sheet 1 of 4
ANSIA Improvement Scheme Amendment Area (2018 Flora Survey)
Vegetation Associations Mapping

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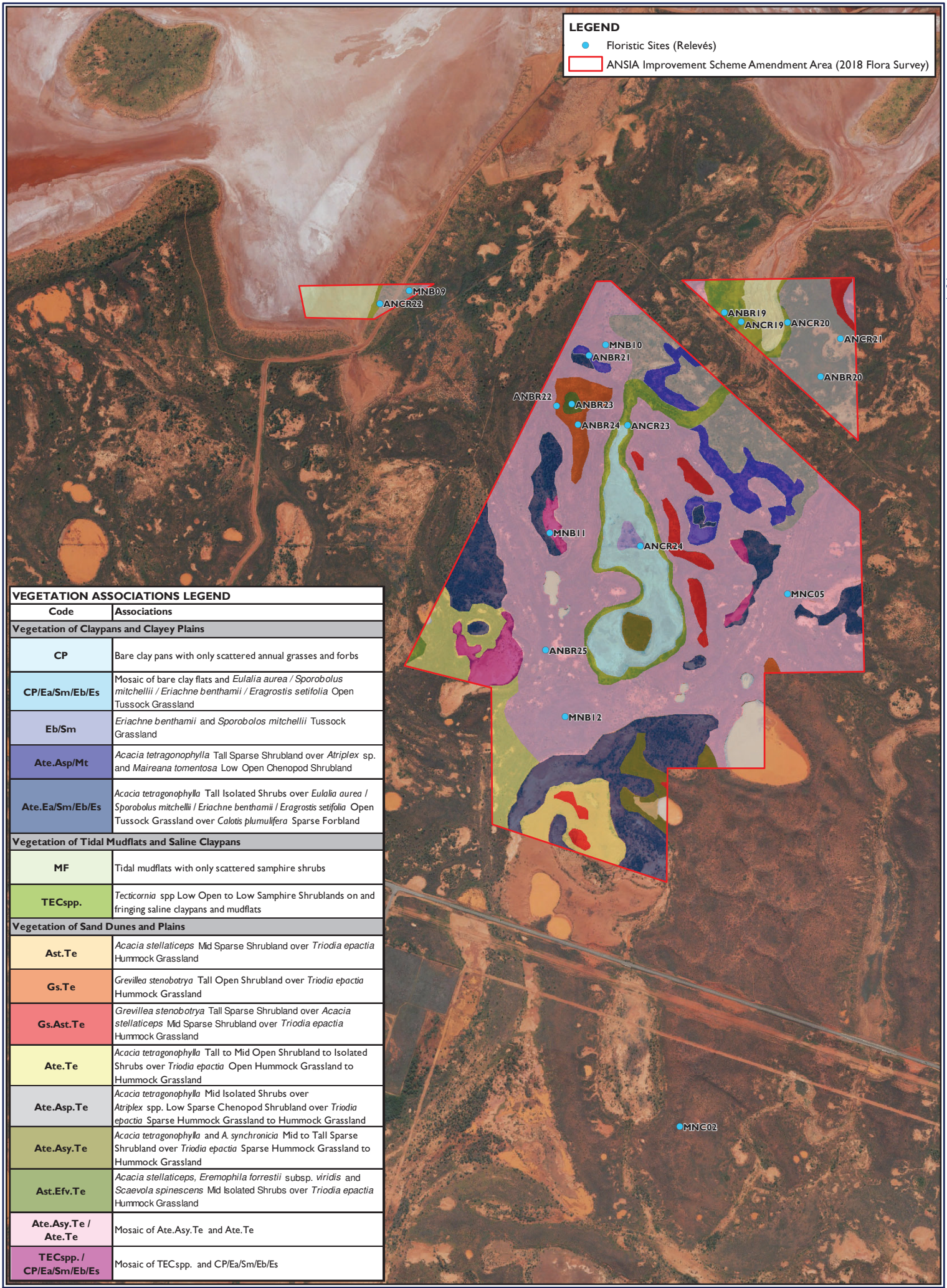

VEGETATION ASSOCIATIONS LEGEND	
Code	**Associations**
Vegetation of Claypans and Clayey Plains	
CP	Bare clay pans with only scattered annual grasses and forbs
CP/Ea/Sm/Eb/Es	Mosaic of bare clay flats and *Eulalia aurea / Sporobolus mitchellii / Eriachne benthamii / Eragrostis setifolia* Open Tussock Grassland
Eb/Sm	*Eriachne benthamii* and *Sporobolos mitchellii* Tussock Grassland
Ate.Asp/Mt	*Acacia tetragonophylla* Tall Sparse Shrubland over *Atriplex* sp. and *Maireana tomentosa* Low Open Chenopod Shrubland
Ate.Ea/Sm/Eb/Es	*Acacia tetragonophylla* Tall Isolated Shrubs over *Eulalia aurea / Sporobolus mitchellii / Eriachne benthamii / Eragrostis setifolia* Open Tussock Grassland over *Calotis plumulifera* Sparse Forbland
Vegetation of Tidal Mudflats and Saline Claypans	
MF	Tidal mudflats with only scattered samphire shrubs
TECspp.	*Tecticornia* spp Low Open to Low Samphire Shrublands on and fringing saline claypans and mudflats
Vegetation of Sand Dunes and Plains	
Ast.Te	*Acacia stellaticeps* Mid Sparse Shrubland over *Triodia epactia* Hummock Grassland
Gs.Te	*Grevillea stenobotrya* Tall Open Shrubland over *Triodia epactia* Hummock Grassland
Gs.Ast.Te	*Grevillea stenobotrya* Tall Sparse Shrubland over *Acacia stellaticeps* Mid Sparse Shrubland over *Triodia epactia* Hummock Grassland
Ate.Te	*Acacia tetragonophylla* Tall to Mid Open Shrubland to Isolated Shrubs over *Triodia epactia* Open Hummock Grassland to Hummock Grassland
Ate.Asp.Te	*Acacia tetragonophylla* Mid Isolated Shrubs over *Atriplex* spp. Low Sparse Chenopod Shrubland over *Triodia epactia* Sparse Hummock Grassland to Hummock Grassland
Ate.Asy.Te	*Acacia tetragonophylla* and *A. synchronicia* Mid to Tall Sparse Shrubland over *Triodia epactia* Sparse Hummock Grassland to Hummock Grassland
Ast.Efv.Te	*Acacia stellaticeps, Eremophila forrestii* subsp. *viridis* and *Scaevola spinescens* Mid Isolated Shrubs over *Triodia epactia* Hummock Grassland
Ate.Asy.Te / Ate.Te	Mosaic of Ate.Asy.Te and Ate.Te
TECspp. / CP/Ea/Sm/Eb/Es	Mosaic of TECspp. and CP/Ea/Sm/Eb/Es

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Figure E-2 Sheet 2 of 4
ANSIA Improvement Scheme Amendment Area (2018 Flora Survey)
Vegetation Associations Mapping

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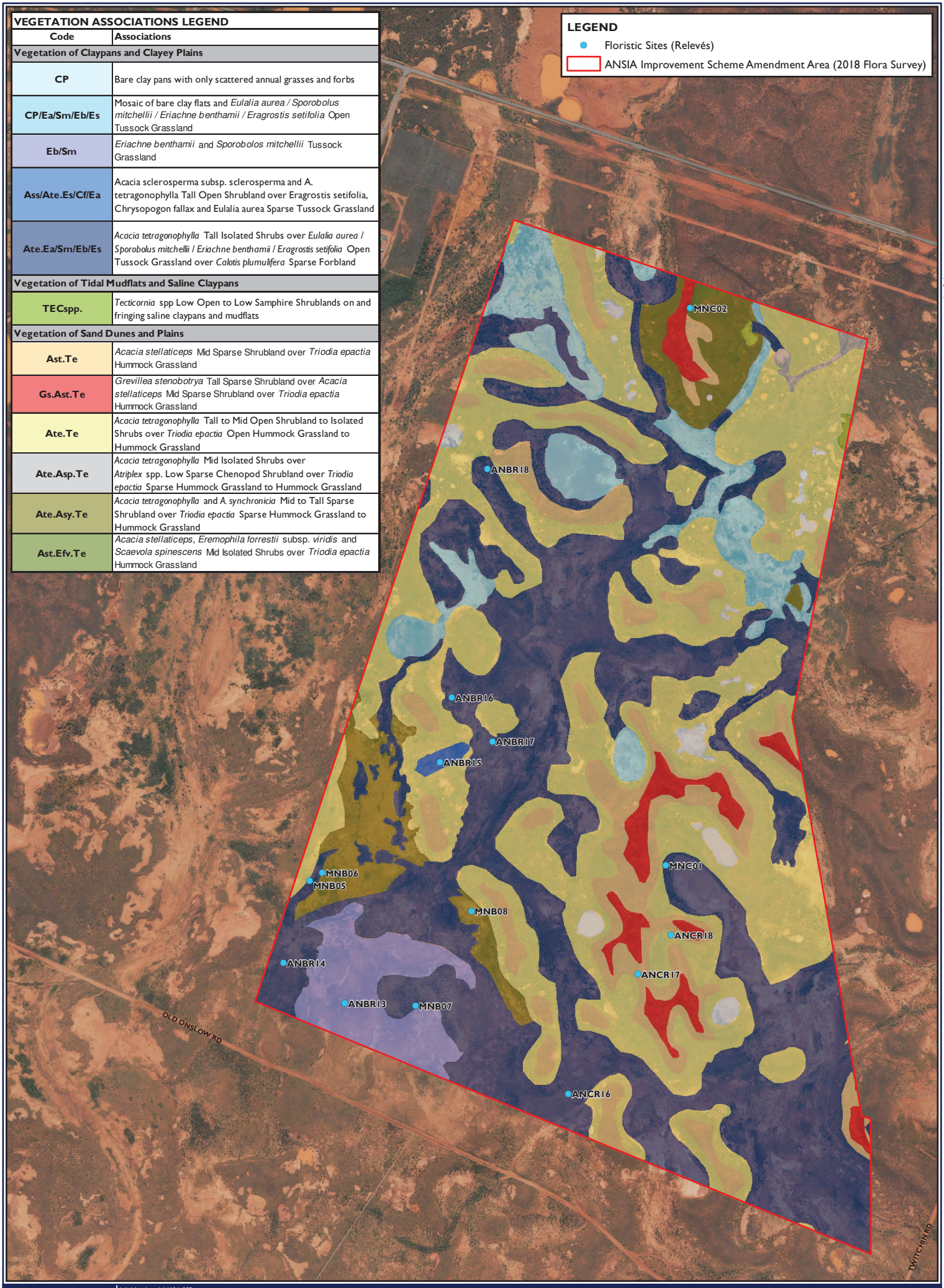

VEGETATION ASSOCIATIONS LEGEND	
Code	**Associations**
Vegetation of Claypans and Clayey Plains	
CP	Bare clay pans with only scattered annual grasses and forbs
CP/Ea/Sm/Eb/Es	Mosaic of bare clay flats and *Eulalia aurea / Sporobolus mitchellii / Eriachne benthamii / Eragrostis setifolia* Open Tussock Grassland
Eb/Sm	*Eriachne benthamii* and *Sporobolos mitchellii* Tussock Grassland
Ass/Ate.Es/Cf/Ea	Acacia sclerosperma subsp. sclerosperma and A. tetragonophylla Tall Open Shrubland over Eragrostis setifolia, Chrysopogon fallax and Eulalia aurea Sparse Tussock Grassland
Ate.Ea/Sm/Eb/Es	*Acacia tetragonophylla* Tall Isolated Shrubs over *Eulalia aurea / Sporobolus mitchellii / Eriachne benthamii / Eragrostis setifolia* Open Tussock Grassland over *Calotis plumulifera* Sparse Forbland
Vegetation of Tidal Mudflats and Saline Claypans	
TECspp.	*Tecticornia* spp Low Open to Low Samphire Shrublands on and fringing saline claypans and mudflats
Vegetation of Sand Dunes and Plains	
Ast.Te	*Acacia stellaticeps* Mid Sparse Shrubland over *Triodia epactia* Hummock Grassland
Gs.Ast.Te	*Grevillea stenobotrya* Tall Sparse Shrubland over *Acacia stellaticeps* Mid Sparse Shrubland over *Triodia epactia* Hummock Grassland
Ate.Te	*Acacia tetragonophylla* Tall to Mid Open Shrubland to Isolated Shrubs over *Triodia epactia* Open Hummock Grassland to Hummock Grassland
Ate.Asp.Te	*Acacia tetragonophylla* Mid Isolated Shrubs over *Atriplex* spp. Low Sparse Chenopod Shrubland over *Triodia epactia* Sparse Hummock Grassland to Hummock Grassland
Ate.Asy.Te	*Acacia tetragonophylla* and *A. synchronicia* Mid to Tall Sparse Shrubland over *Triodia epactia* Sparse Hummock Grassland to Hummock Grassland
Ast.Efv.Te	*Acacia stellaticeps, Eremophila forrestii* subsp. *viridis* and *Scaevola spinescens* Mid Isolated Shrubs over *Triodia epactia* Hummock Grassland

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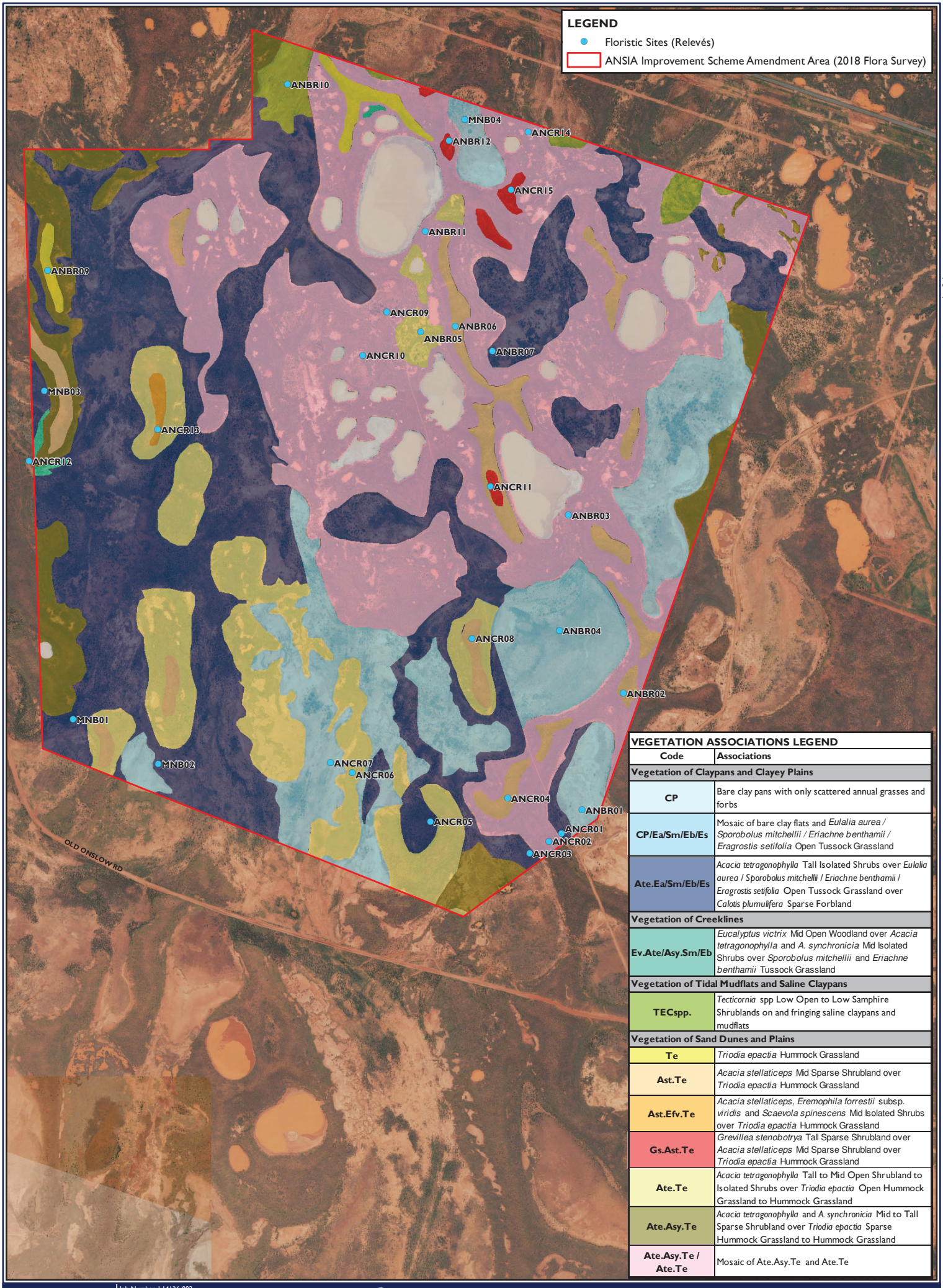
GDA 1994 MGA Zone 50
0 125 250 500 m

Figure E-3 Sheet 3 of 4
ANSIA Improvement Scheme Amendment Area (2018 Flora Survey)
Vegetation Associations Mapping

Document Path: G:\Jobs\L_Jobs\L14136 - Ashburton North SIA\Figures L14136-002\L1413602_G_005-3_FigE-3 Vegetation Associations Sh 3 of 4_181122.mxd



VEGETATION ASSOCIATIONS LEGEND	
Code	**Associations**
Vegetation of Claypans and Clayey Plains	
CP	Bare clay pans with only scattered annual grasses and forbs
CP/Ea/Sm/Eb/Es	Mosaic of bare clay flats and *Eulalia aurea / Sporobolus mitchellii / Eriachne benthamii / Eragrostis setifolia* Open Tussock Grassland
Ate.Ea/Sm/Eb/Es	*Acacia tetragonophylla* Tall Isolated Shrubs over *Eulalia aurea / Sporobolus mitchellii / Eriachne benthamii / Eragrostis setifolia* Open Tussock Grassland over *Calotis plumulifera* Sparse Forbland
Vegetation of Creeklines	
Ev.Ate/Asy.Sm/Eb	*Eucalyptus victrix* Mid Open Woodland over *Acacia tetragonophylla* and *A. synchronicia* Mid Isolated Shrubs over *Sporobolus mitchellii* and *Eriachne benthamii* Tussock Grassland
Vegetation of Tidal Mudflats and Saline Claypans	
TECspp.	*Tecticornia* spp Low Open to Low Samphire Shrublands on and fringing saline claypans and mudflats
Vegetation of Sand Dunes and Plains	
Te	*Triodia epactia* Hummock Grassland
Ast.Te	*Acacia stellaticeps* Mid Sparse Shrubland over *Triodia epactia* Hummock Grassland
Ast.Efv.Te	*Acacia stellaticeps, Eremophila forrestii* subsp. *viridis* and *Scaevola spinescens* Mid Isolated Shrubs over *Triodia epactia* Hummock Grassland
Gs.Ast.Te	*Grevillea stenobotrya* Tall Sparse Shrubland over *Acacia stellaticeps* Mid Sparse Shrubland over *Triodia epactia* Hummock Grassland
Ate.Te	*Acacia tetragonophylla* Tall to Mid Open Shrubland to Isolated Shrubs over *Triodia epactia* Open Hummock Grassland to Hummock Grassland
Ate.Asy.Te	*Acacia tetragonophylla* and *A. synchronicia* Mid to Tall Sparse Shrubland over *Triodia epactia* Sparse Hummock Grassland to Hummock Grassland
Ate.Asy.Te / Ate.Te	Mosaic of Ate.Asy.Te and Ate.Te

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Figure E-4 Sheet 4 of 4
ANSIA Improvement Scheme Amendment Area (2018 Flora Survey)
Vegetation Associations Mapping

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VEGETATION CONDITION LEGEND		
Code	**Condition**	**Definition**
E	Excellent	Pristine or nearly so, no obvious signs of damage caused by human activities since European settlement
VG	Very Good	Some relatively slight signs of damage caused by human activities since European settlement. For example, some signs of damage to tree trunks caused by repeated fire, the presence of some relatively non-aggressive weeds, or occasional vehicle tracks
G	Good	More obvious signs of damage caused by human activity since European settlement, including some obvious impact on the vegetation structure such as that caused by low levels of grazing or slightly aggressive weeds
G-P	Good to Poor	
P	Poor	Still retains basic vegetation structure or ability to regenerate it after very obvious impacts of human activities since European settlement, such as grazing, partial clearing, frequent fires or aggressive weeds
D	Degraded	Severely impacted by grazing, very frequent fires, clearing or a combination of these activities. Scope for some regeneration but not to a state approaching good condition without intensive management. Usually with a number of weed species present including very aggressive species

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Figure F-1 Sheet 1 of 4
ANSIA Improvement Scheme Amendment Area (2018 Flora Survey)
Vegetation Condition Mapping

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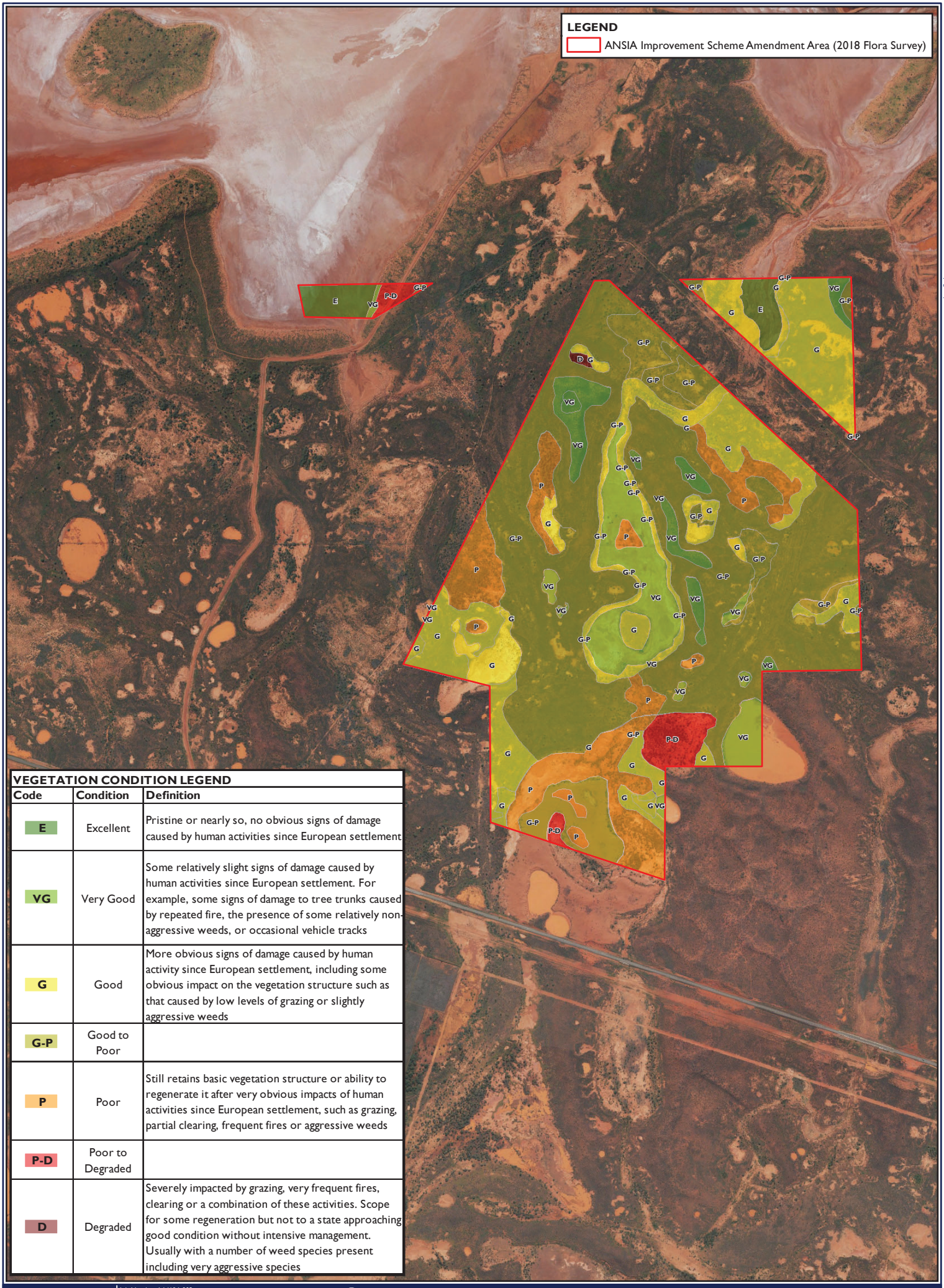

VEGETATION CONDITION LEGEND

Code	Condition	Definition
E	Excellent	Pristine or nearly so, no obvious signs of damage caused by human activities since European settlement
VG	Very Good	Some relatively slight signs of damage caused by human activities since European settlement. For example, some signs of damage to tree trunks caused by repeated fire, the presence of some relatively non-aggressive weeds, or occasional vehicle tracks
G	Good	More obvious signs of damage caused by human activity since European settlement, including some obvious impact on the vegetation structure such as that caused by low levels of grazing or slightly aggressive weeds
G-P	Good to Poor	
P	Poor	Still retains basic vegetation structure or ability to regenerate it after very obvious impacts of human activities since European settlement, such as grazing, partial clearing, frequent fires or aggressive weeds
P-D	Poor to Degraded	
D	Degraded	Severely impacted by grazing, very frequent fires, clearing or a combination of these activities. Scope for some regeneration but not to a state approaching good condition without intensive management. Usually with a number of weed species present including very aggressive species

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GDA 1994 MGA Zone 50
0 125 250 500 m

Figure F-2 Sheet 2 of 4
ANSIA Improvement Scheme Amendment Area (2018 Flora Survey)
Vegetation Condition Mapping

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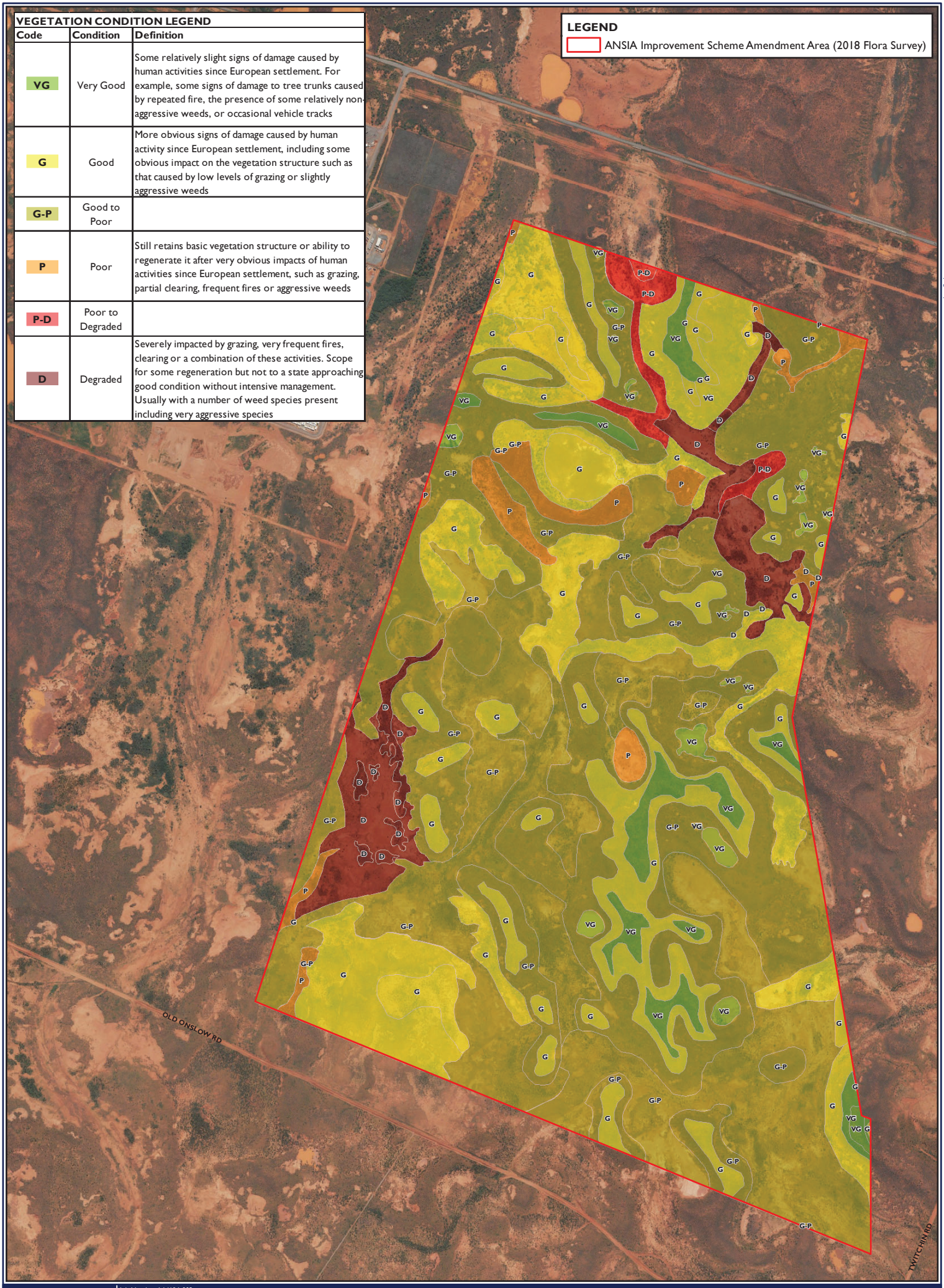

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GDA 1994 MGA Zone 50
0 125 250 500 m

Figure F-3 Sheet 3 of 4
ANSIA Improvement Scheme Amendment Area (2018 Flora Survey)
Vegetation Condition Mapping

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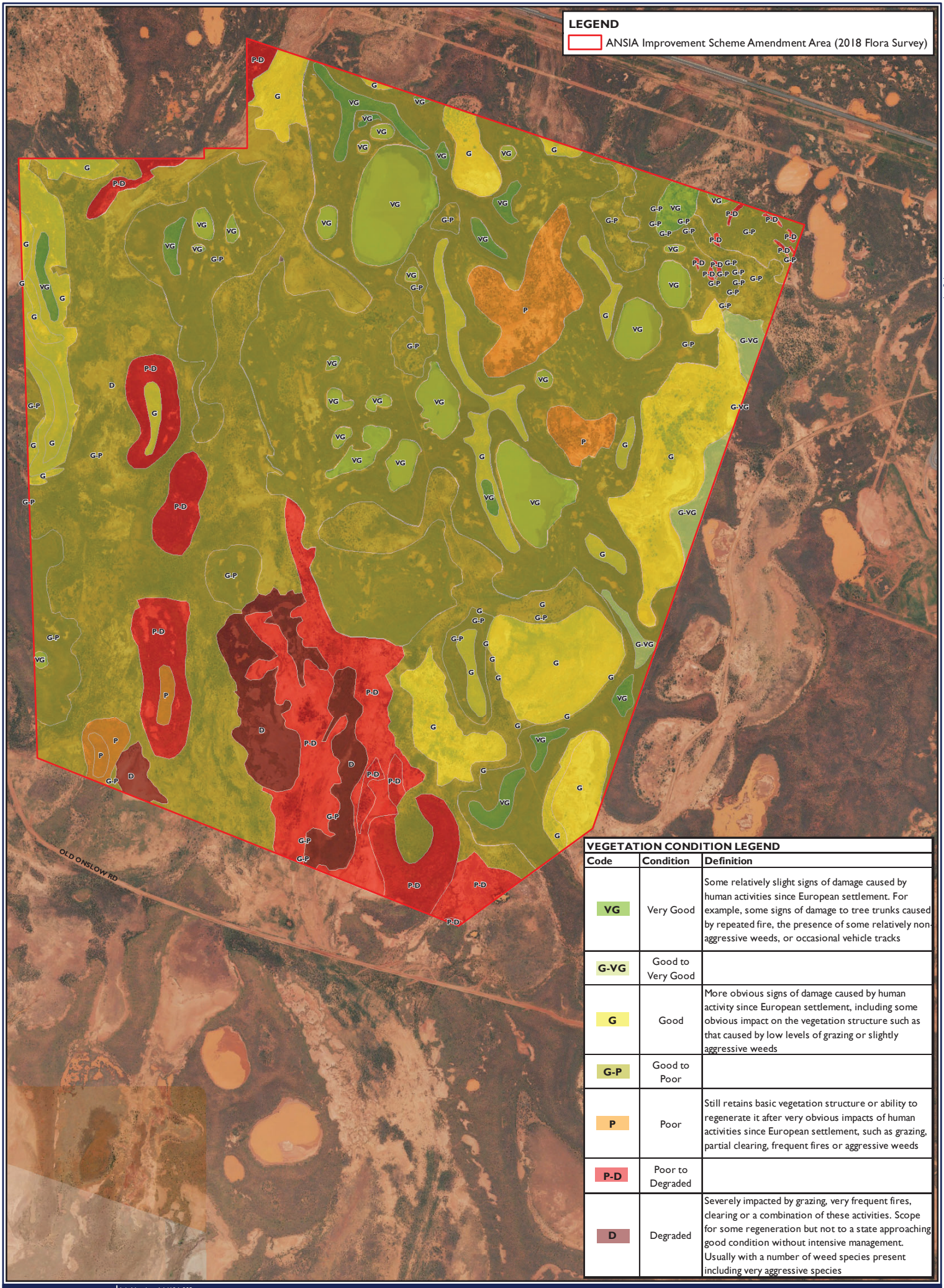

VEGETATION CONDITION LEGEND

Code	Condition	Definition
VG	Very Good	Some relatively slight signs of damage caused by human activities since European settlement. For example, some signs of damage to tree trunks caused by repeated fire, the presence of some relatively non-aggressive weeds, or occasional vehicle tracks
G-VG	Good to Very Good	
G	Good	More obvious signs of damage caused by human activity since European settlement, including some obvious impact on the vegetation structure such as that caused by low levels of grazing or slightly aggressive weeds
G-P	Good to Poor	
P	Poor	Still retains basic vegetation structure or ability to regenerate it after very obvious impacts of human activities since European settlement, such as grazing, partial clearing, frequent fires or aggressive weeds
P-D	Poor to Degraded	
D	Degraded	Severely impacted by grazing, very frequent fires, clearing or a combination of these activities. Scope for some regeneration but not to a state approaching good condition without intensive management. Usually with a number of weed species present including very aggressive species

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0 125 250 500 m

Figure F-4 Sheet 4 of 4
ANSIA Improvement Scheme Amendment Area (2018 Flora Survey)
Vegetation Condition Mapping

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Appendix A
Definitions

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Appendix A Definitions

Table A-1 Conservation codes for Western Australian flora

Category	Definition
T	**Threatened Flora (Extant)** Taxa that have been adequately searched for and are deemed to be in the wild either rare, in danger of extinction, or otherwise in need of special protection, and have been gazetted as such (Schedule 1 of the Wildlife Conservation (Rare Flora) Notice under the *Wildlife Conservation Act 1950*). Threatened Flora (Schedule 1) are further ranked by the Department according to their level of threat using IUCN Red List criteria: CR: Critically Endangered – considered to be facing an extremely high risk of extinction in the wild EN: Endangered – considered to be facing a very high risk of extinction in the wild VU: Vulnerable – considered to be facing a high risk of extinction in the wild.
X	**Presumed Extinct Flora** Taxa which have been adequately searched for and there is no reasonable doubt that the last individual has died, and have been gazetted as such (Schedule 2 of the Wildlife Conservation (Rare Flora) Notice under the *Wildlife Conservation Act 1950*).
P1	**Priority One: Poorly-known Taxa** Species that are known from one or a few locations (generally five or less) which are potentially at risk. All occurrences are either: very small; or on lands not managed for conservation, e.g. agricultural or pastoral lands, urban areas, road and rail reserves, gravel reserves and active mineral leases; or otherwise under threat of habitat destruction or degradation. Species may be included if they are comparatively well known from one or more locations but do not meet adequacy of survey requirements and appear to be under immediate threat from known threatening processes. Such species are in urgent need of further survey
P2	**Priority Two: Poorly-known Taxa** Species that are known from one or a few locations (generally five or less), some of which are on lands managed primarily for nature conservation, e.g. national parks, conservation parks, nature reserves and other lands with secure tenure being managed for conservation. Species may be included if they are comparatively well known from one or more locations but do not meet adequacy of survey requirements and appear to be under threat from known threatening processes. Such species are in urgent need of further survey.
P3	**Priority Three: Poorly-known Taxa** Species that are known from several locations, and the species does not appear to be under imminent threat, or from few but widespread locations with either large population size or significant remaining areas of apparently suitable habitat, much of it not under imminent threat. Species may be included if they are comparatively well known from several locations but do not meet adequacy of survey requirements and known threatening processes exist that could affect them. Such species are in need of further survey.
P4	**Priority Four: Rare, Near Threatened and Other Taxa in Need of Monitoring** (a) Rare. Species that are considered to have been adequately surveyed, or for which sufficient knowledge is available, and that are considered not currently threatened or in need of special protection, but could be if present circumstances change. These species are usually represented on conservation lands. (b) Near Threatened. Species that are considered to have been adequately surveyed and that are close to qualifying for Vulnerable, but are not listed as Conservation Dependent. (c) Species that have been removed from the list of threatened species during the past five years for reasons other than taxonomy.

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Table A-2 EPBC Act conservation codes

Category	Definition
EX	**Extinct** A taxon is Extinct when there is no reasonable doubt that the last individual has died. A taxon is presumed Extinct when exhaustive surveys in known and/or expected habitat, at appropriate times (diurnal, seasonal, annual) throughout its historic range have failed to record an individual. Surveys should be over a time frame appropriate to the taxon's life cycle and life form.
EW	**Extinct in the Wild** A taxon is Extinct in the Wild when it is known only to survive in cultivation, in captivity or as a naturalised population (or populations) well outside the past range. A taxon is presumed Extinct in the Wild when exhaustive surveys in known and/or expected habitat, at appropriate times (diurnal, seasonal, annual) throughout its historic range have failed to record an individual. Surveys should be over a time frame appropriate to the taxon's life cycle and life form.
CR	**Critically Endangered** A taxon is Critically Endangered when the best available evidence indicates that it meets any of the criteria A to E for Critically Endangered (see Section V), and it is therefore considered to be facing an extremely high risk of extinction in the wild.
EN	**Endangered** A taxon is Endangered when the best available evidence indicates that it meets any of the criteria A to E for Endangered (see Section V), and it is therefore considered to be facing a very high risk of extinction in the wild.
VU	**Vulnerable** A taxon is Vulnerable when the best available evidence indicates that it meets any of the criteria A to E for Vulnerable (see Section V), and it is therefore considered to be facing a high risk of extinction in the wild.
NT	**Near Threatened** A taxon is Near Threatened when it has been evaluated against the criteria but does not qualify for Critically Endangered, Endangered or Vulnerable now, but is close to qualifying for or is likely to qualify for a threatened category in the near future.
LC	**Least Concern** A taxon is Least Concern when it has been evaluated against the criteria and it does not qualify for Critically Endangered, Endangered, Vulnerable or Near Threatened. Widespread and abundant taxa are included in this category.
DD	**Data Deficient** A taxon is Data Deficient when there is inadequate information to make a direct, or indirect, assessment of its risk of extinction based on its distribution and/or population status. A taxon in this category may be well studied, and its biology well known, but appropriate data on abundance and/or distribution are lacking. Data Deficient is therefore not a category of threat. Listing of taxa in this category indicates that more information is required and acknowledges the possibility that future research will show that threatened classification is appropriate. It is important to make positive use of whatever data are available. In many cases, great care should be exercised in choosing between DD and a threatened status. If the range of a taxon is suspected to be relatively circumscribed, and a considerable period has elapsed since the last record of the taxon, threatened status may well be justified.
NE	**Not Evaluated** A taxon is Not Evaluated when it has not yet been evaluated against the criteria.

(Source: IUCN Red List 2017)

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Table A-3 Threatened ecological communities category of threat

Category	Definition
Presumed Totally Destroyed (PD)	An ecological community will be listed as presumed totally destroyed if there are no recent records of the community being extant and either of the following applies: Records within the last 50 years have not been confirmed despite thorough searches or known or likely habitats or. All occurrences recorded within the last 50 years have since been destroyed.
Critically Endangered (CR)	An ecological community will be listed as **Critically Endangered** when it has been adequately surveyed and is found to be facing an extremely high risk of total destruction in the immediate future. This will be determined on the basis of the best available information, by it meeting **any one or more** of the following criteria: The estimated geographic range, and/or total area occupied, and/or number of discrete occurrences since European settlement have been reduced by at least 90% and either or both of the following apply: Geographic range, and/or total area occupied and/or number of discrete occurrences are continuing to decline such that total destruction of the community is imminent (within approximately five years). Modification throughout its range is continuing such that in the immediate future (within approximately five years) the community is unlikely to be capable of being substantially rehabilitated. Current distribution is limited, and **one or more** of the following apply (i, ii or iii): Geographic range and/or number of discrete occurrences, and/or area occupied is highly restricted and the community is currently subject to known threatening processes, which are likely to result in total destruction throughout its range in the immediate future (within approximately five years). There are very few occurrences, each of which is small and/or isolated and extremely vulnerable to known threatening processes. There may be many occurrences but total area is very small and each occurrence is small and/or isolated and extremely vulnerable to known threatening processes. The ecological community exists only as highly modified occurrences that may be capable of being rehabilitated if such work begins in the immediate future (within approximately five years).
Endangered (EN)	An ecological community will be listed as Endangered when it has been adequately surveyed and is not Critically Endangered but is facing a very high risk of total destruction in the near future. This will be determined on the basis of the best available information, by it meeting any one or more of the following criteria (A, B or C): The estimated geographic range, and/or total area occupied, and/or number of discrete occurrences since European settlement have been reduced by at least 70% and either or both of the following apply (i or ii) Geographic range, and/or total area occupied and/or number of discrete occurrences are continuing to decline such that total destruction of the community is likely in the short term (within approximately 10 years). Modification throughout its range is continuing such that in the short-term future (within approximately 10 years) the community is unlikely to be capable of being substantially restored or rehabilitated. Current distribution is limited, and one or more of the following apply (i, ii or iii): Geographic range and/or number of discrete occurrences, and/or area occupied is highly restricted and the community is currently subject to known threatening processes which are likely to result in total destruction throughout its range in the short term future (within approximately 10 years). There are very few occurrences, each of which is small and/or isolated and extremely vulnerable to known threatening processes. There may be many occurrences but total area is very small and each occurrence is small and/or isolated and extremely vulnerable to known threatening processes. The ecological community exists only as highly modified occurrences, which may be capable of being rehabilitated if such work begins in the short-term future (within approximately 10 years).

Category	Definition
Vulnerable (VU)	An ecological community will be listed as Vulnerable when it has been adequately surveyed and is not Critically Endangered or Endangered but is facing a high risk of total destruction in the medium to long term future. This will be determined on the basis of the best available information, by it meeting any one or more of the following criteria (A, B or C): The ecological community exists largely as modified occurrences, which are likely to be capable of being substantially restored or rehabilitated. The ecological community can be modified or destroyed and would be vulnerable to threatening processes, is restricted in area and/or range and/or is only found at a few locations. The ecological community may still be widespread but is believed likely to move into a category of higher threat in the medium to long-term future because of existing or impending threatening processes.
Data Deficient (DD)	An ecological community, which has not been adequately evaluated with respect to status or where there is currently insufficient information to assign it to a particular category. (An ecological community with poorly known distribution or biology that is suspected to belong to any of the above categories. These ecological communities have a high priority for survey and/or research).
Lower Risk (LR)	An ecological community that has been adequately surveyed and does not qualify for any of the above categories of threat and appears unlikely to be under threat of significant modification or destruction in the short to medium term future.

(Source: English and Blyth 1997)

Table A-4 Priority ecological communities category definitions

Category	Definition
P1	Priority One: Poorly-known ecological communities Ecological communities with apparently few, small occurrences, all or most not actively managed for conservation (e.g. within agricultural or pastoral lands, urban areas, active mineral leases) and for which current threats exist. Communities may be included if they are comparatively well-known from one or more localities but do not meet adequacy of survey requirements, and/or are not well defined, and appear to be under immediate threat from known threatening processes across their range.
P2	Priority Two: Poorly-known ecological communities Communities that are known from few small occurrences, all or most of which are actively managed for conservation (e.g. within national parks, conservation parks, nature reserves, state forest, unallocated Crown land, water reserves, etc.) and not under imminent threat of destruction or degradation. Communities may be included if they are comparatively well known from one or more localities but do not meet adequacy of survey requirements, and/or are not well defined, and appear to be under threat from known threatening processes.
P3	Priority Three: Poorly known ecological communities Communities that are known from several to many occurrences, a significant number or area of which are not under threat of habitat destruction or degradation, or: Communities known from a few widespread occurrences, which are either large or within significant remaining areas of habitat in which other occurrences may occur, much of it not under imminent threat, or; Communities made up of large, and/or widespread occurrences that may or not be represented in the reserve system, but are under threat of modification across much of their range from processes such as grazing by domestic and/or feral stock, and inappropriate fire regimes. Communities may be included if they are comparatively well known from several localities but do not meet adequacy of survey requirements and/or are not well defined, and known threatening processes exist that could affect them.

Category	Definition
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. These communities require regular monitoring. Rare. Ecological communities known from few occurrences that are considered to have been adequately surveyed, or for which sufficient knowledge is available, and that are considered not currently threatened or in need of special protection, but could be if present circumstances change. These communities are usually represented on conservation lands. Near Threatened. Ecological communities that are considered to have been adequately surveyed and that do not qualify for Conservation Dependent, but that are close to qualifying for Vulnerable. Ecological communities that have been removed from the list of threatened communities during the past five years.
P5	Priority Five: Conservation Dependent ecological communities Ecological communities that are not threatened but are subject to a specific conservation program, the cessation of which would result in the community becoming threatened within five years.

(Source: DEC 2013)

Table A-5: EPBC Act listed threatened ecological communities' category of threat

Category	Definition
CR	Critically Endangered If an ecological community is facing an extremely high risk of extinction in the wild in the immediate future.
EN	Endangered If an ecological community is not Critically Endangered but is facing a very high risk of extinction in the wild in the immediate future.
VU	Vulnerable If an ecological community is not Critically Endangered or Endangered but is facing a very high risk of extinction in the wild in the medium term future.

Table A-6 NVIS vegetation structure classes

Stratum	Growth Form	Height	Structural formation classes (% Cover)					
		Foliage cover *	70-100	30-70	10-30	<10	0-5	~0
		Percentage cover **	>80	50-80	20-50	0.25-20	0-5	<0.25
U	Tree, palm	Tall; Mid; Low	Closed forest	Open forest	Woodland	Open woodland	Isolated clumps of trees	Isolated trees
	Tree mallee	Tall; Mid; Low	Closed mallee forest	Open mallee forest	Mallee woodland	Open mallee woodland	Isolated clumps of mallee trees	Isolated mallee trees
M	Shrub, cycad, grass-tree, tree-fern	Tall; Mid; Low	Closed shrubland	Shrubland	Open shrubland	Sparse shrubland	Isolated clumps of shrubs	Isolated shrubs
	Mallee shrub	Tall; Mid; Low	Closed mallee shrubland	Mallee shrubland	Open mallee shrubland	Sparse mallee shrubland	Isolated clumps of mallee shrubs	Isolated mallee shrubs

Stratum	Growth Form	Height	Structural formation classes (% Cover)					
		Foliage cover *	**70-100**	**30-70**	**10-30**	**<10**	**0-5**	**~0**
		Percentage cover **	**>80**	**50-80**	**20-50**	**0.25-20**	**0-5**	**<0.25**
	Heath shrub	Tall; Mid; Low	Closed heathland	Heathland	Open heathland	Sparse heathland	Isolated clumps of heath shrubs	Isolated heath shrubs
	Chenopod shrub	Tall; Mid; Low	Closed chenopod shrubland	Chenopod shrubland	Open chenopod shrubland	Sparse chenopod shrubland	Isolated clumps of chenopod shrubs	Isolated chenopod shrubs
	Samphire shrub	Mid; Low	Closed samphire shrubland	Samphire shrubland	Open samphire shrubland	Sparse samphire shrubland	Isolated clumps of samphire shrubs	Isolated samphire shrubs
G	Hummock grass	Mid; Low	Closed hummock grassland	Hummock grassland	Open hummock grassland	Sparse hummock grassland	Isolated clumps of hummock grasses	Isolated hummock grasses
	Tussock grass	Mid; Low	Closed tussock grassland	Tussock grassland	Open tussock grassland	Sparse tussock grassland	Isolated clumps of tussock grasses	Isolated tussock grasses
	Other grass	Mid; Low	Closed grassland	Grassland	Open grassland	Sparse grassland	Isolated clumps of grasses	Isolated grasses
	Sedge	Mid; Low	Closed sedgeland	Sedgeland	Open sedgeland	Sparse sedgeland	Isolated clumps of sedges	Isolated sedges
	Rush	Mid; Low	Closed rushland	Rushland	Open rushland	Sparse rushland	Isolated clumps of rushes	Isolated rushes
	Forb (Herb)	Mid; Low	Closed forbland	Forbland	Open forbland	Sparse forbland	Isolated clumps of forbs	Isolated forbs

(Source: ESCAVI 2003)

* Foliage Cover is defined for each stratum as 'the proportion of the ground, which would be shaded if sunshine came from directly overhead'. It includes branches and leaves and is similar to the Crown type of Walker & Hopkins (1990) but is applied to a stratum or plot rather than an individual crown. It is generally not directly measured in the field for the upper stratum, although it can be measured by various line interception methods for ground layer vegetation. For the attribute COVER CODE in the Stratum table, the ground cover category refers to ground foliage cover not percentage cover.

** The percentage cover is defined as the percentage of a strictly defined plot area, covered by vegetation. This can be an estimate and is a less precise measure than using, for example, a point intercept transect methods on ground layer, or overstorey vegetative cover. That is for precisely measured values (e.g. crown densitometer or point intercept transects) the value measured would be 'foliage' cover. Where less precise or qualitative measures are used these will most probably be recorded as 'percentage' cover.

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Table A-7 NVIS vegetation height classes

Height		Growth form			
Height class	**Height range (M)**	**Tree, Vine (M & U), Palm (Single-stemmed)**	**Shrub, Heath Shrub, Chenopod Shrub, Ferns,Samphire Shrub, Cycad, Tree-Fern,Grass-tree, Palm (Multi-stemmed)**	**Tree Mallee, Mallee Shrub**	**Tussock Grass, Hummock Grass, Other Grass, Sedge, Rush, Forbs, Vine (G)**
8	>30	Tall			
7	10-30	Mid		Tall	
6	<10	Low		Mid	
5				Low	
4	>2		Tall		Tall
3	1-2		Mid		Tall
2	0.5-1		Low		Mid
1	<0.5		Low		Low

(Source: ESCAVI 2003)

Table A-8 Vegetation condition scale

Condition		Definition
E	Excellent	Pristine or nearly so, no obvious signs of damage caused by human activities since European settlement
VG	Very Good	Some relatively slight signs of damage caused by human activities since European settlement. For example, some signs of damage to tree trunks caused by repeated fire, the presence of some relatively non-aggressive weeds, or occasional vehicle tracks
G	Good	More obvious signs of damage caused by human activity since European settlement, including some obvious impact on the vegetation structure such as that caused by low levels of grazing or slightly aggressive weeds
P	Poor	Still retains basic vegetation structure or ability to regenerate it after very obvious impacts of human activities since European settlement, such as grazing, partial clearing, frequent fires or aggressive weeds
D	Degraded	Severely impacted by grazing, very frequent fires, clearing or acombination of these activities. Scope for some regeneration but not to a state approaching good condition without intensive management. Usually with a number of weed species presen including very aggressive species
CD	Completely Degraded	Areas that are completely or almost completely without native species in the structure of their vegetation; i.e. areas that are cleared or ‘parkland cleared’ with their flora comprising weed or crop species with isolated native trees or shrubs

(Source: Trudgen 1988)

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Table A-9 Wetland management categories and objectives applied to the swan coastal plain

Management category	General description	Management objectives
Conservation	Wetlands which support a high level of attributes and functions.	Highest priority wetlands. Objective is to preserve and protect the existing conservation values of the wetlands through various mechanisms including: reservation in national parks, Crown reserves and state owned land protection under Environmental Protection Policies wetland covenanting by landowners. No development or clearing is considered appropriate. These are the most valuable wetlands and any activity that may lead to further loss or degradation is inappropriate.
Resource Enhancement	Wetlands which may have been partially modified but still support substantial ecological attributes and functions	Priority wetlands Ultimate objective is to manage, restore and protect towards improving their conservation value. These wetlands have the potential to be restored to Conservation category. This can be achieved by restoring wetland function, structure and biodiversity. Protection is recommended through a number of mechanisms.
Multiple Use	Wetlands with few remaining important attributes and functions	Use, development and management should be considered in the context of ecologically sustainable development and best management practice catchment planning through land care.

(Source: Adapted from Environmental Protection Authority 2004)

Table A-10 Geomorphic wetland types

Hydroperiod	Landform				
	Basin	Channel	Flat	Slope	Highland
Permanent Inundation	Lake	River	-	-	-
Seasonal Inundation	Sumpland	Creek	Floodplain	-	-
Intermittent Inundation	Playa	Wadi	Barlkarra	-	-
Seasonal Waterlogging	Dampland	Trough	Palusplain	Paluslope	Palusmont

(Source: DPAW 2013)

RPS

Appendix B

Flora and vegetation review – ANSIA (RPS 2015)

FLORA AND VEGETATION REVIEW

Ashburton North Strategic Industrial Area





FLORA AND VEGETATION REVIEW

Ashburton North Strategic Industrial Area

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Draft A	Draft for Client Review	CarGil	GilGla	01.10.14	SN 01.10.14		
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(compiled at rear of report)

APPENDICES

1.0 INTRODUCTION

1.1 Background

LandCorp is preparing an Improvement Plan for the Ashburton North Strategic Industrial Area (ANSIA), to provide an effective planning framework for the future. The ANSIA Improvement Plan Area is located 10 kilometres (km) south-west of Onslow in the Shire of Ashburton (Figure 1).

The purpose of the Improvement Plan is to establish a framework for land use co-ordination and infrastructure delivery through highlighting the provisions that will be required within an Improvement Scheme and Guide Plan. Improvement Plan will need to ensure sufficient guidance is included in order to ensure the development of an Improvement Scheme and Guide plan, which includes the following:

- streamlining of the approval process
- reducing the layer of planning required
- avoiding duplication and inconsistencies in requirements / planning provisions
- ensuring projects of state significance are appropriately considered
- ensuring local planning is not neglected or adversely impacted by development.

To inform an appropriate approach to the development of the Improvement Plan and Scheme for the ANSIA, a thorough understanding of the context, broader influences and provisions of existing documentation that may affect the project is required. This includes key environmental aspects such as flora and vegetation and fauna.

The recommended Improvement Plan boundary is based on the inclusion of the ANSIA Structure Plan area, the future expansion area to the east towards Onslow Road and an appropriate buffer to preserve the integrity of the ANSIA (Figure A).

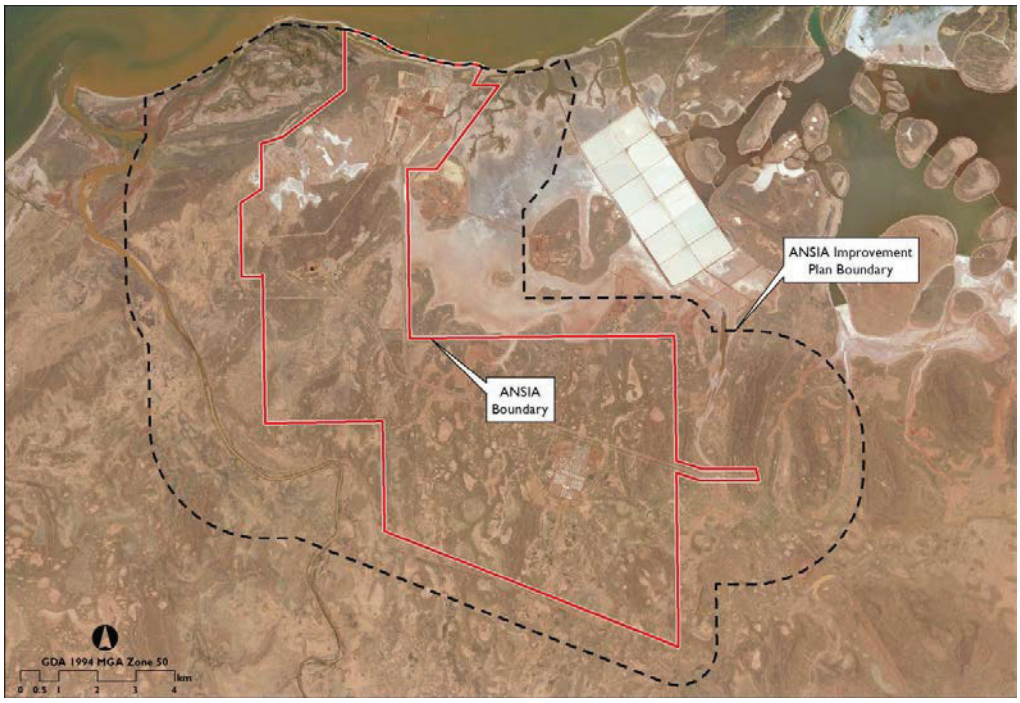

Figure A: Existing ANSIA and Proposed Improvement Plan Boundaries

1.1.1 Previous Environmental Approvals

Since 2008, a raft of documentation has been prepared in order to establish and further develop the ANSIA for the purposes of providing a strategic industrial area that is suitable for hydrocarbon processing industries and support facilities, promoting the common use of infrastructure and industrial synergies. The framework has developed incrementally in order to reflect the varying timeframes associated with the establishment of the gas plants. To date the current planning has produced:

- scheme amendments to the Shire of Ashburton Local Planning Scheme 7 to facilitate the rezoning of the land from "Rural" to "Strategic Industrial", "Industrial" and "Special Use" zones

- ANSIA Structure Plan and Stage 1B and 1C Development Plan which provides the framework for the development of Stage 1, including stages
  - Wheatstone LNG Plant and Common User Coastal Area/Port and Multi-user Infrastructure Access Corridors, and the Wheatstone Transient Workforce Accommodation, and second Transient Workers Accommodation Site
  - Macedon gas plant and Scarborough gas plant
  - future industrial area
  - general industrial area

- both the Macedon gas pipeline and the Wheatstone LNG plant were subject to a formal environmental assessment.

The above structure plans and development approvals were subject to comprehensive flora and vegetation surveys and environmental reporting.

1.1.2 Industrial Development within the ANSIA

Industrial development proposed within the ANSIA is separated into either Heavy or General Industry land uses. **Error! Reference source not found.** shows these land uses in the context of the ANSIA.

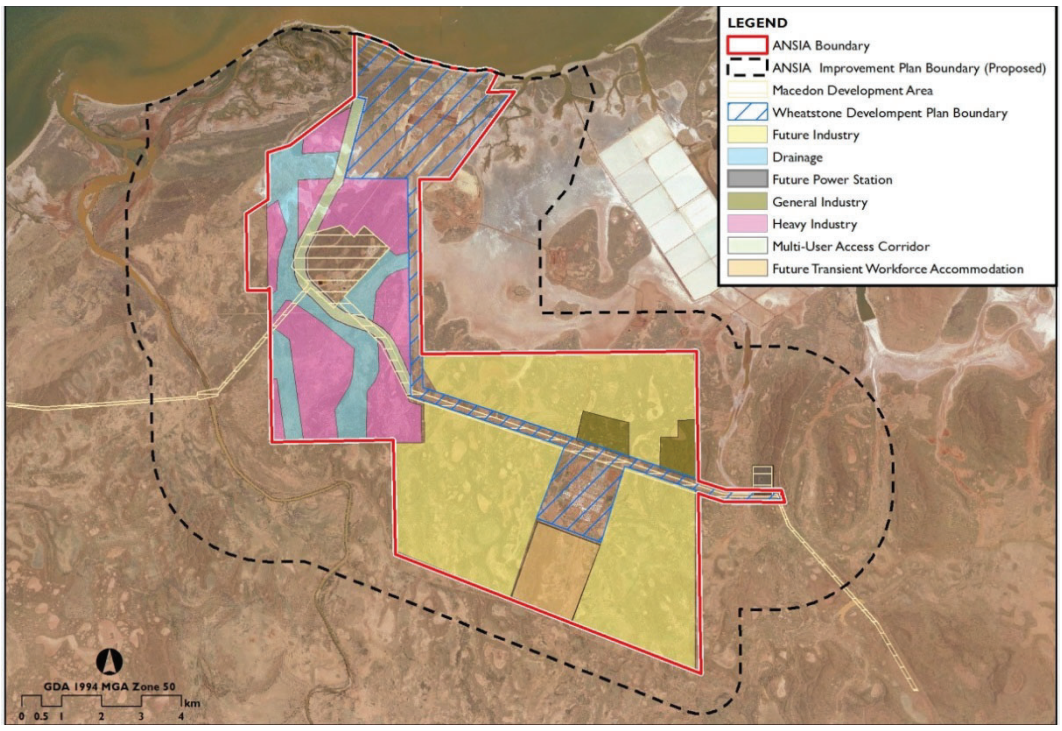

Figure B: Industrial Land Uses within the ANSIA

1.1.2.1 Buffers

The overall aim of the Strategic Industrial Area Buffer is to ensure that no sensitive receptors as defined by the State Industrial Buffer Policies are located within proximity to the ANSIA. The external buffers from the industrial land uses have been established with regard to the following planning and environmental criteria:

- NOISE – AT SENsitive land uses being 35dB(A)
- risk – at a risk level of one in a million per year or less
- air quality.

The ANSIA also accommodates internal buffers from sensitive land uses such as the Temporary Workers Accommodation (TWA). The ANSIA external and internal buffers are depicted in Figure C.

This outcome will deliver "islands" of individual industrial land uses within the ANSIA landscape.

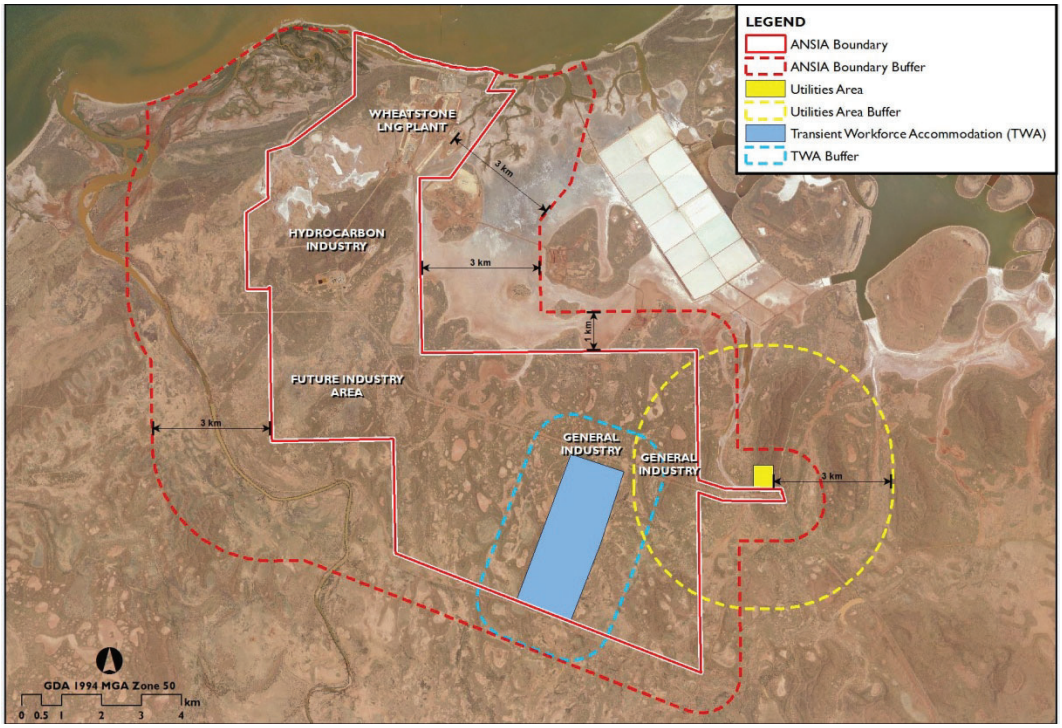

Figure C: ANSIA Internal and External Buffers

1.2 Flora and Vegetation Review

1.2.1 Objectives

The primary objectives of this flora and vegetation literature review are:

- to assess the adequacy of the existing data for the ANSIA Improvement Plan Area in terms of informing potential impacts to flora and vegetation values
- to identify any data gaps to determine the need for further surveys.

1.2.2 Scope of Work

The scope of work addressed by this review involves the following tasks:

- Undertake a review of all environmental literature and reports relevant to the ANSIA Improvement Plan Area, and collate and summarise the historical knowledge of the flora and vegetation.
- Provide a summary of the vegetation communities and flora present within the ANSIA Improvement Plan Area.

- Assess the conservation significance of the ANSIA Improvement Plan Area flora and vegetation.

- Assess the adequacy of the available data in satisfactorily describing the flora and vegetation values of ANSIA Improvement Plan Area.

- Identify knowledge gaps, if any, in the biological information available for the ANSIA Improvement Plan Area.

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2.0 LEGISLATIVE CONTEXT

The principal legislation governing environmental protection in Western Australia is the *Wildlife Conservation Act 1950* (WC Act), the *Environmental Protection Act 1986* (EP Act) and the *Environmental Protection Biodiversity Conservation (*EPBC Act*) 1999*.

Western Australian legislation guiding this assessment includes the WC Act (as amended) as it relates to flora, flora collection and the listing of Threatened Ecological Communities (TECs), and the EP Act (as amended), as it relates to Environmental Impact Assessment requirements for flora and vegetation assessments in Western Australia.

As it specifically applies to flora and vegetation, the Commonwealth EPBC Act may be relevant where TECs, or Threatened Flora species or their critical habitat, are found to be present.

2.1 *Wildlife Conservation Act 1950*

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

Species that have not been surveyed adequately, to be listed under Schedule 1 or 2 are added to the Priority Flora Lists under Priorities 1, 2 or 3. These three categories are ranked in order of priority for survey and evaluation of conservation status so that consideration can be given to their declaration as threatened flora. Species that are adequately known are rare but not threatened, or they meet criteria for Near Threatened, or have been recently removed from the threatened list for other than taxonomic reasons, are placed in Priority 4. These species require regular monitoring. Conservation Dependent species are placed in Priority 5.

Priority Flora are not specifically covered under current legislation, but their conservation status warrants some protection as under both the WC Act and the EP Act the precautionary and "prevention of extinction" principles apply to the conservation of Priority Flora.

Conservation codes for Threatened and Priority flora are defined in Appendix 1.

2.2 *Environment Protection and Biodiversity Conservation Act 1999*

Some flora species are afforded additional federal protection under the EPBC Act. In Western Australia the flora species listed as threatened under the EPBC Act are predominantly Threatened Flora (as listed under the WC Act).

Conservation codes for federally listed flora are defined in Appendix 1.

2.3 *Environmental Protection Act 1986*

The EP Act is the principal legislation that provides for the prevention, control and abatement of pollution and environmental harm, for the conservation, preservation, protection, enhancement and management of the environment. The EP Act is administered by the Environmental Protection Authority (EPA).

Activities that may affect upon the environment within the jurisdiction of Western Australia are recommended to be referred to the EPA for assessment under the EP Act. Unlike the WC Act or the EPBC Act, the EP Act does not specifically protect individual species. However, the EPA does provide guidance on environmental factors that are assessed under the EP Act.

3.0 METHODOLOGY

3.1 Review of Existing Data

3.1.1 Database Searches

Database searches were conducted to determine a list of conservation significant flora (i.e. those protected under the WC Act and/or the EPBC Act, or considered Priority species by Department of Parks and Wildlife (DPaW)), and ecological communities of conservation significance that may occur within the vicinity of the ANSIA Improvement Plan Area. The databases searched and the corresponding search areas are provided in Table 1. The results of the database searches are presented in Appendix 2 and discussed in Section 6.2.

Table 1: Flora and Ecological Community Databases Searched and Corresponding Search Areas

Database Name	Administering Organisation	Search Area Defined
NatureMap Database	DPaW	Circle search within a 25 km radius of 115˚01'05"E; 21˚45'06"S
Threatened and Priority Flora Databases (TPFL)	DPaW	Circle search within a 50 km radius of 115˚01'05"E; 21˚45'06"S
WA Herbarium Database (WAHERB)	DPAW	Circle search within a 50 km radius of 115˚01'05"E; 21˚45'06"S
Threatened and Priority Flora List	DPAW	Circle search within a 50 km radius of 115˚01'05"E; 21˚45'06"S
TEC and Priority Ecological Community (PEC) Database	DPAW	Circle search within a 50 km radius of 115˚01'05"E; 21˚45'06"S
Protected Matters Search Tool	DoE	Circle search within a 25 km radius of 115˚01'05"E; 21˚45'06"S

3.1.2 Historical Regional Surveys and Mapping

The following regional land surveys and mapping datasets relating to the ANSIA Improvement Plan Area were reviewed to provide a regional context in which to assess flora and vegetation values:

- the Interim Biogeographical Regionalisation of Australia (IBRA) biological subregions within Australia (Environment Australia 2000; Kendrick and Mau 2002)
- Land Systems (Payne et al. 1988)
- Beard Vegetation Mapping (1975).

3.1.3 Previous Flora and Vegetation Assessments

A number of terrestrial flora and vegetation surveys and assessments have been undertaken within and adjacent to the ANSIA Improvement Plan Area in recent years. This report provides a review and summary of the findings of the survey reports. The survey area boundaries for each of these flora and vegetation surveys are presented in Figure 1. The following eight documents were reviewed to inform this Flora and Vegetation Review (Table 2).

Table 2: Summary of Flora and Vegetation Surveys for the ANSIA Improvement Plan Area

Report Name	Author	Level of Survey
A Vegetation and Flora Survey of the Wheatstone Study Area, near Onslow	Biota (2010a)	Level 2 quadrat based field survey
Flora and Vegetation Survey – Ashburton North Project	Onshore Environmental Consultants (2008)	Level 2 quadrat based field survey
Flora and Vegetation Survey – Ashburton North Project Area – Stage 2	Onshore Environmental Consultants (2009)	Level 2 quadrat based field survey
Wheatstone Project Flora and Fauna Assessment Addendum	Biota (2010b); Outback Ecology Services (2010)	Level 2 quadrat based field survey
Ashburton North Strategic Industrial Area Flora and Vegetation Assessment	ENV (2012a)	Level 2 quadrat based field survey
BHBP Macedon Gas Development-For a and Vegetation Survey	Astron (2009)	Level 2 quadrat based field survey
Baseline Vegetation and Flora Survey Ashburton North Pipeline Route Option 3	RPS (2009)	Level 2 quadrat based field survey
Ashburton North Strategic Industrial Area Biological Desktop Review	ENV (2012b)	Desktop survey
Desktop Review of the Proposed Onslow Micro-Siting Survey Area	Biota (2013)	Desktop survey

4.0 REGIONAL INFORMATION

4.1 Interim Biogeographical Regionalisation of Australia

The IBRA currently recognises 89 bioregions and 419 biological subregions within Australia. The ANSIA Improvement Plan Area lies within the Cape Range CAR1 subregion of the Carnarvon region (Environment Australia 2000).

4.1.1 Carnarvon Region (Cape Range Subregion)

The Cape Range CAR1 subregion is 2,547,911 ha in size and is described by Kendrick and Mau (2002) as:

> Cape Range and Giralia dune fields form the northern part of Carnarvon Basin. Rugged tertiary limestone and extensive areas of red aeolian dunefield, Quaternary coastal beach dunes and mud flats. Acacia shrublands over Triodia on limestone (*Acacia stuartii* or *A. bivenosa*) and red dune fields, Triodia hummock grasslands with sparse Eucalyptus trees and shrubs on the Cape Range. Extensive hummock grasslands (Triodia) on the Cape Range and eastern dune-fields. Tidal mudflats of sheltered embayments of Exmouth Gulf support extensive mangroves. Beach dunes with Spinifex communities. An extensive mosaic of saline alluvial plains with samphire and saltbush low shrublands along the eastern hinterland of Exmouth Gulf. Islands of the Muiron, Barrow, Lowendal and Montebello groups are limestone-based.

4.2 Land System Mapping

Land system mapping of the rangelands of Western Australia by the Department of Agriculture and Food and Department of Land and Surveys defines a map unit or land system as "an area or group of areas throughout which there is a recurring pattern of topography, soils and vegetation". The area was mapped at a scale of 1: 250, 000 and Payne et al. (1988) identified five land systems within the Ashburton River Catchment that coincide with the ANSIA Improvement Plan Area (Table 3) (Figure 2).

Table 3: Land Systems Represented within the ANSIA Improvement Plan Area

Land System	Description
Dune	Dune fields supporting soft spinifex grasslands.
Giralia	Linear dunes and broad sandy plains supporting hard and soft spinifex grasslands.
Littoral	Bare coastal mudflats with mangroves on seaward fringes, samphire flats, sandy islands, coastal dunes and beaches.
Minderoo	Alluvial plains supporting tall shrublands and tussock grasslands and sandy plains supporting hummock grasslands.
Onslow	Undulating sandplains, dunes and level clay plains supporting soft spinifex grasslands and minor tussock grasslands.

4.3 Beard (1975) Regional Vegetation Mapping

4.3.1 Bioregion

The vegetation of the ANSIA Improvement Plan Area lies within the Carnarvon Botanical District of the Eremaean Botanical Province of Western Australia. More specifically it is situated in the Cape Yannarie Coastal Plain (CYCP) subdistrict as mapped and described by Beard (1975). Beard described three broad vegetation community types for the CYCP as follows:

- mangroves along the coastline within the intertidal zone, dominated by *Avicennia marina* and *Rhizophora stylosa* to a lesser extent
- behind the intertidal zone, there is a belt of bare hyper-saline mud generally devoid of vegetation but with some samphire (*Tecticornia* spp.)
- behind the saline tidal mud flats, there is low country with numerous bare clay pans, seasonally filled and interspersed with grass plains (clay soil) and sand ridges (sand) with *Triodia* dominant. On higher ground there are extensive plains with patchy vegetation of *Acacia xiphophylla* (snakewood), *A. tetragonophylla, A. bivenosa* and *A. victoriae (A. synchronicia*), grassland including *Triodia basedowii* (*T. lanigera*?), clay pans and bare patches of gravel.

4.3.2 Vegetation Mapping

Beard (1975) mapped the vegetation of the Pilbara region at a scale of 1:1,000,000. Shepherd, Beetson and Hopkins (2002) used Beard's existing vegetation mapping to produce 1:250,000 scale vegetation association mapping. The ANSIA Improvement Plan Area intersects the following five vegetation associations described by Shepherd, Beetson and Hopkins (2002) (Table 4) (Figure 3).

Table 4: Beard Vegetation Associations Represented within the ANSIA Improvement Plan Area

Assoc. No.	Beard Association Description
117	Hummock grasslands, grass steppe; soft spinifex
124	Steppe
127	Bare areas: mudflats
589	Mosaic: Short bunch grassland – savannah/grass plain (Pilbara)/hummock grasslands, grass steppe; soft spinifex soft spinifex
670	Hummock grasslands, shrub steppe; scattered shrubs over *Triodia basedowii*.

(Sources: Beard 1975; Shepherd, Beetson and Hopkins 2002)

4.3.3 Reservation Priorities of Vegetation Associations Mapped for the ANSIA Improvement Plan Area

The vegetation associations mapped by Beard (1975) for the ANSIA Improvement Plan Area are widespread in the subregion with 100% of their pre-European extent remaining for four of the five associations represented (there was no available information for Vegetation Association 124). Kendrick and Mau (2002) assessed the reservation priority for these associations on a bioregional level (Table 5).

Table 5: Reservation Status and Priority of Beard Vegetation Associations Represented within the ANSIA Improvement Plan Area

Assoc. No.	Percentage of Pre-European Extent Remaining	IUCN Class I-IV Reserves	Non-IUCN Reserves	DPAW-Purchased Lease	Reservation Priority
117	100%	13.3	1.0	0.0	Medium
124	No Information available	No Information available	No Information available	No Information available	No Information available
127	100%	7.0	4.0	0.0	High
589	100%	1.6	0.0	0.0	High
670	100%	0.0	0.0	1.9	Low

(Sources: Shepherd, Beetson and Hopkins 2002; Kendrick and Mau 2002)

4.4 Conservation Reserves

The Carnarvon IBRA bioregion has only 3.45% represented in conservation reserve (IUCN I-IV). At a subregional level, Cape Range CARI has 2.2% in reserve (Kendrick and Mau 2002). CAR1 reserves include:

- Cape Range National Park
- Ningaloo Marine Park
- Bundegi Conservation Park
- Jurabi Conservation Park
- Barrow Island Nature Reserve.

There are also numerous small island reserves in the subregion.

The ANSIA Improvement Plan Area does not occur within, or adjacent to, any conservation reserves. Nor does it intersect any Environmentally Sensitive Areas.

4.5 Regional Flora

A total of 1014 flora taxa have been recorded for the Cape Range CAR1 subregion (FloraBase 2014). Approximately 43% of these belong to five families. The number of taxa for each of these dominant families is presented in Table 6. The numbers in brackets refer to the number of weed species included in each total.

Table 6: Numbers of Taxa of the Five Dominant Plant Families in the Cape Range Subregion

Family	Common Name	No. of Taxa
FABACEAE	Peas	131 (8)
POACEAE	Grasses	97 (7)
ASTERACEAE	Daisies	83 (9)
MALVACEAE	Mallows	70 (2)
CHENOPODIACEAE	Goosefoots	55 (1)

A total of 31 Conservation Significant flora taxa are known from the CAR1 subregion (FloraBase 2014), none of these are listed as Threatened or are protected under the WC Act These comprise four Priority 1; 12 Priority 2; 11 Priority 3; and four Priority 4 taxa (FloraBase 2014).

Fifty-five alien (weed) taxa are known from the CAR1 subregion (FloraBase 2014). The families with the greatest number of weed species are Asteraceae (nine taxa), Fabaceae (eight taxa), and Poaceae (seven taxa).

According to the Western Australian Organism List (WAOL) (Department of Agriculture and Food Western Australia (DAFWA) 2014), which lists organisms that are declared under the *Biosecurity and Agriculture Management Act 2007*, nine flora species with a status of Declared Pest (s22) are identified within the Shire of Ashburton all belonging to the Control Category C3 – Management. Additionally, the list of Weeds of National Significance names two species occurring within the Shire of Ashburton (Table 7).

Table 7: Declared Pests (Flora Taxa) and Weeds of National Significance for the Shire of Ashburton

Family	Species	Common Name	Declared Pest	Weed of National Significance
PAPAVERACEAE	*Argemone ochroleuca* Sweet subsp. *ochroleuca*	Mexican poppy	✓	-
SOLANACEAE	*Datura ferox*	Fierce thornapple	✓	-
SOLANACEAE	*Datura inoxia*	-	✓	-

Family	Species	Common Name	Declared Pest	Weed of National Significance
SOLANACEAE	*Datura leichhardtii*	Native thornapple	✓	-
SOLANACEAE	*Datura metel*	Downy thornapple	✓	-
SOLANACEAE	*Datura stramonium*	Common thornapple	✓	-
SOLANACEAE	*Datura wrightii*	Hairy thornapple	✓	-
LAMIACEAE	*Marrubium vulgare*	Horehound	✓	-
FABACEAE	*Parkinsonia aculeata*	Parkinsonia	✓	✓
FABACEAE	*Prosopis pallida*	Mesquite	-	✓

(Source: DAFWA 2014)

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5.0 RESULTS OF DATABASE SEARCHES

5.1 Threatened and Priority Flora

A search of the Protected Matters Database, DPaW Flora Databases and NatureMap Database revealed that no Threatened Flora taxa are known, or expected, to occur within a 50 km radius of search coordinates 115°01'05"E; 21°45'06"S.

The database searches revealed records of seven conservation significant flora species comprising two Priority 1 (P1), two Priority 2 (P2) and three Priority 3 (P3) species within a 50 km radius of search coordinates 115°01'05"E; 21°45'06"S. (Table 8). One of these taxa, *Eleocharis papillosa*, is also listed federally as Vulnerable under the EPBC Act. The locations of these records in relation to the ANSIA Improvement Plan Area are shown in Figure 4.

Table 8: Flora Database Search Results for Species Records within a 50 km Radius of 115°01'05"E; 21°45'06"S

Species	Cons. Code (WC Act)	Cons. Code (EPBC Act)
Abutilon sp. *Pritzelianum* (S. van Leeuwen 5095)	P1	-
Abutilon sp. *Onslow* (F. Smith s.n. 10/9/61) PN	P1	-
Carpobrotus sp. Thevenard Island (M. White 050)	P2	-
Vigna sp. central (M.E. Trudgen 1626)	P2	-
Eleocharis papillosa	P3	VU
Eremophila forrestii subsp. *viridis*	P3	-
Triumfetta echinata	P3	-

These species were assessed in terms of their likelihood of occurring within the ANSIA Improvement Plan Area based on proximity of documented records, and on the presence of suitable habitat within the site (Table 9). Definitions of the conservation codes are presented in Appendix 1.

Four of these seven Priority-listed species are known to occur within the ANSIA Improvement Plan Area having been recorded in previous surveys.

Abutilon sp. Pritzelianum (S. van Leeuwen 5095) may occur within the ANSIA Improvement Plan Area; the nearest record is within 10 km of the site, however no habitat information was readily available. Neither *Abutilon* sp. *Onslow* (F. Smith s.n. 10/9/61) PN nor *Carpobrotus* sp. *Thevenard Island* (M. White 050) are likely to occur within the ANSIA Improvement Plan Area because the site is well outside their documented range.

Table 9: Likelihood of Priority flora Species Identified in the Database Searches Occurring in the ANSIA Improvement Plan Area

Species	Cons. Code	Preferred Habitat (FloraBase 2014)	Suitable Habitat within ANSIA Improvement Plan Area	Closest Record	Likelihood of Occurrence
Abutilon sp. *Pritzelianum* (S. van Leeuwen 5095)	P1	Not available	Not known	Recorded 10 km from the ANSIA Improvement Plan Area	Possibly
Abutilon sp. *Onslow* (F. Smith s.n. 10/9/61) PN	P1	Not available	Yes	Recorded < 30 km to the east of the ANSIA Improvement Plan Area	Not likely (outside documented range)
Carpobrotus sp. *Thevenard Island* (M. White 050)	P2	Coarse white sand. Dune tops, disturbed areas.	No	Recorded on Thevenard Island	Not likely
Vigna sp. *central* (M.E. Trudgen 1626)	P2	Sandplains, coastal dunes.	Yes	Recorded just outside the northern boundary of the ANSIA Improvement Plan Area	Known to occur in the vicinity
Eleocharis papillosa	P3	Red clay over granite, open clay flats. Clay pans	Yes	Recorded within the ANSIA Improvement Plan Area	Known to occur
Eremophila forrestii subsp. *viridis*	P3	Not available	Yes	Recorded within the ANSIA Improvement Plan Area	Known to occur
Triumfetta echinata	P3	Red sandy soils. Sand dunes	Yes	Recorded on the eastern boundary of the ANSIA Improvement Plan Area	Known to occur

5.2 Threatened and Priority Ecological Communities

There are two TECs within the Pilbara region endorsed by the Minister of the Environment (DPaW 2014a), *46. Themeda Grasslands: Themeda grasslands on cracking clays (Hamersley Station, Pilbara)* and *78. Ethel Gorge: Ethel Gorge aquifer stygobiont community*. Neither of these communities occurs near Onslow or is likely to occur within the ANSIA Improvement Plan Area

Additionally, there are 30 PECs listed for the Pilbara region (DPaW 2014b), however none of these correlate to any of the 33 vegetation sub-associations mapped and described for the ANSIA Improvement Plan Area to date (Biota 2010a).

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6.0 RESULTS OF PREVIOUS SURVEYS

6.1 Flora Statistics

A total of 433 native taxa and 13 exotic (weed) taxa have been recorded from the surveys undertaken for the ANSIA to date. These taxa represent 167 genera from 58 families. This total represents an amalgamation of the numbers recorded for each survey (Table 12). The numbers in brackets represent the number of taxa recorded for that survey that were not recorded for any of the other studies. The floristic data from the surveys undertaken by OEC (2008; 2009), Astron (2009), RPS (2009), Biota (2010a), Biota (2010b) and ENV (2012a) was compiled to create the final flora inventory of 446 species (Appendix 3). This total of 446 native and weed taxa recorded for the ANSIA to date represents 44% of the total number of 1,014 flora taxa recorded for the Cape Range CAR1 subregion (FloraBase 2014).

The families and genera with the greatest number of species are presented in Table 10 and Table 11. The numbers in brackets refer to the number of weed species included in each total.

Table 10: Dominant Families within the ANSIA Improvement Plan Area

Family	Common Name	No. of Taxa	Proportion of Total Taxa in CAR1 Subregion (%)
FABACEAE	Peas	80 (4)	59
POACEAE	Grasses	71 (3)	70
CHENOPODIACEAE	Goosefoots	46 (0)	78
ASTERACEAE	Daisies	29 (1)	35
MALVACEAE	Mallows	30 (1)	39

Table 11: Dominant Genera within the ANSIA Improvement Plan Area

Genus	Common Name	No. of Taxa
Acacia	Wattle	23
Tecticornia	Samphire	18
Ptilotus	Mulla mulla	14
Abutilon	Lantern bush	11
Senna	-	11
Euphorbia	-	12

Table 12: Statistics for the Flora and Vegetation Surveys Undertaken for the ANSIA Improvement Plan Area

Report Name	Level of Survey	Survey Area (ha)	No. of Quadrats Sampled (within ANSIA)	No. of Native Taxa	No. of Weed Taxa	Vegetation Sub-associations
A Vegetation and Flora Survey of the Wheatstone Study Area, near Onslow (Biota 2010a)	Level 2 quadrat based field survey	9,700	280	338	12	33
Flora and Vegetation Survey – Ashburton North Project (Onshore Environmental Consultants 2008)	Level 2 quadrat based field survey	460		232 (51*)	7	
Flora and Vegetation Survey – Ashburton North Project Area – Stage 2 (Onshore Environmental Consultants 2009)	Level 2 quadrat based field survey	2,200				
Wheatstone Project Flora and Fauna Assessment Addendum (Biota 2010b; Outback Ecology Services 2010)	Level 2 quadrat based field survey	3,400		80	6	
Ashburton North Strategic Industrial Area Flora and Vegetation Review (ENV 2012a)	Level 2 quadrat based field survey	564	22	131 (19*)	6	N/A
BHBP Macedon Gas Development-For a and Vegetation Survey (Astron 2009)	Level 2 quadrat based field survey	1,200	16	105 (19*)	6	NA
Baseline Vegetation and Flora Survey Ashburton North Pipeline Route Option 3 (RPS 2009)	Level 2 quadrat based field survey	1,000	4	66 (3*)	2	NA
Ashburton North Strategic Industrial Area Biological Desktop Review (ENV 2012b)	Desktop survey	564	NA	NA	NA	NA
Desktop Review of the Proposed Onslow Micro-Siting Survey Area (Biota 2013)	Desktop survey	1,669	NA	NA	NA	NA
Total			322	433	13	33

* The numbers in brackets represent the number of taxa recorded for that survey that were not recorded for any of the other studies

6.2 Conservation Significant Flora

6.2.1 Threatened Flora (EPBC Act) Listed for the ANSIA Improvement Plan Area

One taxon, *Eleocharis papillosa*, listed federally as Vulnerable under the EPBC Act, was recorded from the ANSIA Improvement Plan Area during surveys in 2009 (Biota 2010a). No other species listed under the EPBC Act have been previously recorded from the site, the locality, or are expected to occur in the habitats within the ANSIA Improvement Plan Area.

6.2.2 Threatened Flora (WC Act) Listed for the ANSIA Improvement Plan Area

No species listed as Threatened Flora by DPaW and protected under the Western Australian WC Act were recorded from the ANSIA Improvement Plan Area, or from the 50 km database search area. No Threatened Flora species are expected to occur in the habitats within the site.

6.2.3 Priority Flora Listed for the ANSIA Improvement Plan Area

Four Priority species have been recorded from the ANSIA Improvement Plan Area to date (Biota 2010a): *Eleocharis papillosa, Eremophila forrestii* subsp. *viridis, Triumfetta echinata*, and *Atriplex flabelliformis* Paul G. Wilson. A description of these species follows. Priority Flora locations recorded in previous surveys within the ANSIA Improvement Plan Area are presented in Figure 6.

6.2.3.1 *Eleocharis papillosa* – Priority 3 (WC Act), Vulnerable (EPBC Act)

Small annual sedge, this species is not considered Critically Endangered or Endangered but is Vulnerable because it is facing a high risk of extinction in the wild in the medium-term future. The species was assigned P3 status by DPaW as its consideration for Threatened status was probably overlooked (Biota 2010a).

E. papillosa was recorded from one location in Vegetation of Clay pans vegetation sub-association *TEC*spp. The species was considered by Biota (2010a) to be likely to occur throughout this habitat type and may be more widespread. It is known to grow on red clay over granite, open clay flats and clay pans (FloraBase 2014).

6.2.3.2 *Eremophila forrestii* subsp. *viridis* – Priority 3 (WC Act)

A perennial shrub to one metre (FloraBase 2014), *E. forrestii* subsp. *viridis* is probably restricted to the Onslow locality despite FloraBase showing records further afield; these have probably been misidentified (Biota 2010a).

E. forrestii subsp. *viridis* was recorded from three locations in the ANSIA Improvement Plan Area (Biota 2010a) within the Vegetation of Inland Sand Dunes vegetation sub-associations *GsCRcTRzTe* and *GsCRcHBbTsTe*. The species has also been recorded at other locations near the ANSIA Improvement Plan Area and wider Onslow locality (OEC 2008; Astron 2009; ENV 2012a; Biota unpublished data).

6.2.3.3 *Triumfetta echinata* – Priority 3 (WC Act)

A prostrate shrub to 0.3 metres occurring on red sandy soils and sand dunes (FloraBase 2014), *T. echinata* occurs primarily in the Onslow area although there is an outlier population approximately 120 km south in the Gascoyne bioregion.

T. echinata was recorded from numerous (> 30) locations within and adjacent to the ANSIA Improvement Plan Area (OEC 2008; OEC 2009; Biota 2010a; RPS 2009) within the Vegetation of Inland Sand Dunes vegetation sub-associations *GsCRcTRzTe* and *GsCRcHBbTsTe*.

The species has also been recorded at other locations near the ANSIA Improvement Plan Area and wider Onslow locality and it appears to be widespread in the locality however; it is relatively rare and restricted to red sand dunes (Biota 2010a).

6.2.3.4 *Atriplex flabelliformis* Paul G. Wilson – Priority 3 (WC Act)

A monoecious perennial herb to 0.35 metres occurring on clay loam, loam and saline flats or marshes (FloraBase 2014). *A. flabelliformis* was recorded from five locations within the ANSIA Improvement Plan Area in Vegetation of Clay pans and Clayey Plains vegetation sub-associations *TECspp* and *SPmERIbEUa*.

6.3 Vegetation

An amalgamation of survey data from Biota (2010a), Onshore Environmental Consultants (2008), Onshore Environmental Consultants (2009), and Biota (2010b); Outback Ecology Services (2010) resulted in the delineation and description of 33 vegetation sub-associations over the ANSIA Improvement Plan Area. Figure 1 shows the survey boundaries for each of the studies undertaken and shows how these survey areas intersect with the ANSIA Improvement Plan Area.

The Astron (2009) study mapped and described 39 vegetation sub-associations; however, these were mapped along a corridor approximately 80 km long, which traversed landforms and vegetation types not represented within the ANSIA Improvement Plan Area. Similarly, the RPS (2009) survey was linear in nature and traversed vegetation not recorded within the ANSIA Improvement Plan Area. For this reason, this review focusses on the vegetation mapping and descriptions compiled by Biota (2010a; 2010b) as it relates directly to the ANSIA Improvement Plan Area. Mapping of these 33 vegetation sub-associations and a brief description of each is presented in Figure 5.

6.3.1 Conservation Significance of the Vegetation within the ANSIA Improvement Plan Area

The two TECs and 30 PECs known from the Pilbara region do not occur within the ANSIA Improvement Plan Area or the vicinity.

The vegetation of the 33 sub-associations was assessed by Biota (2010a) for conservation significance and was ranked in order of conservation priority. Their assessment focussed on three factors:

- the Land System to which the vegetation sub-association belongs, and its level of representation within the region
- the capacity for the vegetation sub-association to support conservation significant flora
- the reservation priority of the ecosystems as identified by Kendrick and Mau (2002).

This assessment identified three vegetation sub-associations within Biota's project area of High conservation significance, and two of Moderate conservation significance. The remaining 28 sub-associations were considered by Biota (2010a; 2010b) to be of Low conservation significance as they were representative of the locality. Only four of these five sub-associations lie within the ANSIA Improvement Plan Area (Table 13).

Table 13: Vegetation Sub-associations of Conservation Significance

Vegetation Sub-association	Description	Rank	Reason
Vegetation of Inland Sand Dune			
GsCRcTRzTe	*Grevillea stenobotrya* tall open shrubland over *Crotalaria Cunninghamii*, *Trichodesma zeylanicum* var. *grandiflorum* open shrubland over *Triodia epactia* open hummock grassland	H	Supports Priority taxa *Eremophila forrestii* subsp. *viridis* (P3) and *Triumfetta echinata* (P3) Susceptible to erosion and weed invasion
GsCRcHBbTsTe	*Grevillea stenobotrya* tall open shrubland over *Crotalaria Cunninghamii*, *Hibiscus brachychlaenus* open shrubland over *Triodia shhinzii (Triodia epactia)* open hummock grassland	H	Supports Priority taxa *Eremophila forrestii* subsp. *viridis* (P3) and *Triumfetta echinata* (P3) Susceptible to erosion and weed invasion
Vegetation of Clay Pans			
*TEC*spp	Tecticornia spp. Low shrubland	H	Supports Priority taxon *Eleocharis papillosa* (P3/Vulnerable)

Vegetation Sub-association	Description	Rank	Reason
Cracking Clay Grasslands			
SPmERlbEUa	*Sporobolus mitchellii, Eriachne* aff. *Benthamii, Eriachne benthamii, Eulalia aurea* tussock grassland	M	Supports Priority taxon *Atriplex flabelliformis* (P3). Generally in very Good condition

(Source: Biota 2010a)

7.0 DISCUSSION

The key considerations relating to flora and vegetation of the ANSIA Improvement Plan Area are discussed below.

7.1 Flora

7.1.1 Regional Representation

The 435 flora taxa recorded for the ANSIA represent 43% of the total flora taxa recorded for the entire Cape Range CARI subregion (FloraBase 2014). The studies conducted over the ANSIA Improvement Plan Area in recent years therefore constitute a relatively intensive survey effort in what is regarded a poorly surveyed subregion, with only small areas having undergone detailed investigation by botanists (Kendrick and Mau 2002). The three dominant plant families recorded for the ANSIA Improvement Plan Area; Fabaceae (Peas), Poaceae (Grasses), and Chenopodiaceae (Goosefoots or Samphires); represented an even greater proportion of the subregional totals with 59% of Fabaceae, 70% of Poaceae and 78% of Chenopodiaceae known from the subregion recorded within the ANSIA Improvement Plan Area.

7.1.2 Conservation Significance of the Flora

Four conservation significant flora species were collectively recorded from the surveys undertaken for the ANSIA Improvement Plan Area, *Eleocharis papillosa* (P3), *Eremophila forrestii* subsp. *viridis* (P3), *Triumfetta echinata* (P3), and *Atriplex flabelliformis* (P3). These species were associated with particular vegetation associations and landforms (Table 14). Figure 6 shows Priority Flora records coinciding with the crests and ridges of inland sand dunes.

Table 14: Priority Species and Associated Vegetation and Landform

Priority Taxon	Vegetation Sub-association	Landform
Eleocharis papillosa (P3)	Samphire shrublands vegetation sub-association *TEC*spp.	Dune crest
Eremophila forrestii subsp. *viridis* (P3)	Inland sand dune vegetation sub-association *GsCRcTRzTe*	Dune crest
Triumfetta echinata (P3)	Inland sand dune vegetation sub-association *GsCRcHBbTsTe*	Dune crest
Atriplex flabelliformis (P3)	Clay pan vegetation sub-association *TECspp* and Clayey Plain vegetation sub-association *SPmERLbEUa*	Clay pan and plains

7.2 Vegetation

7.2.1 Regional Representation

Although Kendrick and Mau (2002) identified several areas within the CAR1 subregion as having known special values relating to landscape, ecosystem and species, relating particularly to areas of high biodiversity and/or endemism or refugia, the area within which the ANSIA Improvement Plan Area occurs was not one. These recognised areas predominantly consisted of the numerous small islands off the Pilbara coast, the Karst System of Cape Range, the Bundera Sinkhole, Mangroves of eastern Exmouth Gulf and Ningaloo Reef. None of the ecosystems represented within the ANSIA Improvement Plan Area were considered by Kendrick and Mau (2002) to be "Ecosystems at Risk".

The five Beard (1975) vegetation associations represented within the ANSIA Improvement Plan Area are widespread in the subregion with 100% of their pre-European extent remaining. Kendrick and Mau (2002) identified two of the associations (127 and 589) as being of High reservation priority because they are under-represented in reserves within the subregion:

- vegetation association 127 – *Bare areas: mudflats* intersects with a small north-eastern portion of the ANSIA Improvement Plan Area (Figure 3)

- vegetation association 589 – *Mosaic: Short bunch grassland – savannah/grass plain (Pilbara)/Hummock grasslands, grass steppe; soft spinifex soft spinifex* covers between 20% and 30% of the ANSIA Improvement Plan Area (Figure 3).

The remaining vegetation associations (117, 124 and 127) have been listed as having Medium to Low reservation priority, as they are adequately represented in the Cane River Conservation Park.

7.2.2 Conservation Significance of the Vegetation Sub-associations

In *A Vegetation and Flora Survey of the Wheatstone Project Area, near Onslow* and *Vegetation of the Wheatstone Addendum Area* Biota (2010a; 2010b) identified three vegetation sub-associations of High conservation priority and one vegetation sub-association of Medium conservation priority (Table 13), due to their susceptibility to erosion and/or weed invasion, and provision of habitat to Priority Flora species. These consisted of two inland sand dune units, one clay pan unit and one clayey plain unit.

7.2.2.1 Vegetation of Inland Sand Dunes

GsCRcTRzTe – Grevillea stenobotrya tall open shrubland over *Crotalaria Cunninghamii, Trichodesma zeylanicum* var. *grandiflorum* open shrubland over *Triodia epactia* open hummock grassland.

GsCRcHBbTsTe – Grevillea stenobotrya tall open shrubland over *Crotalaria Cunninghamii, Hibiscus brachychlaenus* open shrubland over *Triodia shhinzii* (*Triodia epactia*) open hummock grassland.

7.2.2.2 Vegetation of Clay Pans

TECspp – *Tecticornia* spp. Low shrubland

Biota (2010a) assessed the remainder of the vegetation sub-associations as Low conservation significance.

7.2.2.3 Vegetation of Clayey Plains

SPmERlbEUa – Sporobolus mitchellii, *Eriachne* aff. *Benthamii*, *Eriachne benthamii*, *Eulalia aurea* tussock grassland.

7.3 Survey Effort / Adequacy of the Representative Data

The combined studies conducted over the ANSIA Improvement Plan Area in recent years constitute a relatively intensive survey effort in a generally poorly surveyed subregion. This is evident in the total number of taxa recorded for the area as a percentage of the total taxa known for the subregion (44%). Survey statistics (Table 12) show that Biota (2010a) surveyed 9,700 ha for which 350 flora taxa were recorded. Onshore Environmental Consultants (2008; 2009) surveyed 2,660 ha and only recorded an additional 51 (previously unrecorded) species. Biota (2010b) surveyed 3,400 ha and recorded 24 species not recorded in previous studies, Astron's (2009) survey of 1,200 ha recorded 19 species not recorded in any other study, ENV (2012a) surveyed 564 ha and recorded 19 species not recorded for any other survey, and the survey of an additional 1,000 ha by RPS (2009) only recorded three species not recorded in any other study.

The species area curve for the sampling effort is shown in Figure D. It illustrates that the actual number of flora taxa recorded for the ANSIA Improvement Plan Area is approaching the theoretical maximum; it is therefore unlikely that further survey work over the unsurveyed portions of the ANSIA Improvement Plan Area would result in a significant increase in number of taxa recorded.

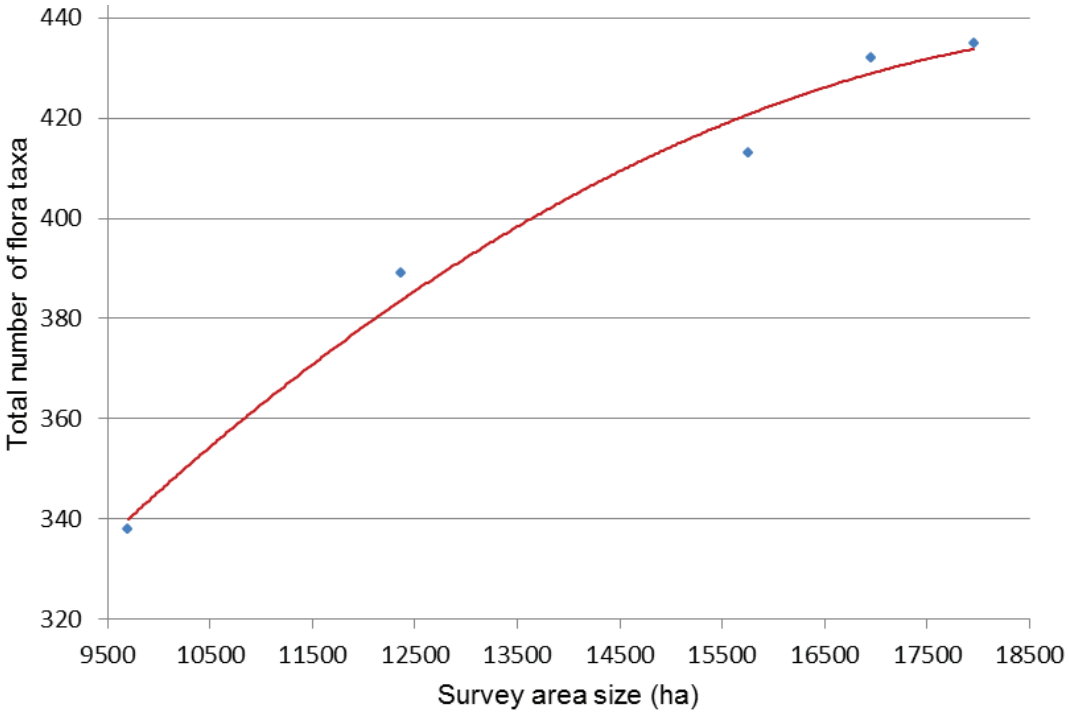

Figure D: Species Area Curve for Combined Flora Surveys

The extensive survey work that has been undertaken over the ANSIA Improvement Plan Area has allowed the vegetation to be mapped with a high level of confidence (Biota 2013). Vegetation mapping of areas that have not been field surveyed can be extrapolated reasonably confidently using a combination of the existing sub-association mapping within the ANSIA Improvement Plan Area, aerial imagery and topographic mapping.

Conservation significant flora searches undertaken as part of previous surveys have provided a good understanding of the vegetation types within the ANSIA Improvement Plan Area that are likely to provide habitat for Priority Flora, therefore mapping the remainder of the proposed ANSIA Improvement Plan Area should assist in identifying additional areas where Priority flora may occur.

8.0 CONCLUSION

The primary objective of this review is to determine if the data from previous flora and vegetation surveys is sufficient to assess adequately the flora and vegetation values of the ANSIA Improvement Plan Area and therefore the potential impacts the future development may pose to the resident flora and vegetation values.

The previous flora survey work, that is the subject of this review, constitutes a substantial survey effort and has resulted in the comprehensive sampling of a large proportion of the ANSIA Improvement Plan Area. None of the studies identified Threatened flora species or TECs / PECs within the target area. The studies have, to date, recorded 446 flora taxa and mapped 33 vegetation sub-associations within the ANSIA Improvement Plan Area, which represents 44% of the total taxa known for the subregion. It is considered unlikely that additional surveys would result in a significant increase in either the number of taxa recorded, or the mapping of additional vegetation types.

The available dataset is considered adequate to comprehensively describe the flora and vegetation values of the proposed ANSIA Improvement Plan Area and could reliably be used to map potential habitat, and therefore predict additional populations of conservation significant flora taxa throughout areas of the ANSIA Improvement Plan Area that were not the subject of a field survey.

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FIGURES

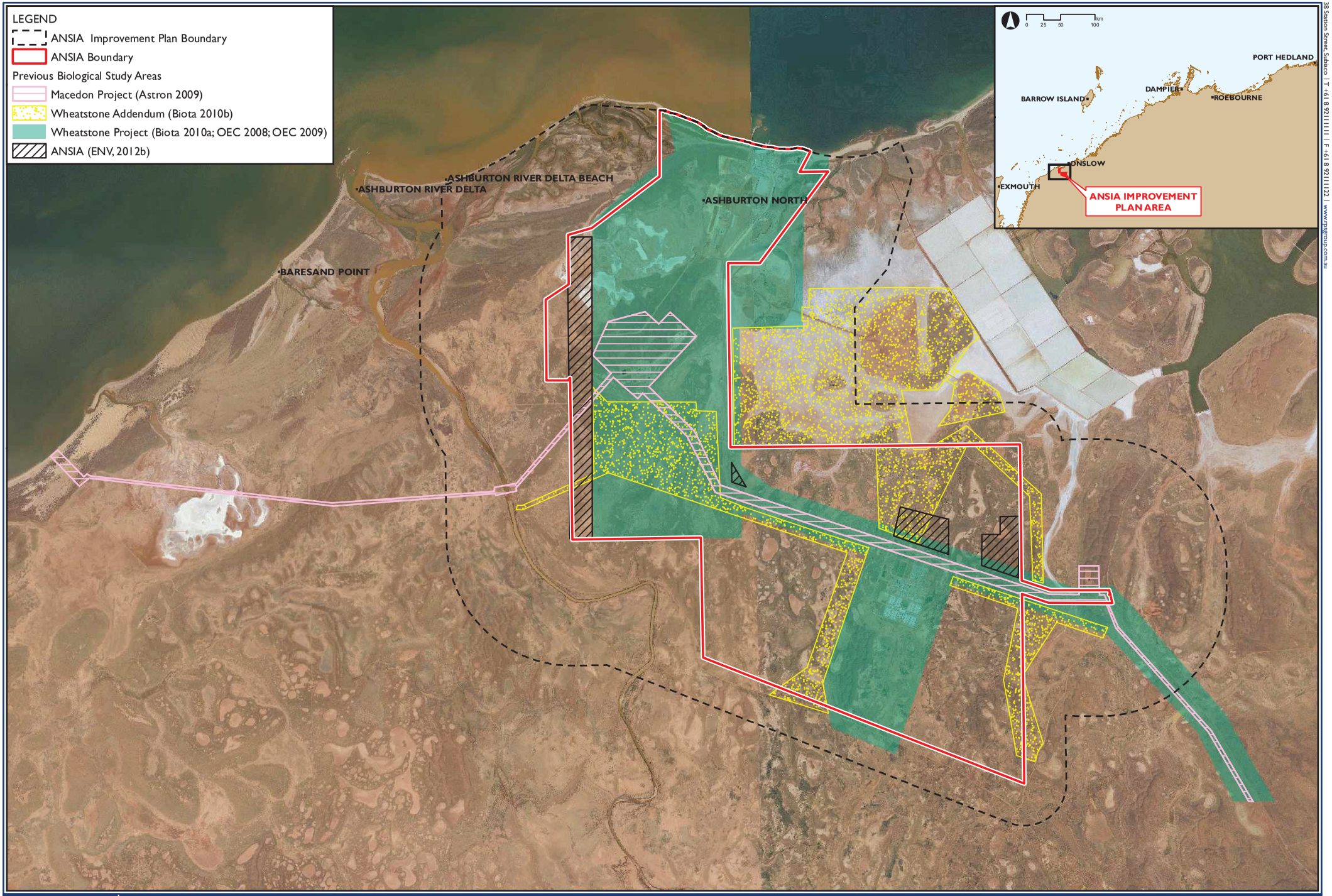

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Figure 1

Site Location and Existing Biological Surveys

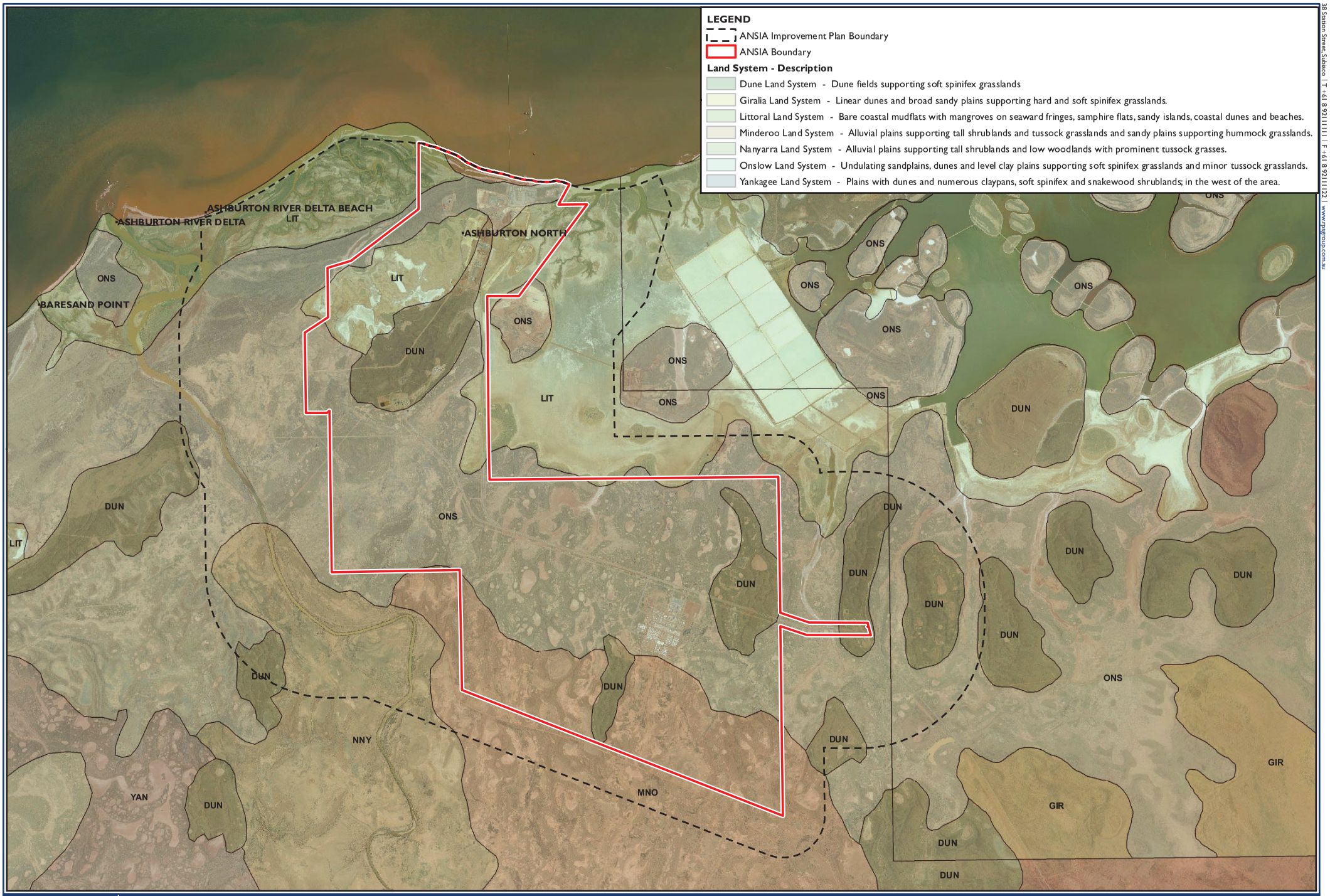

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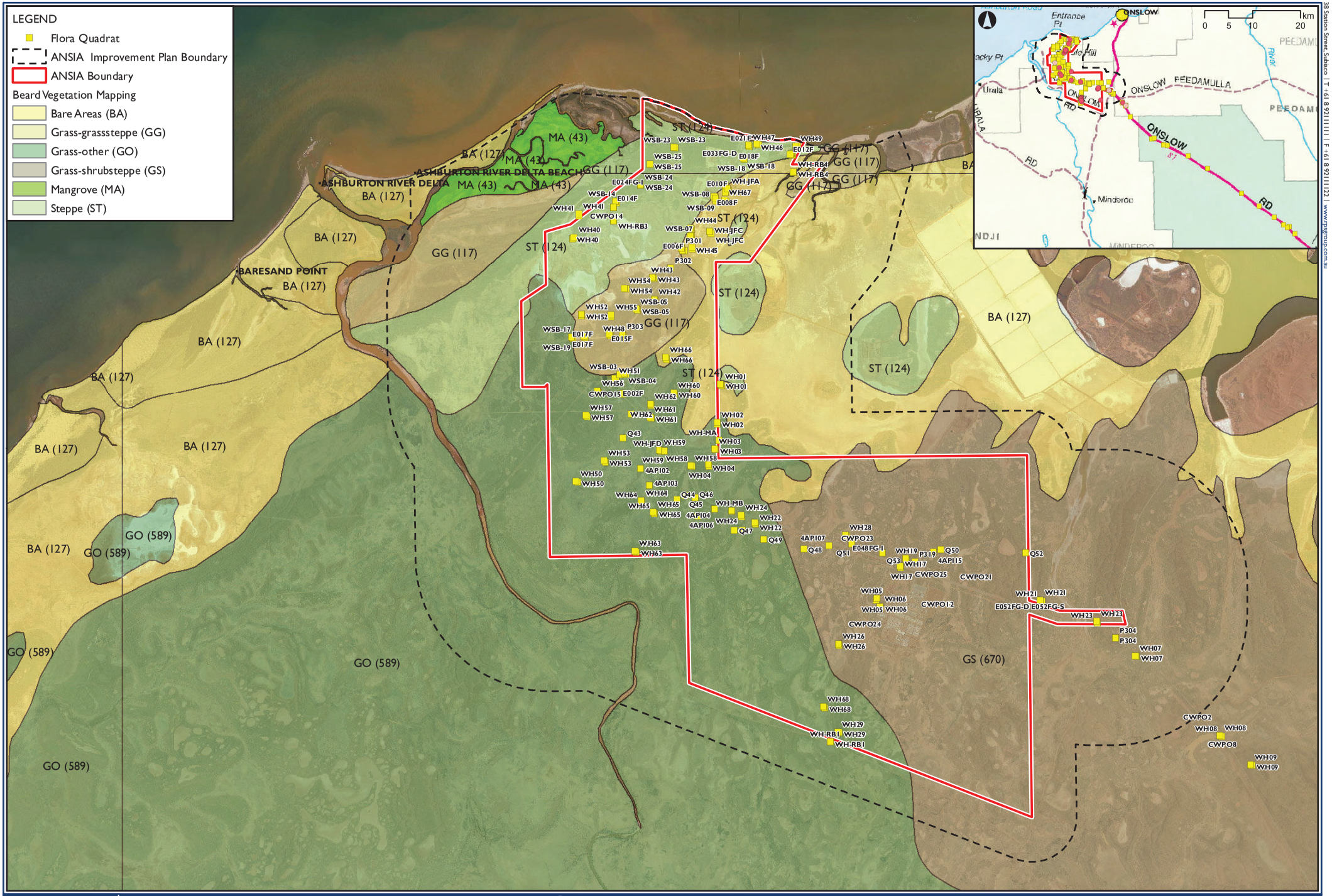
Figure 2

Land Systems Represented within the Study Area



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Source: Orthophoto - Landgate, 2014 Cadastre and Contours - Landgate, 2013 Vegetation Mapping - Beard et al 2006

GDA 1994 MGA Zone 50
0 0.5 1 2 km

Figure 3

Beard (1975) Vegetation Associations Represented within the Study Area and Survey Quadrat Locations

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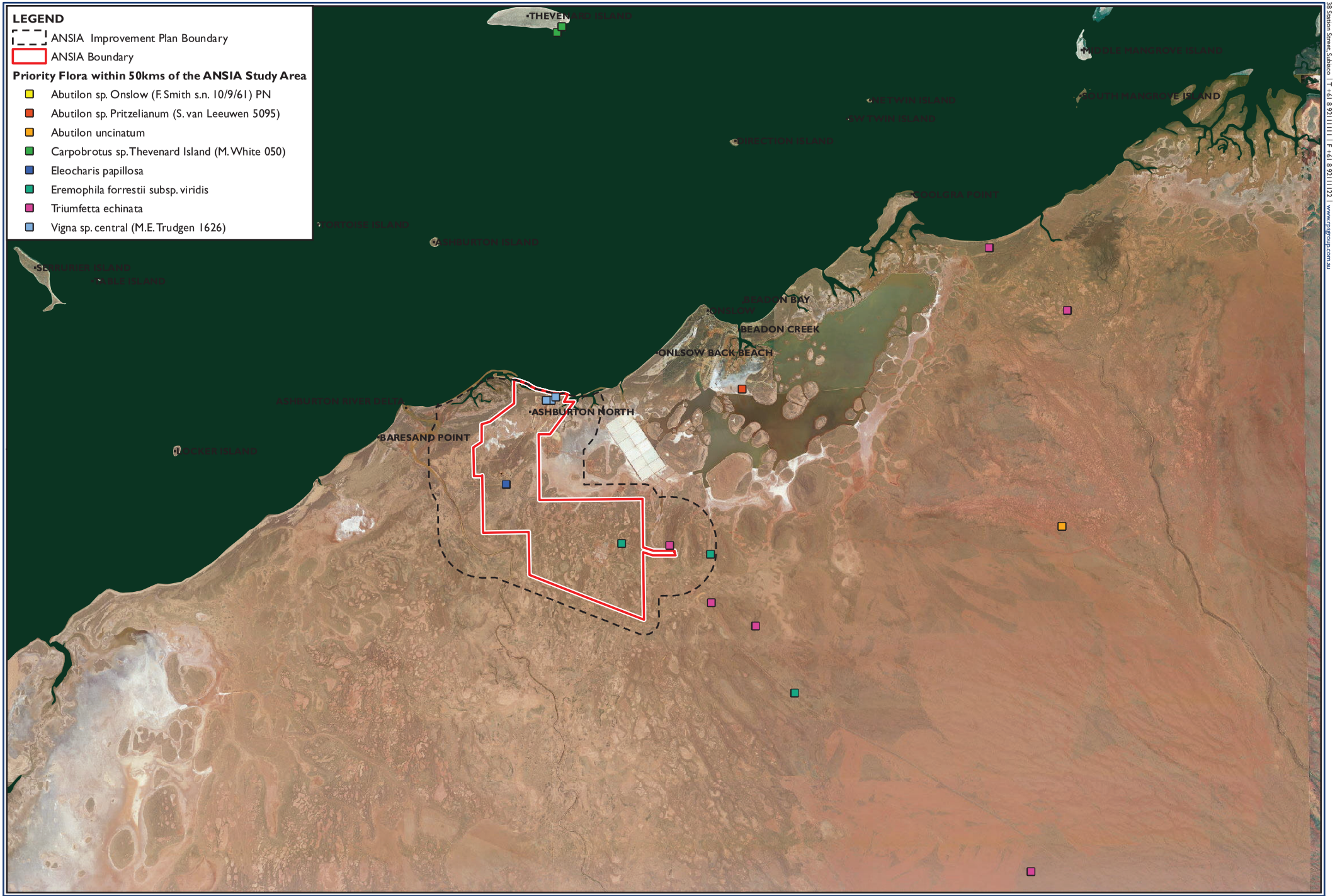

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Source: Orthophoto - Landgate, 2014

Figure 4

Location of Flora Database Search Records within 50km of the ANSIA Study Area

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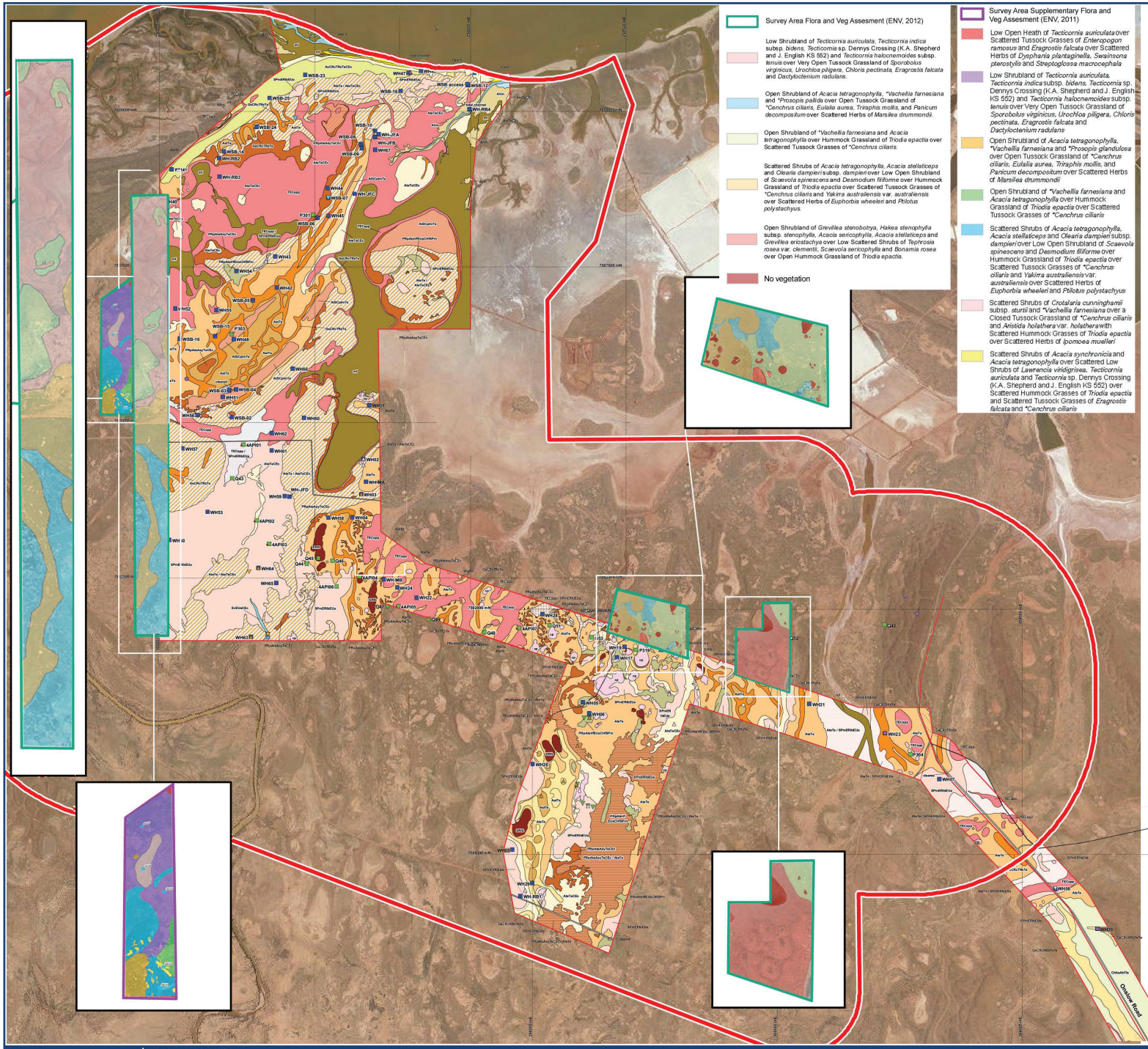

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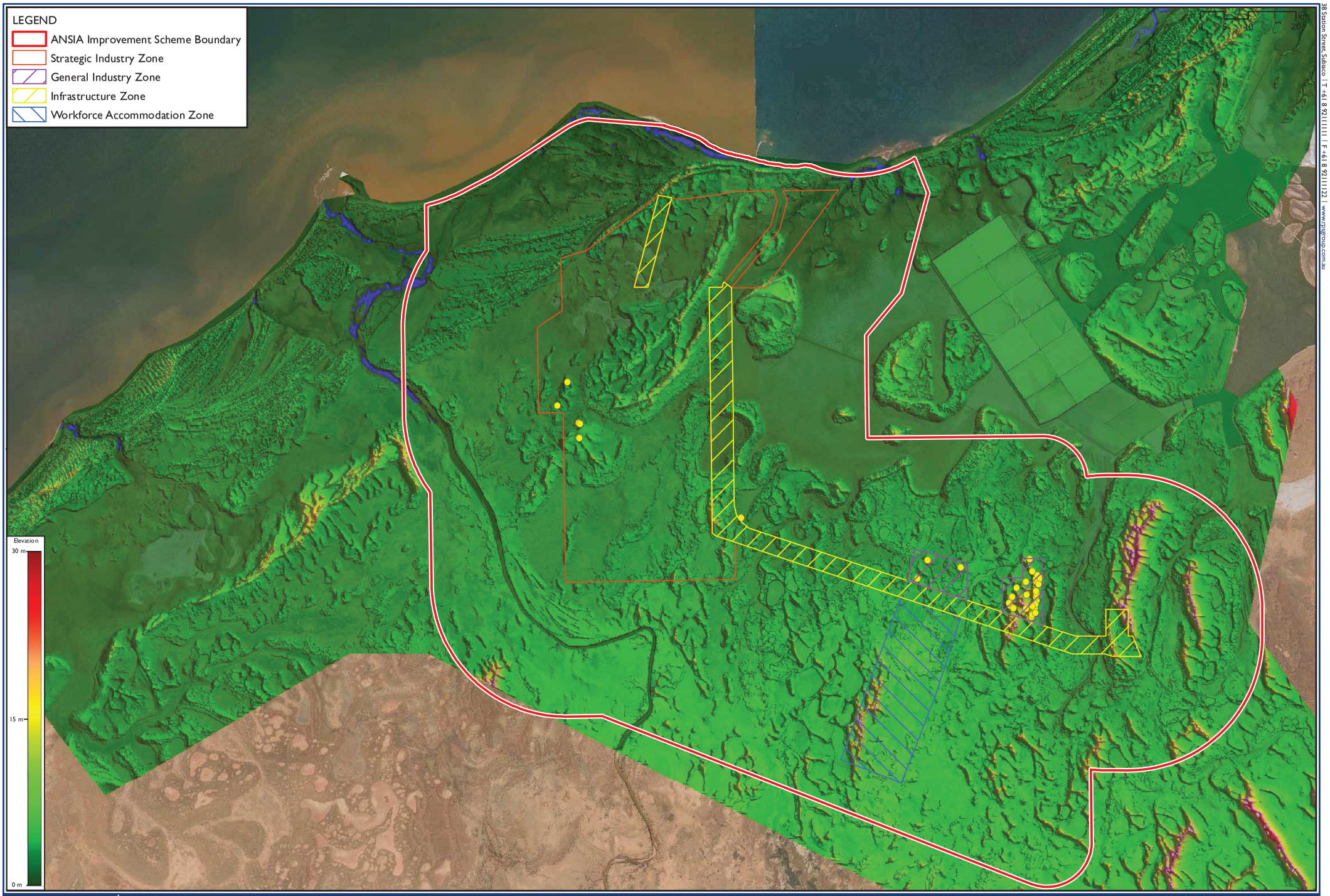
Source: Vegetation Wheatstone Study Area - Biota Environmental Services Vegetation - Flora and Veg Assesment and Supplementary Survey - ENV, 2011, 2012

GDA 1994 MGA Zone 50

0 1.0 2.0 3.0 4.0 km

Figure 5

Vegetation Sub-associations



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GDA 1994 MGA Zone 50
0 0.5 1 2 3 4 km

Figure 6

Priority Flora Records

APPENDIX I

Priority Codes and Categories of Threatened Species

APPENDIX 1: Conservation Codes

Table 1-1: Conservation Codes for Western Australian Flora (FloraBase 2014)

Category	Definition
T	**Threatened Flora (Extant)** Taxa that have been adequately searched for and are deemed to be in the wild either rare, in danger of extinction, or otherwise in need of special protection, and have been gazetted as such (Schedule 1 of the Wildlife Conservation (Rare Flora) Notice under the *Wildlife Conservation Act 1950*). Threatened Flora (Schedule 1) are further ranked by the Department according to their level of threat using IUCN Red List criteria: ▪ CR: Critically Endangered – considered to be facing an extremely high risk of extinction in the wild ▪ EN: Endangered – considered to be facing a very high risk of extinction in the wild ▪ VU: Vulnerable – considered to be facing a high risk of extinction in the wild.
X	**Presumed Extinct Flora** Taxa which have been adequately searched for and there is no reasonable doubt that the last individual has died, and have been gazetted as such (Schedule 2 of the Wildlife Conservation (Rare Flora) Notice under the *Wildlife Conservation Act 1950*).
P1	**Priority One: Poorly-known Taxa** Taxa that are known from one or a few collections or sight records (generally less than five), all on lands not managed for conservation, e.g. agricultural or pastoral lands, urban areas, Shire, Westrail and Main Roads WA road, gravel and soil reserves, and active mineral leases and under threat of habitat destruction or degradation. Taxa may be included if they are comparatively well known from one or more localities but do not meet adequacy of survey requirements and appear to be under immediate threat from known threatening processes.
P2	**Priority Two: Poorly-known Taxa** Taxa that are known from one or a few collections or sight records, some of which are on lands not under imminent threat of habitat destruction or degradation, e.g. national parks, conservation parks, nature reserves, state forest, vacant Crown land, water reserves, etc. Taxa may be included if they are comparatively well known from one or more localities but do not meet adequacy of survey requirements and appear to be under threat from known threatening processes.
P3	**Priority Three: Poorly-known Taxa** Taxa that are known from collections, or sight records from several localities not under imminent threat, or from few but widespread localities, with either large population size or significant remaining areas of apparently suitable habitat, much of it not under imminent threat. Taxa may be included if they are comparatively well known from several localities but do not meet adequacy of survey requirements and known threatening processes exist that could affect them.
P4	**Priority Four: Rare, Near Threatened and Other Taxa in Need of Monitoring** ▪ Rare. Taxa that are considered to have been adequately surveyed, or for which sufficient knowledge is available, and that are considered not currently threatened or in need of special protection, but could be if present circumstances change. These taxa are usually represented on conservation lands. ▪ Near Threatened. Taxa that are considered to have been adequately surveyed and that do not qualify for Conservation Dependent, but that are close to qualifying for Vulnerable. ▪ Taxa that have been removed from the list of threatened species during the past five years for reasons other than taxonomy.
P5	**Priority Five: Conservation Dependent Taxa** Taxa that are not threatened but are subject to a specific conservation program, the cessation of which would result in the taxon becoming threatened within five years.

Table 1-2: EPBC Act Conservation Categories (IUCNRedList 2014)

Category	Definition
EX	**Extinct** A taxon is Extinct when there is no reasonable doubt that the last individual has died. A taxon is presumed Extinct when exhaustive surveys in known and/or expected habitat, at appropriate times (diurnal, seasonal, annual) throughout its historic range have failed to record an individual. Surveys should be over a time frame appropriate to the taxon's life cycle and life form.
EW	**Extinct in the Wild** A taxon is Extinct in the Wild when it is known only to survive in cultivation, in captivity or as a naturalised population (or populations) well outside the past range. A taxon is presumed Extinct in the Wild when exhaustive surveys in known and/or expected habitat, at appropriate times (diurnal, seasonal, annual) throughout its historic range have failed to record an individual. Surveys should be over a time frame appropriate to the taxon's life cycle and life form.
CR	**Critically Endangered** A taxon is Critically Endangered when the best available evidence indicates that it meets any of the criteria A to E for Critically Endangered (see Section V), and it is therefore considered to be facing an extremely high risk of extinction in the wild.
EN	**Endangered** A taxon is Endangered when the best available evidence indicates that it meets any of the criteria A to E for Endangered (see Section V), and it is therefore considered to be facing a very high risk of extinction in the wild.
VU	**Vulnerable** A taxon is Vulnerable when the best available evidence indicates that it meets any of the criteria A to E for Vulnerable (see Section V), and it is therefore considered to be facing a high risk of extinction in the wild.
NT	**Near Threatened** A taxon is Near Threatened when it has been evaluated against the criteria but does not qualify for Critically Endangered, Endangered or Vulnerable now, but is close to qualifying for or is likely to qualify for a threatened category in the near future.
LC	**Least Concern** A taxon is Least Concern when it has been evaluated against the criteria and it does not qualify for Critically Endangered, Endangered, Vulnerable or Near Threatened. Widespread and abundant taxa are included in this category.
DD	**Data Deficient** A taxon is Data Deficient when there is inadequate information to make a direct, or indirect, assessment of its risk of extinction based on its distribution and/or population status. A taxon in this category may be well studied, and its biology well known, but appropriate data on abundance and/or distribution are lacking. Data Deficient is therefore not a category of threat. Listing of taxa in this category indicates that more information is required and acknowledges the possibility that future research will show that threatened classification is appropriate. It is important to make positive use of whatever data are available. In many cases, great care should be exercised in choosing between DD and a threatened status. If the range of a taxon is suspected to be relatively circumscribed, and a considerable period has elapsed since the last record of the taxon, threatened status may well be justified.
NE	**Not Evaluated** A taxon is Not Evaluated when it has not yet been evaluated against the criteria.

RPS

APPENDIX 2

Results of Database Searches

Australian Government
Department of the Environment

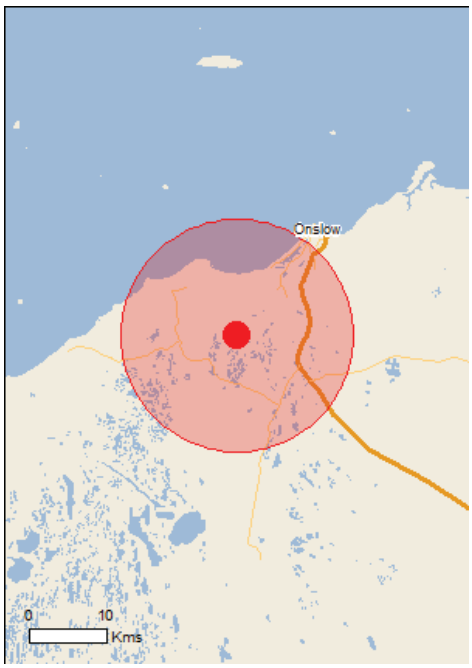
EPBC Act Protected Matters Report

This report provides general guidance on matters of national environmental significance and other matters protected by the EPBC Act in the area you have selected.

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

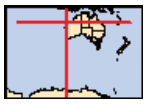
Information is available about Environment Assessments and the EPBC Act including significance guidelines, forms and application process details.

Report created: 10/09/14 11:47:05



This map may contain data which are ©Commonwealth of Australia (Geoscience Australia), ©PSMA 2010

Coordinates
Buffer: 15.0Km



Summary

Matters of National Environmental Significance

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

World Heritage Properties:	None
National Heritage Places:	None
Wetlands of International Importance:	None
Great Barrier Reef Marine Park:	None
Commonwealth Marine Areas:	None
Listed Threatened Ecological Communities:	None
Listed Threatened Species:	16
Listed Migratory Species:	26

Other Matters Protected by the EPBC Act

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

The EPBC Act protects the environment on Commonwealth land, the environment from the actions taken on Commonwealth land, and the environment from actions taken by Commonwealth agencies. As heritage values of a place are part of the 'environment', these aspects of the EPBC Act protect the Commonwealth Heritage values of a Commonwealth Heritage place and the heritage values of a place on the Register of the National Estate.

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

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

Commonwealth Land:	1
Commonwealth Heritage Places:	None
Listed Marine Species:	57
Whales and Other Cetaceans:	13
Critical Habitats:	None
Commonwealth Reserves Terrestrial:	None
Commonwealth Reserves Marine	None

Extra Information

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

Place on the RNE:	2
State and Territory Reserves:	None
Regional Forest Agreements:	None
Invasive Species:	9
Nationally Important Wetlands:	None
Key Ecological Features (Marine)	None

Details

Matters of National Environmental Significance

Listed Threatened Species		[Resource Information]
Name	Status	Type of Presence
Birds		
Macronectes giganteus Southern Giant-Petrel [1060]	Endangered	Species or species habitat may occur within area
Mammals		
Balaenoptera musculus Blue Whale [36]	Endangered	Species or species habitat may occur within area
Dasyurus hallucatus Northern Quoll [331]	Endangered	Species or species habitat likely to occur within area
Eubalaena australis Southern Right Whale [40]	Endangered	Species or species habitat may occur within area
Megaptera novaeangliae Humpback Whale [38]	Vulnerable	Congregation or aggregation known to occur within area
Reptiles		
Aipysurus apraefrontalis Short-nosed Seasnake [1115]	Critically Endangered	Species or species habitat likely to occur within area
Caretta caretta Loggerhead Turtle [1763]	Endangered	Species or species habitat known to occur within area
Chelonia mydas Green Turtle [1765]	Vulnerable	Breeding known to occur within area
Ctenotus angusticeps Airlie Island Ctenotus [25937]	Vulnerable	Species or species habitat may occur within area

Name	Status	Type of Presence
Dermochelys coriacea		
Leatherback Turtle, Leathery Turtle, Luth [1768]	Endangered	Breeding likely to occur within area
Eretmochelys imbricata		
Hawksbill Turtle [1766]	Vulnerable	Breeding known to occur within area
Natator depressus		
Flatback Turtle [59257]	Vulnerable	Breeding known to occur within area
Sharks		
Carcharias taurus (west coast population)		
Grey Nurse Shark (west coast population) [68752]	Vulnerable	Species or species habitat likely to occur within area
Carcharodon carcharias		
Great White Shark [64470]	Vulnerable	Species or species habitat may occur within area
Pristis clavata		
Dwarf Sawfish, Queensland Sawfish [68447]	Vulnerable	Species or species habitat likely to occur within area
Rhincodon typus		
Whale Shark [66680]	Vulnerable	Species or species habitat may occur within area

Listed Migratory Species [Resource Information]

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

Name	Threatened	Type of Presence
Migratory Marine Birds		
Apus pacificus		
Fork-tailed Swift [678]		Species or species habitat likely to occur within area
Macronectes giganteus		
Southern Giant-Petrel [1060]	Endangered	Species or species habitat may occur within area
Sterna bengalensis		
Lesser Crested Tern [815]		Breeding known to occur within area
Migratory Marine Species		
Balaenoptera edeni		
Bryde's Whale [35]		Species or species habitat may occur within area
Balaenoptera musculus		
Blue Whale [36]	Endangered	Species or species habitat may occur within area
Carcharodon carcharias		
Great White Shark [64470]	Vulnerable	Species or species habitat may occur within area
Caretta caretta		
Loggerhead Turtle [1763]	Endangered	Species or species habitat known to occur within area
Chelonia mydas		
Green Turtle [1765]	Vulnerable	Breeding known to occur within area
Dermochelys coriacea		
Leatherback Turtle, Leathery Turtle, Luth [1768]	Endangered	Breeding likely to occur within area
Dugong dugon		
Dugong [28]		Species or species habitat known to occur within area
Eretmochelys imbricata		
Hawksbill Turtle [1766]	Vulnerable	Breeding known to occur within area

Name	Threatened	Type of Presence
Eubalaena australis Southern Right Whale [40]	Endangered	Species or species habitat may occur within area
Manta birostris Giant Manta Ray, Chevron Manta Ray, Pacific Manta Ray, Pelagic Manta Ray, Oceanic Manta Ray [84995]		Species or species habitat known to occur within area
Megaptera novaeangliae Humpback Whale [38]	Vulnerable	Congregation or aggregation known to occur within area
Natator depressus Flatback Turtle [59257]	Vulnerable	Breeding known to occur within area
Orcinus orca Killer Whale, Orca [46]		Species or species habitat may occur within area
Rhincodon typus Whale Shark [66680]	Vulnerable	Species or species habitat may occur within area
Sousa chinensis Indo-Pacific Humpback Dolphin [50]		Species or species habitat likely to occur within area
Tursiops aduncus (Arafura/Timor Sea populations) Spotted Bottlenose Dolphin (Arafura/Timor Sea populations) [78900]		Species or species habitat likely to occur within area
Migratory Terrestrial Species		
Haliaeetus leucogaster White-bellied Sea-Eagle [943]		Species or species habitat known to occur within area
Hirundo rustica Barn Swallow [662]		Species or species habitat may occur within area
Merops ornatus Rainbow Bee-eater [670]		Species or species habitat may occur within area
Migratory Wetlands Species		
Ardea alba Great Egret, White Egret [59541]		Breeding known to occur within area
Ardea ibis Cattle Egret [59542]		Species or species habitat likely to occur within area
Charadrius veredus Oriental Plover, Oriental Dotterel [882]		Species or species habitat may occur within area
Glareola maldivarum Oriental Pratincole [840]		Species or species habitat may occur within area

Other Matters Protected by the EPBC Act

Commonwealth Land [Resource Information]

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

Name
Commonwealth Land -

Listed Marine Species [Resource Information]

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

Name	Threatened	Type of Presence
Birds		
Apus pacificus Fork-tailed Swift [678]		Species or species habitat likely to occur within area
Ardea alba Great Egret, White Egret [59541]		Breeding known to occur within area
Ardea ibis Cattle Egret [59542]		Species or species habitat likely to occur within area
Charadrius veredus Oriental Plover, Oriental Dotterel [882]		Species or species habitat may occur within area
Glareola maldivarum Oriental Pratincole [840]		Species or species habitat may occur within area
Haliaeetus leucogaster White-bellied Sea-Eagle [943]		Species or species habitat known to occur within area
Hirundo rustica Barn Swallow [662]		Species or species habitat may occur within area
Macronectes giganteus Southern Giant-Petrel [1060]	Endangered	Species or species habitat may occur within area
Merops ornatus Rainbow Bee-eater [670]		Species or species habitat may occur within area
Pandion haliaetus Osprey [952]		Breeding known to occur within area
Sterna bengalensis Lesser Crested Tern [815]		Breeding known to occur within area
Fish		
Bulbonaricus brauni Braun's Pughead Pipefish, Pug-headed Pipefish [66189]		Species or species habitat may occur within area
Campichthys tricarinatus Three-keel Pipefish [66192]		Species or species habitat may occur within area
Choeroichthys brachysoma Pacific Short-bodied Pipefish, Short-bodied Pipefish [66194]		Species or species habitat may occur within area
Choeroichthys suillus Pig-snouted Pipefish [66198]		Species or species

Name	Threatened	Type of Presence
		habitat may occur within area
Doryrhamphus janssi Cleaner Pipefish, Janss' Pipefish [66212]		Species or species habitat may occur within area
Doryrhamphus negrosensis Flagtail Pipefish, Masthead Island Pipefish [66213]		Species or species habitat may occur within area
Festucalex scalaris Ladder Pipefish [66216]		Species or species habitat may occur within area
Filicampus tigris Tiger Pipefish [66217]		Species or species habitat may occur within area
Halicampus brocki Brock's Pipefish [66219]		Species or species habitat may occur within area
Halicampus grayi Mud Pipefish, Gray's Pipefish [66221]		Species or species habitat may occur within area
Halicampus nitidus Glittering Pipefish [66224]		Species or species habitat may occur within area
Halicampus spinirostris Spiny-snout Pipefish [66225]		Species or species habitat may occur within area
Haliichthys taeniophorus Ribboned Pipehorse, Ribboned Seadragon [66226]		Species or species habitat may occur within area
Hippichthys penicillus Beady Pipefish, Steep-nosed Pipefish [66231]		Species or species habitat may occur within area
Hippocampus angustus Western Spiny Seahorse, Narrow-bellied Seahorse [66234]		Species or species habitat may occur within area
Hippocampus histrix Spiny Seahorse, Thorny Seahorse [66236]		Species or species habitat may occur within area
Hippocampus kuda Spotted Seahorse, Yellow Seahorse [66237]		Species or species habitat may occur within area
Hippocampus planifrons Flat-face Seahorse [66238]		Species or species habitat may occur within area
Micrognathus micronotopterus Tidepool Pipefish [66255]		Species or species habitat may occur within area
Solegnathus hardwickii Pallid Pipehorse, Hardwick's Pipehorse [66272]		Species or species habitat may occur within area
Solegnathus lettiensis Gunther's Pipehorse, Indonesian Pipefish [66273]		Species or species habitat may occur within area
Solenostomus cyanopterus Robust Ghostpipefish, Blue-finned Ghost Pipefish, [66183]		Species or species habitat may occur within

Name	Threatened	Type of Presence
		area
Solenostomus paegnius Rough-snout Ghost Pipefish [68425]		Species or species habitat may occur within area
Syngnathoides biaculeatus Double-end Pipehorse, Double-ended Pipehorse, Alligator Pipefish [66279]		Species or species habitat may occur within area
Trachyrhamphus bicoarctatus Bentstick Pipefish, Bend Stick Pipefish, Short-tailed Pipefish [66280]		Species or species habitat may occur within area
Trachyrhamphus longirostris Straightstick Pipefish, Long-nosed Pipefish, Straight Stick Pipefish [66281]		Species or species habitat may occur within area
Mammals		
Dugong dugon Dugong [28]		Species or species habitat known to occur within area
Reptiles		
Acalyptophis peronii Horned Seasnake [1114]		Species or species habitat may occur within area
Aipysurus apraefrontalis Short-nosed Seasnake [1115]	Critically Endangered	Species or species habitat likely to occur within area
Aipysurus duboisii Dubois' Seasnake [1116]		Species or species habitat may occur within area
Aipysurus eydouxii Spine-tailed Seasnake [1117]		Species or species habitat may occur within area
Aipysurus laevis Olive Seasnake [1120]		Species or species habitat may occur within area
Astrotia stokesii Stokes' Seasnake [1122]		Species or species habitat may occur within area
Caretta caretta Loggerhead Turtle [1763]	Endangered	Species or species habitat known to occur within area
Chelonia mydas Green Turtle [1765]	Vulnerable	Breeding known to occur within area
Dermochelys coriacea Leatherback Turtle, Leathery Turtle, Luth [1768]	Endangered	Breeding likely to occur within area
Disteira kingii Spectacled Seasnake [1123]		Species or species habitat may occur within area
Disteira major Olive-headed Seasnake [1124]		Species or species habitat may occur within area
Emydocephalus annulatus Turtle-headed Seasnake [1125]		Species or species habitat may occur within area
Ephalophis greyi North-western Mangrove Seasnake [1127]		Species or species habitat may occur within area

Name	Threatened	Type of Presence
Eretmochelys imbricata Hawksbill Turtle [1766]	Vulnerable	Breeding known to occur within area
Hydrophis czeblukovi Fine-spined Seasnake [59233]		Species or species habitat may occur within area
Hydrophis elegans Elegant Seasnake [1104]		Species or species habitat may occur within area
Hydrophis ornatus Spotted Seasnake, Ornate Reef Seasnake [1111]		Species or species habitat may occur within area
Natator depressus Flatback Turtle [59257]	Vulnerable	Breeding known to occur within area
Pelamis platurus Yellow-bellied Seasnake [1091]		Species or species habitat may occur within area

Whales and other Cetaceans [Resource Information]

Name	Status	Type of Presence
Mammals		
Balaenoptera acutorostrata Minke Whale [33]		Species or species habitat may occur within area
Balaenoptera edeni Bryde's Whale [35]		Species or species habitat may occur within area
Balaenoptera musculus Blue Whale [36]	Endangered	Species or species habitat may occur within area
Delphinus delphis Common Dophin, Short-beaked Common Dolphin [60]		Species or species habitat may occur within area
Eubalaena australis Southern Right Whale [40]	Endangered	Species or species habitat may occur within area
Grampus griseus Risso's Dolphin, Grampus [64]		Species or species habitat may occur within area
Megaptera novaeangliae Humpback Whale [38]	Vulnerable	Congregation or aggregation known to occur within area
Orcinus orca Killer Whale, Orca [46]		Species or species habitat may occur within area
Sousa chinensis Indo-Pacific Humpback Dolphin [50]		Species or species habitat likely to occur within area
Stenella attenuata Spotted Dolphin, Pantropical Spotted Dolphin [51]		Species or species habitat may occur within area
Tursiops aduncus Indian Ocean Bottlenose Dolphin, Spotted Bottlenose Dolphin [68418]		Species or species habitat likely to occur within area
Tursiops aduncus (Arafura/Timor Sea populations) Spotted Bottlenose Dolphin (Arafura/Timor Sea populations) [78900]		Species or species habitat likely to occur

Name	Status	Type of Presence
		within area
Tursiops truncatus s. str. Bottlenose Dolphin [68417]		Species or species habitat may occur within area

Extra Information

Places on the RNE

[Resource Information]

Note that not all Indigenous sites may be listed.

Name	State	Status
Natural		
Coastal Margin Exmouth Gulf to Cape Preston	WA	Indicative Place
Historic		
Old Onslow Townsite	WA	Indicative Place

Invasive Species

[Resource Information]

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

Name	Status	Type of Presence
Mammals		
Capra hircus Goat [2]		Species or species habitat likely to occur within area
Equus asinus Donkey, Ass [4]		Species or species habitat likely to occur within area
Felis catus Cat, House Cat, Domestic Cat [19]		Species or species habitat likely to occur within area
Mus musculus House Mouse [120]		Species or species habitat likely to occur within area
Oryctolagus cuniculus Rabbit, European Rabbit [128]		Species or species habitat likely to occur within area
Vulpes vulpes Red Fox, Fox [18]		Species or species habitat likely to occur within area
Plants		
Cenchrus ciliaris Buffel-grass, Black Buffel-grass [20213]		Species or species habitat likely to occur within area
Parkinsonia aculeata Parkinsonia, Jerusalem Thorn, Jelly Bean Tree, Horse Bean [12301]		Species or species habitat likely to occur

Name	Status	Type of Presence
		within area
Prosopis spp. Mesquite, Algaroba [68407]		Species or species habitat likely to occur within area

Coordinates

-21.75193 115.01833

Caveat

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

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

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

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

For species where the distributions are well known, maps are digitised from sources such as recovery plans and detailed habitat studies. Where appropriate, core breeding, foraging and roosting areas are indicated under 'type of presence'. For species whose distributions are less well known, point locations are collated from government wildlife authorities, museums, and non-government organisations; bioclimatic distribution models are generated and these validated by experts. In some cases, the distribution maps are based solely on expert knowledge.

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

- migratory and
- marine

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

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

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

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

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

Acknowledgements

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

-Department of Environment, Climate Change and Water, New South Wales
-Department of Sustainability and Environment, Victoria
-Department of Primary Industries, Parks, Water and Environment, Tasmania
-Department of Environment and Natural Resources, South Australia
-Parks and Wildlife Service NT, NT Dept of Natural Resources, Environment and the Arts
-Environmental and Resource Management, Queensland
-Department of Environment and Conservation, Western Australia
-Department of the Environment, Climate Change, Energy and Water
-Birds Australia
-Australian Bird and Bat Banding Scheme
-Australian National Wildlife Collection
-Natural history museums of Australia
-Museum Victoria
-Australian Museum
-SA Museum
-Queensland Museum
-Online Zoological Collections of Australian Museums
-Queensland Herbarium
-National Herbarium of NSW
-Royal Botanic Gardens and National Herbarium of Victoria
-Tasmanian Herbarium
-State Herbarium of South Australia
-Northern Territory Herbarium
-Western Australian Herbarium
-Australian National Herbarium, Atherton and Canberra
-University of New England
-Ocean Biogeographic Information System
-Australian Government, Department of Defence
-State Forests of NSW
-Geoscience Australia
-CSIRO
-Other groups and individuals

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

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

Department of the Environment
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Canberra ACT 2601 Australia
+61 2 6274 1111

Government of **Western Australia**
Department of **Parks and Wildlife**

Your Ref:
Our Ref: **40-0914FL**
Enquiries: Rebecca Kay
Phone: (08) 9334 0453
Email: flora.data@dpaw.wa.gov.au

RPS
PO Box 465
Subiaco WA 6904

Attention: Giles Glasson

Dear Giles Glasson,

REQUEST FOR THREATENED AND PRIORITY FLORA INFORMATION

I refer to your request of 12 September 2014 for Threatened (Declared Rare) and Priority Flora information in the Ashburton area. The search was conducted within the area of the central coordinates you submitted with an additional 50km buffer.

A search was undertaken for this area of **(1)** the Department's *Threatened (Declared Rare) and Priority Flora* database (for results, *if any*, see "TPFL" – coordinates are GDA94), **(2)** the *Western Australian Herbarium Specimen* database for priority species opportunistically collected in the area of interest (for results, *if any*, see "WAHERB"- coordinates are GDA94 – see condition number 9 in the attached 'Conditions in Respect of Supply' and **(3)**, the Department's *Threatened and Priority Flora List* [this list is searched using 'place names'. This list, which may also be used as a species target list, contains species that are declared rare (Conservation Code R or X for those presumed to be extinct), poorly known (Conservation Codes 1, 2 or 3), or require monitoring (Conservation Code 4) – for results, *if any*, see "TP List"]. The results are attached electronically to this email.

Attached also are the conditions under which this information has been supplied. Your attention is specifically drawn to the seventh point, which refers to the requirement to undertake field investigations for the accurate determination of Threatened and Priority flora occurrence at a site. *The information supplied should be regarded as an indication only of the Threatened and Priority flora that may be present and may be used as a target list in any surveys undertaken.*

The information provided does not preclude you from obtaining and complying with, where necessary, land clearing approvals from other agencies.

An invoice for $300 (plus GST) to supply this information will be forwarded.

It would be appreciated if any populations of Threatened and Priority flora you encounter in the area could be reported to this Department to ensure their ongoing management.

If you require any further details, or wish to discuss Threatened and Priority flora management, please contact Dr Ken Atkins, Manager, Species and Communities Branch, on (08) 9334 0455.

Yours faithfully

Rebecca Kay
.....
THREATENED FLORA DATABASE OFFICER
for the Director General

19 September 2014

Species and Communities Branch
17 Dick Perry Ave, Technology Park, Kensington
Phone: (08) 9334 0455 Fax: (08) 9334 0278
Locked Bag 104, Bentley Delivery Centre, Bentley, Western Australia 6983
www.dpaw.wa.gov.au

DEPARTMENT OF PARKS AND WILDLIFE

THREATENED (DECLARED RARE) AND PRIORITY FLORA INFORMATION

CONDITIONS IN RESPECT OF SUPPLY OF INFORMATION

1. All requests for data to be made in writing to the Director General, Department of Parks and Wildlife, Attention: Threatened Flora Database Officer, Species and Communities Branch.

2. The data supplied may not be supplied to other organisations, nor be used for any purpose other than for the project for which they have been provided, without the prior written consent of the Director General, Department of Parks and Wildlife.

3. Specific locality information for Threatened and Priority Flora is regarded as confidential, and should be treated as such by receiving organisations. Specific locality information may not be used in public reports without the written permission of the Director General, Department of Parks and Wildlife. Publicly available reports may only show generalised locations or, where necessary, show specific locations without identifying species. Species and Communities Branch is to be contacted for guidance on the presentation of Threatened and Priority Flora information.

4. Note that the Department of Parks and Wildlife respects the privacy of private landowners who may have Threatened and Priority Flora on their property. Threatened and Priority Flora locations identified in the data as being on private property should be treated in confidence, and contact with property owners made through the Department of Parks and Wildlife.

5. Receiving organisations should note that while every effort has been made to prevent errors and omissions in the data provided, they may be present. The Department of Parks and Wildlife accepts no responsibility for this.

6. Receiving organisations must also recognise that the database is subject to continual updating and amendment, and such considerations should be taken into account by the user.

7. **It should be noted that the supplied data do not necessarily represent a comprehensive listing of the Threatened and Priority Flora of the area in question. Its comprehensiveness is dependant on the amount of survey carried out within the specified area. The receiving organisation should employ a botanist, if required, to undertake a survey of the area under consideration.**

8. Acknowledgment of the Department of Parks and Wildlife as source of the data is to be made in any published material. The unique reference number that is given upon the request for information should be quoted when referencing the data. Copies of all such publications are to be forwarded to the Department of Parks and Wildlife, Attention: The Manager, Species and Communities Branch.

9. The development of the PERTH Herbarium database was not originally intended for electronic mapping (eg. GIS ArcView). The latitude and longitude coordinates for each entry are not verified prior to being databased. It is only in recent times that collections have been submitted with GPS coordinates. Therefore, be aware when using this data in ArcView that some records may not plot to the locality description given with each collection.

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DECLARED RARE AND PRIORITY FLORA LIST

CONSERVATION CODES

for Western Australian taxa

T: **Threatened Flora** (Declared Rare Flora - Extant)
Schedule 1 under the *Wildlife Conservation Act 1950* Rare Flora Notice

Taxa which have been adequately searched for and are deemed to be in the wild either rare, in danger of extinction, or otherwise in need of special protection, and have been gazetted as such. The assessment of the conservation status of these species is based on their national extent.

X: **Presumed Extinct Flora** (Declared Rare Flora – Extinct)
Schedule 2 under the *Wildlife Conservation Act 1950* Rare Flora Notice

Taxa which have been adequately searched for and there is no reasonable doubt that the last individual has died, and have been gazetted as such.

Threatened Flora (Schedule 1) are further ranked by the Department according to their level of threat using IUCN Red List criteria:

CR: **Critically Endangered** – considered to be facing an extremely high risk of extinction in the wild.

EN: **Endangered** – considered to be facing a very high risk of extinction in the wild.

VU: **Vulnerable** – considered to be facing a high risk of extinction in the wild.

A list of the current rankings can be downloaded from DPAW's Listing of species and ecological communities webpage at
http://www.dpaw.wa.gov.au/plants-and-animals/threatened-species-and-communities

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Species that have not yet been adequately surveyed to be listed under Schedule 1 or 2 are added to the Priority Flora and Priority Fauna Lists under Priorities 1, 2 or 3. These three categories are ranked in order of priority for survey and evaluation of conservation status so that consideration can be given to their declaration as threatened flora or fauna. Species that are adequately known, are rare but not threatened, or meet criteria for Near Threatened, or that have been recently removed from the threatened list for other than taxonomic reasons, are placed in Priority 4. These species require regular monitoring. Conservation Dependent species are placed in Priority 5.

Assessment of Priority codes is based on the Western Australian distribution of the species, unless the distribution in WA is part of a contiguous population extending into adjacent States, as defined by the known spread of locations.

1: Priority One: Poorly-known species

Species that are known from one or a few locations (generally five or less) which are potentially at risk. All occurrences are either: very small; or on lands not managed for conservation, e.g. agricultural or pastoral lands, urban areas, road and rail reserves, gravel reserves and active mineral leases; or otherwise under threat of habitat destruction or degradation. Species may be included if they are comparatively well known from one or more locations but do not meet adequacy of survey requirements and appear to be under immediate threat from known threatening processes. Such species are in urgent need of further survey.

2: Priority Two: Poorly-known species

Species that are known from one or a few locations (generally five or less), some of which are on lands managed primarily for nature conservation, e.g. national parks, conservation parks, nature reserves and other lands with secure tenure being managed for conservation. Species may be included if they are comparatively well known from one or more locations but do not meet adequacy of survey requirements and appear to be under threat from known threatening processes. Such species are in urgent need of further survey.

3: Priority Three: Poorly-known species

Species that are known from several locations, and the species does not appear to be under imminent threat, or from few but widespread locations with either large population size or significant remaining areas of apparently suitable habitat, much of it not under imminent threat. Species may be included if they are comparatively well known from several locations but do not meet adequacy of survey requirements and known threatening processes exist that could affect them. Such species are in need of further survey.

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

(a) Rare. Species that are considered to have been adequately surveyed, or for which sufficient knowledge is available, and that are considered not currently threatened or in need of special protection, but could be if present circumstances change. These species are usually represented on conservation lands.
(b) Near Threatened. Species that are considered to have been adequately surveyed and that do not qualify for Conservation Dependent, but that are close to qualifying for Vulnerable.
(c) Species that have been removed from the list of threatened species during the past five years for reasons other than taxonomy.

5: Priority Five: Conservation Dependent species

Species that are not threatened but are subject to a specific conservation program, the cessation of which would result in the species becoming threatened within five years.

Recommendations for additions, deletions or changes to the Declared Rare and Priority Flora List should be forwarded to the Flora Administration Officer or Senior Botanist Species and Communities Branch, DEC.

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ABBREVIATIONS USED IN THREATENED AND PRIORITY FLORA DATABASE

VESTING

AAP	Aboriginal Planning Authority
AGR	Chief Executive, Dep. of Agriculture
ALT	Aboriginal Land Trust
APB	Agricultural Protection Board of WA
BGP	Botanical Gardens & Parks Authority
BSA	Boy Scouts Association
CC	Conservation Commission – NPNCA - LFC
CGT	Crown Grant in Trust
COM	Commonwealth of Australia
CRO	Crown Freehold-Govt Ownership
CRW	Crown
DAG	Dep. of Agriculture
DOW	Dep. of Water
DPI	Dep. of Planning
EXD	Exec Direc CALM
FES	Fire and Emergency Services Aust.
HOW	Dep. of Housing/State Housing Commission
ILD	Industrial Lands Develop. Auth
LAC	LandCorp
LGA	Shire/LGA
MAG	Minister for Agriculture
MCB	Metropolitan Cemeteries Board
MED	Ministry of Education
MHE	Minister for Health
MIN	Minister for Mines
MPL	Ministry for Planning
MPR	Minister for Prisons
MRD	Main Roads WA
MTR	Minister for Transport
MWA	Minister for Water Resources
MWO	Minister for Works
NAT	Natural Trust of Australia WA
NON	Not Vested
PLB	Pastoral Lands Board
PRI	Private/Freehold
RAI	Public Transport Authority
REL	Religious Organisation
SPC	State Planning Commission
SYN	Synergy (ex Western Power)
SWA	State of Western Australia
TEL	Telstra
UNK	Unknown
WAT	Water Corporation
WEL	Minister Community Welfare
WRC	Water & Rivers Commission
XPL	Ex-Pastoral Lease

PURPOSES

ABR	Aboriginal Reserve
ACC	Access Track
AER	Aerodrome
AIR	Airport
ARS	Agricultural Research Station
BAP	Baptist Union of WA
CAM	Camping
CAR	Caravan park
CEM	Cemetery
CFA	Conservation of Fauna
CFF	Conservation Of Flora & Fauna
CFL	Conservation of Flora
CHU	Church
CMN	Communications
COM	Common
CON	Conservation Park
CPK	Car Park
CRM	Conservation & Resource Management
DEF	Defence
DRA	Drain
EDE	Educational Endowment
EDU	Educational purposes UWA
ENE	Enjoyment of Natural Environ.
EPL	Ex-pastoral Lease (Sect 33(2) CALM Act)
EPS	Explosives
EXC	Excepted from sale
EXL	Exploration Lease
EXP	Experimental Farm
FIR	Firing Range
FOR	State Forest
FP	Foreshore Purposes
GE	General Lease
GHA	Grain Handling
GOL	Golf
GRA	Gravel Pit
GVT	Government Requirements
HAR	Harbour Purposes
HEP	Heritage Purposes
HER	Heritage trail
HOS	Hospital
KEN	Kennels
LGA	LGA/Shire Requirements
LPR	Landscape Protection
MIN	Mining lease
MUN	Municipal Purposes
NPK	National Park
NRE	Nature Reserve
OTH	Other
PAR	Parkland (& Recreation)
PAS	Pastoral lease
PCR	Proposed for Conservation
PFF	Protection of Flora & Fauna
PFL	Protection of Flora
PIC	Picnic ground
PLA	Plantation
PMC	Protection of Meteorite Crater
POS	Public Open Space
PPA	Public parkland
PRS	Prison site
PUR	Purchase Lease
PUT	Public Utility
QUA	Quarry
RAC	Racecourse
RAD	Radio Station
REC	Recreation
REH	Rehabilitation/Re-establish Native Plants
RRE	Railway Reserve
RUB	Rubbish
SAL	Saleyards
SAN	Sand
SCH	School-site
SET	Settlers requirements
SHO	Showgrounds
SNN	Sanitary
SOI	Soil Conservation
STO	Stopping place
STK	Stock Route
TIM	Timber
TOU	Tourism
TOW	Town-site
TRA	Training Ground
TRI	Trig station
UCL	Unallocated Crown Land
UNK	Unknown
VER	Road Verge
VPF	Vermin Proof Fence
WAT	Water
WLS	Wildlife Sanctuary
WOO	Firewood

ABBREVIATIONS USED IN THE WESTERN AUSTRALIAN HERBARIUM DATABASE

Geocode Method - The method that was used to record the latitude and longitude.

Auto - Indicates that the coordinate data in the record was created automatically (i.e. by software), usually by creating a coordinate from information provided in the Nearest Named Place or Locality textual description fields.

GAP - Acronym for "Generalised Arbitrary Point" as used in HISPID. GAP indicates that the coordinate data was obtained manually from the Nearest Named Place or Locality textual description fields.

GPS - Acronym for "Global Positioning System". GPS indicates that the coordinate data in the record was obtained from a GPS unit by the collector of the specimen.

MAN - Shorthand for manual. MAN indicates that the coordinate data was created by hand using some method not allowed for by one of the other manual Geocode Method values, in particular, TOPO, GAP, or GPS.

TOPO - Shorthand for topographic map. TOPO indicates that the coordinate data was obtained by plotting textual locality details against a topographic map.

None - Indicates that no coordinate data has been supplied by the collector.

Unknown - Indicates that there is no known method for determining the coordinate data. Should be used if the collector provided no indication of how they sampled the specimen's coordinate data.

PREC (Precision) - precision ratings for coordinates.

Precision 1: Absolutely precise (to nearest 100m or nearest second) and must be GPS determined. For example 35°26'42"S 123°40'26"E

Precision 2: Falling within a diameter of 3km (ca 2 minutes) or if no GPS mentioned in collecting notes. (The location must be able to be pinpointed on a 1:250 000 map, a spot locality. For example 35°26'42"S 123°40'26"E

Precision 3: Falling within a diameter of 10km (ca 7 minutes) or for degrees and minutes, where seconds have not been given. For example 35°26'_"S 123°40'_"E

Precision 4: Falling within a diameter of ca 50km (30 minutes). For example 35°26'_"S 123°40'_"E

Precision 5: Where a location is a prescribed large geographical area within a state or only the state is given. Diameter is greater than 50km. For example 35°_'_"S 123°_'_"E

Precision 6: used when localities are New Holland, Eastern Australia or Not given. Fields will be left blank.

FID_	PopId	Nameid	Taxon	ConsStatus	WARank	PopNumbe	SubPopCo	Gda94Lat	Gda94Long	PopStatus	Location	District	Vesting	Purpose1	Purpose2	CountDate	Method	MatureCo	JuvenileCo	SeedlingCc	LiveTotal	PlantType	AreaOccup	inFlower	Population
	94348	14110	Abutilon sp		1	1		-21.7683	115.3389		Davis Bore	KARRATHA	PLB	PAS		########		0			0			N	
	94416	18359	Carpobrotu		2	1		-21.4632	115.0196		Thevenard	KARRATHA	CC	CFF		########		0			0			Y	

Taxon	Status	Rank	IUCNCriter	EPBC	DECRegion	DECDistrict	Distribution	FloweringP	RecoveryPl
Abutilon sp. Onslow (F. Smith s.n. 10/9/61) PN		1			PILB	KARRATHA	Onslow, Yaraloola Stn	Sep	
Eremophila forrestii subsp. viridis		3			PILB	KARRATHA	Onslow, Canning Stock Route	Aug	
Eremophila youngii subsp. lepidota		4			GOLD,MWST,PILB	KALGOORLIE,EXMOUTH,KARRA	Exmouth, Fortescue Marsh, Paraburdoo, Mulga Downs Stn., Jigalong Creek, Giralia Stn., Minilya	Mar,Jun	
Euphorbia inappendiculata var. inappendiculata		2			PILB	KARRATHA	Barlee Range N.R., Warralong Stn, Fortescue, Tom Price	May, Aug	
Goodenia pallida		1			PILB	KARRATHA	Fortescue		
Myriocephalus nudus		1			PILB	EXMOUTH	Yannarie River	May,Aug,Sep	
Sclerolaena stylosa		1			MWST,PILB	EXMOUTH,GERALDTON,SHARK	Shark Bay, Giralia Stn., Carbla	Aug	
Tecticornia globulifera		1			PILB	KARRATHA	Fortescue Marsh		
Tecticornia medusa		3			PILB	KARRATHA	Roy Hill, Fortescue Marsh	Nov	
Tecticornia sp. Christmas Creek (K.A. Shepherd & T. Colmer et al. KS 1063)		1			GOLD,PILB	KALGOORLIE,KARRATHA	Fortescue Marsh, Roy Hill Stn, Little Sandy Desert	Jul-Aug	
Tephrosia rosea var. Port Hedland (A.S. George 1114) PN		1			PILB	KARRATHA	Peawah River, Finucane Is.	Jul-Sep	
Triumfetta echinata		3			PILB	KARRATHA	Peedamulla Stn, Varoo Stn		

FID_	Sheet_no	Taxon	Cons_code	Site	Vegetation	Locality	Lat	Long	Geocode_r	Prec	Coll_Date	F12
	PERTH	060 Abutilon sp	1			1 km S of (	-21.6833	115.1333	MAN	3	03 08 1963	
	PERTH	049 Abutilon u	1	Plain with :	Hard humr	Davis Bore	-21.7683	115.3389	MAN	0	13 09 1996	
	PERTH	074 Carpobrotu	2	Low open a		Thevenarc	-21.4667	115.0167	GPS	2	23 06 1988	
	PERTH	139 Carpobrotu	2	Coarse whi		Thevenarc	-21.4632	115.0196	UNK	2	24 08 1990	
	PERTH	084 Eleocharis	3	Broad drai	Mosaic of '	Site: 567_I	-21.7389	114.9799	GPS	1	14 03 2011	
	PERTH	083 Eremophila	3	Dune. Red	Tall shrubl	Onslow	-21.8671	115.1649	GPS	1	02 09 2011	
	PERTH	085 Eremophila	3	Red sands	Acacia tetr	Ca 30 km S	-21.7756	115.054	GPS	1	19 08 2009	
	PERTH	406 Eremophila	3			10 miles S	-21.7828	115.1117	AUTO	3	28 08 1960	
	PERTH	081 Triumfetta	3	Dune. Red	Shrubland	Ca 16 km S	-21.7771	115.0854	GPS	1	01 11 2009	
	PERTH	046 Triumfetta	3	Slope of sa	Soft humm	Ca 35 km N	-21.5997	115.2939	MAN	0	05 11 1996	
	PERTH	080 Triumfetta	3	Ridge. Red	Low open \	ca 25 km S	-21.8264	115.1401	GPS	1	14 11 2008	
	PERTH	080 Triumfetta	3	Flat. Red-b	Open Shru	ca 50 km S	-21.9767	115.3162	GPS	1	14 11 2008	
	PERTH	154 Triumfetta	3	Growing o	With soft s	20 km E of	-21.6381	115.3439	AUTO	3	25 10 1980	
	PERTH	154 Triumfetta	3			12 miles S	-21.8119	115.1117	AUTO	3	28 05 1962	
	PERTH	080 Vigna sp. c	2	Sandy plair	Triodia epa	N Ashburt	-21.6887	115.0098	GPS	1	02 04 2009	
	PERTH	080 Vigna sp. c	2	Plain with	Triodia epa	N Ashburt	-21.6887	115.0065	GPS	1	18 07 2008	
	PERTH	080 Vigna sp. c	2	Sandplains	Triodia epa	Onslow	-21.6867	115.0128	GPS	1	18 07 2008	

NatureMap
Mapping Western Australia's biodiversity

NatureMap Species Report

Created By Guest user on 15/09/2014

Current Names Only Yes
Core Datasets Only Yes
Method 'By Circle'
Centre 115°01' 05" E,21°45' 06" S
Buffer 25km
Group By Conservation Status

Conservation Status	Species	Records
Non-conservation taxon	673	19845
Other specially protected fauna	3	12
Priority 1	2	2
Priority 2	1	3
Priority 3	4	8
Priority 4	7	51
Protected under international agreement	26	179
Rare or likely to become extinct	16	56
TOTAL	**732**	**20156**

	Name ID	Species Name	Naturalised	Conservation Code	[1]Endemic To Query Area
Rare or likely to become extinct					
1.	24783	*Calidris canutus subsp. rogersi (Red Knot (north-eastern Siberia))*		T	
2.	24784	*Calidris ferruginea (Curlew Sandpiper)*		T	
3.	24790	*Calidris tenuirostris (Great Knot)*		T	
4.	24372	*Charadrius leschenaultii subsp. leschenaultii (Greater Sand Plover (Mongolian))*		T	
5.	25576	*Charadrius mongolus (Lesser Sand Plover)*		T	
6.	25336	*Chelonia mydas (Green Turtle)*		T	
7.	24093	*Dasyurus hallucatus (Northern Quoll)*		T	
8.	25238	*Liasis olivaceus subsp. barroni (Pilbara Olive Python)*		T	
9.	24796	*Limosa lapponica subsp. menzbieri (Bar-tailed Godwit (northern Siberian))*		T	
10.	25344	*Natator depressus (Flatback Turtle)*		T	
11.	24798	*Numenius madagascariensis (Eastern Curlew)*		T	
12.	25504	*Perameles bougainville (Western Barred Bandicoot, Marl)*		T	
13.	24743	*Pezoporus occidentalis (Night Parrot)*		T	
14.	34037	*Pristis zijsron (Green Sawfish)*		T	
15.	24530	*Sterna nereis subsp. nereis (Fairy Tern)*		T	
Protected under international agreement					
16.	41323	*Actitis hypoleucos (Common Sandpiper)*		IA	
17.	25554	*Apus pacificus (Fork-tailed Swift)*		IA	
18.	41324	*Ardea modesta (Eastern Great Egret)*		IA	
19.	25560	*Ardea sacra (Eastern Reef Egret, Eastern Reef Heron)*		IA	
20.	25736	*Arenaria interpres (Ruddy Turnstone)*		IA	
21.	24779	*Calidris acuminata (Sharp-tailed Sandpiper)*		IA	
22.	24780	*Calidris alba (Sanderling)*		IA	
23.	24788	*Calidris ruficollis (Red-necked Stint)*		IA	
24.	25575	*Charadrius leschenaultii (Greater Sand Plover)*		IA	
25.	24378	*Charadrius veredus (Oriental Plover)*		IA	
26.	24481	*Glareola maldivarum (Oriental Pratincole)*		IA	
27.	24293	*Haliaeetus leucogaster (White-bellied Sea-Eagle)*		IA	
28.	30932	*Limosa lapponica (Bar-tailed Godwit)*		IA	
29.	24598	*Merops ornatus (Rainbow Bee-eater)*		IA	
30.	24799	*Numenius minutus (Little Curlew)*		IA	
31.	25742	*Numenius phaeopus (Whimbrel)*		IA	
32.	24497	*Oceanites oceanicus (Wilson's Storm Petrel)*		IA	
33.	24383	*Pluvialis squatarola (Grey Plover)*		IA	
34.	24521	*Sterna bengalensis (Lesser Crested Tern)*		IA	
35.	24523	*Sterna caspia (Caspian Tern)*		IA	
36.	25640	*Sterna dougallii (Roseate Tern)*		IA	
37.	25642	*Sterna hirundo (Common Tern)*		IA	
38.	24529	*Sterna leucoptera (White-winged Black Tern)*		IA	

	Name ID	Species Name	Naturalised	Conservation Code	[1]Endemic To Query Area
39.	24803	*Tringa brevipes (Grey-tailed Tattler)*		IA	
40.	24806	*Tringa glareola (Wood Sandpiper)*		IA	
41.	24808	*Tringa nebularia (Common Greenshank)*		IA	
Other specially protected fauna					
42.	24859	*Crocodylus porosus (Salt-water Crocodile)*		S	
43.	24084	*Dugong dugon (Dugong)*		S	
44.	25624	*Falco peregrinus (Peregrine Falcon)*		S	
Priority 1					
45.	43021	*Abutilon sp. Pritzelianum (S. van Leeuwen 5095)*		P1	
46.	25164	*Lerista planiventralis subsp. maryani (Keeled Slider (NW coast Onslow to Barradale), skink)*		P1	
Priority 2					
47.	20671	*Vigna sp. central (M.E. Trudgen 1626)*		P2	
Priority 3					
48.	31017	*Eleocharis papillosa*		P3	
49.	17177	*Eremophila forrestii subsp. viridis*		P3	
50.	34036	*Pristis microdon (Freshwater Sawfish)*		P3	
51.	17524	*Triumfetta echinata*		P3	
Priority 4					
52.	24610	*Ardeotis australis (Australian Bustard)*		P4	
53.	24359	*Burhinus grallarius (Bush Stone-curlew)*		P4	
54.	24217	*Leggadina lakedownensis (Short-tailed Mouse, Karekanga)*		P4	
55.	24411	*Phaps histrionica (Flock Bronzewing, Flock Pigeon)*		P4	
56.	24233	*Pseudomys chapmani (Western Pebble-mound Mouse, Ngadji)*		P4	
57.	24064	*Sousa chinensis (Indo-Pacific Humpback Dolphin)*		P4	
58.	24067	*Stennella longirostris subsp. longirostris (Spinner Dolphin)*		P4	
Non-conservation taxon					
59.	-14089	*? ?*			
60.	-16040	*Ablennes hians*			
61.	-16986	*Abudefduf bengalensis*			
62.	4895	*Abutilon lepidum*			
63.	42920	*Abutilon sp. Dioicum (A.A. Mitchell PRP 1618)*			
64.	3214	*Acacia ancistrocarpa (Fitzroy Wattle)*			
65.	3241	*Acacia bivenosa*			
66.	3260	*Acacia citrinoviridis*			
67.	17013	*Acacia colei var. colei*			
68.	13500	*Acacia coriacea subsp. coriacea*			
69.	14088	*Acacia cyperophylla var. cyperophylla*			
70.	3356	*Acacia gregorii (Gregory's Wattle)*			
71.	13078	*Acacia sclerosperma subsp. sclerosperma*			
72.	20819	*Acacia sp. Ripon Hills (B.R. Maslin 8460)*			
73.	19456	*Acacia stellaticeps*			
74.	3577	*Acacia tetragonophylla (Kurara, Wakalpuka)*			
75.	3579	*Acacia trachycarpa (Minni Ritchi, Balgali)*			
76.	3603	*Acacia wiseana*			
77.	-14198	*Acanthocepola abbreviata*			
78.	-17600	*Acanthopagrus latus*			
79.	-16776	*Acanthopagrus palmaris*			
80.	25243	*Acanthophis pyrrhus (Desert Death Adder)*			
81.	25535	*Accipiter cirrocephalus (Collared Sparrowhawk)*			
82.	25536	*Accipiter fasciatus (Brown Goshawk)*			
83.	-15954	*Acentrogobius viridipunctatus*			
84.	17422	*Adriana tomentosa var. tomentosa*			
85.	-17061	*Adventor elongatus*			
86.	25544	*Aegotheles cristatus (Australian Owlet-nightjar)*			
87.	2646	*Aerva javanica (Kapok Bush)*	Y		
88.	3680	*Aeschynomene indica (Budda Pea)*			
89.	25355	*Aipysurus laevis (Olive Seasnake)*			
90.	-16972	*Alectis indica*			
91.	2652	*Alternanthera nodiflora (Common Joyweed)*			
92.	4907	*Alyogyne pinoniana (Sand Hibiscus)*			
93.	-17085	*Ambassis agassizi*			
94.	-14392	*Ambassis gymnocephalus*			
95.	-17037	*Amniataba caudavittata*			
96.	-16970	*Amniataba percoides*			
97.	-16787	*Amniataba percoides?*			Y
98.	30831	*Amphibolurus gilberti (Ta-ta, Gilbert's Dragon)*			

	Name ID	Species Name	Naturalised	Conservation Code	[1]Endemic To Query Area
99.	30833	*Amphibolurus longirostris (Long-nosed Dragon)*			
100.	-11939	*Aname ellenae*			
101.	24312	*Anas gracilis (Grey Teal)*			
102.	24316	*Anas superciliosa (Pacific Black Duck)*			
103.	7822	*Angianthus acrohyalinus (Hook-leaf Angianthus)*			
104.	7832	*Angianthus milnei (Cone-spike Angianthus)*			
105.	25553	*Anhinga melanogaster (Darter)*			
106.	25448	*Antaresia stimsoni (Stimson's Python)*			
107.	25241	*Antaresia stimsoni subsp. stimsoni (Stimson's Python)*			
108.	25670	*Anthus australis (Australian Pipit)*			
109.	-17586	*Apistus carinatus*			
110.	-16968	*Apogon rueppellii*			
111.	24285	*Aquila audax (Wedge-tailed Eagle)*			
112.	25538	*Aquila morphnoides (Little Eagle)*			
113.	25556	*Ardea alba (Great Egret)*			
114.	25557	*Ardea garzetta (Little Egret)*			
115.	25559	*Ardea intermedia (Intermediate Egret)*			
116.	24340	*Ardea novaehollandiae (White-faced Heron)*			
117.	24341	*Ardea pacifica (White-necked Heron)*			
118.	207	*Aristida contorta (Bunched Kerosene Grass)*			
119.	12063	*Aristida holathera var. holathera*			
120.	215	*Aristida latifolia (Feathertop Wiregrass)*			
121.	-17554	*Arothron manilensis*			
122.	-14218	*Arrhamphus sclerolepis*			
123.	25566	*Artamus cinereus (Black-faced Woodswallow)*			
124.	24353	*Artamus cyanopterus (Dusky Woodswallow)*			
125.	25567	*Artamus leucorynchus (White-breasted Woodswallow)*			
126.	24356	*Artamus personatus (Masked Woodswallow)*			
127.	26486	*Asparagopsis taxiformis*			
128.	25320	*Aspidites melanocephalus (Black-headed Python)*			
129.	-16039	*Assiculus punctatus*			
130.	-16798	*Atelomycterus fasciatus*			
131.	-18014	*Atherinid sp.*			
132.	-17697	*Atherinomorus endrachtensis*			
133.	-15754	*Atherinomorus vaigiensis*			
134.	2451	*Atriplex bunburyana (Silver Saltbush)*			
135.	2453	*Atriplex codonocarpa (Flat-topped Saltbush)*			
136.	2476	*Atriplex semilunaris (Annual Saltbush)*			
137.	-17564	*Aulopus purpurissatus*			
138.	-15230	*Austronibea oedegenys?*			Y
139.	233	*Avena barbata (Bearded Oat)*	Y		
140.	26498	*Avrainvillea obscura*			
141.	24318	*Aythya australis (Hardhead)*			
142.	-15645	*Bathygobius cocosensis*			
143.	-14919	*Bathygobius fuscus*			
144.	5185	*Bergia perennis*			
145.	-16494	*Blennodesmus scapularis*			
146.	-15849	*Bodianus frenchii*			
147.	11167	*Bonamia erecta*			
148.	24251	*Bos taurus (European Cattle)*	Y		
149.	7870	*Brachyscome cheilocarpa*			
150.	7872	*Brachyscome ciliocarpa*			
151.	3000	*Brassica tournefortii (Mediterranean Turnip)*	Y		
152.	7047	*Buchnera linearis (Blackrod)*			
153.	750	*Bulbostylis barbata*			
154.	-17746	*Butis amboinensis*			
155.	25561	*Butorides striatus (Striated Heron, Mangrove Heron)*			
156.	24346	*Butorides striatus subsp. stagnatilis (Striated Heron, Mangrove Heron)*			
157.	25715	*Cacatua roseicapilla (Galah)*			
158.	25716	*Cacatua sanguinea (Little Corella)*			
159.	42307	*Cacomantis pallidus (Pallid Cuckoo)*			
160.	2860	*Calandrinia polyandra (Parakeelya)*			
161.	7906	*Calotis plumulifera*			
162.	3749	*Canavalia rosea (Wild Jack Bean)*			
163.	25454	*Canis lupus (Dog, Dingo)*	Y		
164.	-15202	*Canthigaster coronata*			
165.	-17853	*Caranx ignobilis*			
166.	-17032	*Caranx sexfasciatus*			
167.	12073	*Cassytha aurea var. aurea*			
168.	258	*Cenchrus ciliaris (Buffel Grass)*	Y		

	Name ID	Species Name	Naturalised	Conservation Code	[1]Endemic To Query Area
169.	19762	*Centipeda minima subsp. macrocephala*			
170.	-16746	*Centriscus sp.*			
171.	25600	*Centropus phasianinus (Pheasant Coucal)*			
172.	24564	*Certhionyx variegatus (Pied Honeyeater)*			
173.	24181	*Chaerephon jobensis (Northern Freetail-bat)*			
174.	-16481	*Chaetodontoplus duboulayi*			
175.	-14947	*Chanos chanos*			
176.	24373	*Charadrius melanops (Black-fronted Dotterel)*			
177.	24377	*Charadrius ruficapillus (Red-capped Plover)*			
178.	-17502	*Chelmon marginalis*			
179.	-16247	*Chelonodon patoca*			
180.	24321	*Chenonetta jubata (Australian Wood Duck, Wood Duck)*			
181.	24488	*Cheramoeca leucosternus (White-backed Swallow)*			
182.	-16211	*Chirocentrus dorab*			
183.	269	*Chloris pectinata (Comb Chloris)*			
184.	270	*Chloris pumilio*			
185.	-14929	*Choerodon cyanodus*			
186.	24431	*Chrysococcyx basalis (Horsfield's Bronze Cuckoo)*			
187.	24434	*Chrysococcyx osculans (Black-eared Cuckoo)*			
188.	273	*Chrysopogon fallax (Golden Beard Grass)*			
189.	24833	*Cincloramphus cruralis (Brown Songlark)*			
190.	24834	*Cincloramphus mathewsi (Rufous Songlark)*			
191.	24288	*Circus approximans (Swamp Harrier)*			
192.	24289	*Circus assimilis (Spotted Harrier)*			
193.	2988	*Cleome viscosa (Tickweed, Tjinduwadhu)*			
194.	2778	*Codonocarpus cotinifolius (Native Poplar, Kundurangu)*			
195.	25675	*Colluricincla harmonica (Grey Shrike-thrush)*			
196.	-15704	*Colurodontis paxmani*			
197.	25568	*Coracina novaehollandiae (Black-faced Cuckoo-shrike)*			
198.	-17106	*Coradion chrysozonus*			
199.	18414	*Corchorus sidoides subsp. vermicularis*			
200.	-17760	*Coris aygula*			
201.	24416	*Corvus bennetti (Little Crow)*			
202.	25593	*Corvus orru (Torresian Crow)*			
203.	17084	*Corymbia zygophylla*			
204.	1284	*Corynotheca flexuosissima*			
205.	1286	*Corynotheca pungens*			
206.	24671	*Coturnix pectoralis (Stubble Quail)*			
207.	25701	*Coturnix ypsilophora (Brown Quail)*			
208.	24420	*Cracticus nigrogularis (Pied Butcherbird)*			
209.	25595	*Cracticus tibicen (Australian Magpie)*			
210.	-14049	*Cracticus tibicen subsp. longirostris*			Y
211.	25596	*Cracticus torquatus (Grey Butcherbird)*			
212.	-16355	*Craterocephalus capreoli*			
213.	19565	*Cressa australis*			
214.	3774	*Crotalaria cunninghamii (Green Birdflower, Bilbun)*			
215.	20175	*Crotalaria cunninghamii subsp. sturtii*			
216.	20179	*Crotalaria medicaginea var. neglecta*			
217.	-13208	*Cryptoerithus occultus*			
218.	25458	*Ctenophorus caudicinctus (Ring-tailed Dragon)*			
219.	24865	*Ctenophorus caudicinctus subsp. caudicinctus (Ring-tailed Dragon)*			
220.	24872	*Ctenophorus femoralis (Dune Dragon)*			
221.	25459	*Ctenophorus isolepis (Crested Dragon, Military Dragon)*			
222.	24875	*Ctenophorus isolepis subsp. gularis (Central Military Dragon)*			
223.	24876	*Ctenophorus isolepis subsp. isolepis (Crested Dragon, Military Dragon)*			
224.	24882	*Ctenophorus nuchalis (Central Netted Dragon)*			
225.	24885	*Ctenophorus rubens (Red Dragon)*			
226.	24887	*Ctenophorus rufescens (Red Rock Dragon)*			
227.	-17370	*Ctenotrypauchen microcephalus*			
228.	25032	*Ctenotus calurus*			
229.	25462	*Ctenotus grandis*			
230.	25043	*Ctenotus grandis subsp. titan*			
231.	25044	*Ctenotus hanloni*			
232.	25046	*Ctenotus iapetus*			
233.	25053	*Ctenotus maryani*			
234.	25463	*Ctenotus pantherinus (Leopard Ctenotus)*			
235.	25064	*Ctenotus pantherinus subsp. ocellifer (Leopard Ctenotus)*			
236.	25066	*Ctenotus quattuordecimlineatus*			
237.	25069	*Ctenotus rufescens*			
238.	25073	*Ctenotus saxatilis (Rock Ctenotus)*			

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239.	25074	*Ctenotus schomburgkii*			
240.	17117	*Cullen cinereum*			
241.	17116	*Cullen martinii*			
242.	25375	*Cyclorana maini (Sheep Frog)*			
243.	25376	*Cyclorana platycephala (Water-holding Frog)*			
244.	24322	*Cygnus atratus (Black Swan)*			
245.	-15128	*Cymbacephalus staigeri?*			
246.	777	*Cyperus bulbosus (Bush Onion, Tjanmata)*			
247.	808	*Cyperus pygmaeus*			
248.	809	*Cyperus rigidellus*			
249.	814	*Cyperus squarrosus*			
250.	25547	*Dacelo leachii (Blue-winged Kookaburra)*			
251.	24304	*Dacelo leachii subsp. leachii (Blue-winged Kookaburra)*			
252.	-18141	*Dactyloptena papilio*			
253.	-15781	*Dactylopus dactylopus*			
254.	24091	*Dasykaluta rosamondae (Little Red Kaluta)*			
255.	7958	*Decazesia hecatocephala*			
256.	25000	*Delma haroldi*			
257.	25001	*Delma nasuta*			
258.	25004	*Delma tincta*			
259.	25468	*Demansia psammophis (Yellow-faced Whipsnake)*			
260.	25295	*Demansia psammophis subsp. cupreiceps (Yellow-faced Whipsnake)*			
261.	311	*Digitaria ciliaris (Summer Grass)*	Y		
262.	24926	*Diplodactylus conspicillatus (Fat-tailed Gecko)*			
263.	24940	*Diplodactylus pulcher*			
264.	4745	*Diplopeltis eriocarpa (Hairy Pepperflower)*			
265.	42400	*Diporiphora adductus (Carnarvon Dragon)*			
266.	-15410	*Drepane punctata*			
267.	24470	*Dromaius novaehollandiae (Emu)*			
268.	-18179	*Drombus triangularis*			
269.	2502	*Dysphania kalpari (Rat's Tail, Kalpari)*			
270.	2504	*Dysphania plantaginella*			
271.	-16237	*Echeneis naucrates*			
272.	340	*Echinopogon ovatus (Hedgehog Grass)*			
273.	14301	*Ehretia saligna var. saligna*			
274.	25540	*Elanus caeruleus (Black-shouldered Kite)*			
275.	-15053	*Elops hawaiensis*			
276.	24631	*Emblema pictum (Painted Finch)*			
277.	-16377	*Engraulis australis?*			Y
278.	25362	*Ephalophis greyae*			
279.	24387	*Ephippiorhynchus asiaticus subsp. australis (Black-necked Stork)*			
280.	-15457	*Epinephelus amblycephalus*			
281.	-14167	*Epinephelus corallicola*			
282.	-14255	*Epinephelus lanceolatus*			
283.	-14249	*Epinephelus malabaricus*			
284.	-14920	*Epinephelus multinotatus*			
285.	-16070	*Epinephelus quoyanus*			
286.	-16017	*Epinephelus rankini (invalid)*			Y
287.	-16524	*Epinephelus rivulatus*			
288.	-15001	*Epinephelus sexfasciatus*			
289.	-16557	*Epinephelus sp.*			
290.	-16626	*Epinephelus tauvina*			
291.	24568	*Epthianura aurifrons (Orange Chat)*			
292.	24570	*Epthianura tricolor (Crimson Chat)*			
293.	378	*Eragrostis dielsii (Mallee Lovegrass)*			
294.	381	*Eragrostis falcata (Sickle Lovegrass)*			
295.	393	*Eragrostis setifolia (Neverfail Grass)*			
296.	42404	*Eremiascincus isolepis*			
297.	43381	*Eremiascincus pallidus (Western Narrow-banded Skink, Narrow-banded Sand Swimmer)*			
298.	24837	*Eremiornis carteri (Spinifex-bird)*			
299.	16696	*Eremophila fraseri subsp. fraseri*			
300.	403	*Eriachne benthamii (Swamp Wanderrie)*			
301.	408	*Eriachne flaccida (Claypan Grass)*			
302.	409	*Eriachne gardneri*			
303.	414	*Eriachne obtusa (Northern Wandarrie Grass)*			
304.	35198	*Eriochloa pseudoacrotricha (Perennial Cupgrass)*			
305.	4335	*Erodium cygnorum (Blue Heronsbill)*			
306.	24379	*Erythrogonys cinctus (Red-kneed Dotterel)*			
307.	-14592	*Escualosa thoracata*			Y

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308.	35343	*Eucalyptus camaldulensis subsp. refulgens*			
309.	14548	*Eucalyptus victrix*			
310.	15592	*Eucalyptus xerothermica*			
311.	11011	*Eulalia aurea*			
312.	4629	*Euphorbia hirta (Asthma Plant)*	Y		
313.	4635	*Euphorbia myrtoides*			
314.	12097	*Euphorbia tannensis subsp. eremophila (Desert Spurge)*			
315.	24368	*Eurostopodus argus (Spotted Nightjar)*			
316.	-14261	*Eurypegasus draconis*			
317.	25621	*Falco berigora (Brown Falcon)*			
318.	25622	*Falco cenchroides (Australian Kestrel)*			
319.	24472	*Falco cenchroides subsp. cenchroides (Australian Kestrel)*			
320.	25623	*Falco longipennis (Australian Hobby)*			
321.	24476	*Falco subniger (Black Falcon)*			
322.	24041	*Felis catus (Cat)*	Y		
323.	-16124	*Feroxodon multistriatus*			
324.	-15461	*Fistularia petimba*			
325.	35558	*Flaveria trinervia (Speedy Weed)*	Y		
326.	25327	*Fordonia leucobalia (White-bellied Mangrove Snake)*			
327.	5188	*Frankenia ambita*			
328.	25301	*Furina ornata (Moon Snake)*			
329.	42314	*Gavicalis virescens (Singing Honeyeater)*			
330.	24952	*Gehyra australis*			
331.	24956	*Gehyra pilbara*			
332.	24958	*Gehyra punctata*			
333.	24957	*Gehyra purpurascens*			
334.	24959	*Gehyra variegata*			
335.	24401	*Geopelia cuneata (Diamond Dove)*			
336.	24402	*Geopelia humeralis (Bar-shouldered Dove)*			
337.	25585	*Geopelia striata (Zebra Dove)*			
338.	24403	*Geopelia striata subsp. placida (Peaceful Dove)*			
339.	24404	*Geophaps plumifera (Spinifex Pigeon)*			
340.	-14906	*Gerres filamentosus*			
341.	-17716	*Gerres oyena*			
342.	-14970	*Gerres sp.*			
343.	-18084	*Gerres subfasciatus*			
344.	25531	*Gerygone levigaster (Mangrove Gerygone)*			
345.	24276	*Gerygone tenebrosa (Dusky Gerygone)*			
346.	2835	*Glinus lotoides (Hairy Carpet Weed)*			
347.	7988	*Gnephosis arachnoidea (Cobwebby-headed Gnephosis)*			
348.	7501	*Goodenia corynocarpa*			
349.	7526	*Goodenia microptera*			
350.	12571	*Goodenia pascua*			
351.	4910	*Gossypium australe (Native Cotton)*			
352.	4913	*Gossypium hirsutum (Upland Cotton)*	Y		
353.	24443	*Grallina cyanoleuca (Magpie-lark)*			
354.	2001	*Grevillea eriostachya (Flame Grevillea, Kaliny-kalinypa)*			
355.	19570	*Grevillea pyramidalis subsp. leucadendron*			
356.	2096	*Grevillea stenobotrya*			
357.	24484	*Grus rubicunda (Brolga)*			
358.	-17862	*Gymnothorax undulatus*			
359.	-17039	*Gymnura australis*			
360.	2784	*Gyrostemon ramulosus (Corkybark)*			
361.	25627	*Haematopus fuliginosus (Sooty Oystercatcher)*			
362.	24487	*Haematopus longirostris (Pied Oystercatcher)*			
363.	19137	*Hakea lorea subsp. lorea*			
364.	16897	*Hakea stenophylla subsp. stenophylla*			
365.	25541	*Haliastur indus (Brahminy Kite)*			
366.	24294	*Haliastur indus subsp. girrenera (Brahminy Kite)*			
367.	24295	*Haliastur sphenurus (Whistling Kite)*			
368.	-15722	*Halophryne diemensis*			
369.	-16449	*Halophryne ocellatus*			
370.	6174	*Haloragis gossei*			
371.	23464	*Haloragis gossei var. inflata*			
372.	24297	*Hamirostra melanosternon (Black-breasted Buzzard)*			
373.	17782	*Hannafordia quadrivalvis subsp. recurva*			
374.	17301	*Heliotropium chrysocarpum*			
375.	6705	*Heliotropium crispatum*			
376.	6707	*Heliotropium curassavicum (Smooth Heliotrope)*			
377.	6712	*Heliotropium heteranthum*			

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378.	17309	*Heliotropium pachyphyllum*			
379.	25232	*Hemidactylus frenatus (Asian House Gecko)*	Y		
380.	-15819	*Hemigaleus australiensis*			
381.	-16387	*Hemigaleus sp.*			
382.	-14240	*Hemiramphus robustus*			
383.	-17613	*Hemiscyllium trispeculare*			
384.	-15286	*Herklotsichthys blackburni*			
385.	-16148	*Herklotsichthys collettei*			
386.	-16690	*Herklotsichthys collettei?*			Y
387.	-15714	*Herklotsichthys koningsbergeri*			
388.	-17267	*Herklotsichthys quadrimaculatus*			Y
389.	24961	*Heteronotia binoei (Bynoe's Gecko)*			
390.	-16781	*Hilsa kelee?*			Y
391.	25734	*Himantopus himantopus (Black-winged Stilt)*			
392.	-15020	*Hippocampus sp.*			
393.	-17128	*Hippocampus tuberculatus*			
394.	24489	*Hirundo ariel (Fairy Martin)*			
395.	24491	*Hirundo neoxena (Welcome Swallow)*			
396.	25629	*Hirundo nigricans (Tree Martin)*			
397.	-12268	*Holconia westralia*			
398.	-18385	*Hydrophis major*			
399.	42410	*Hydrophis ornatus*			
400.	43385	*Hydrophis stokesii (Stoke's Seasnake, Sea Snake)*			
401.	-18131	*Hypopterus macropterus*			
402.	3971	*Indigofera boviperda*			
403.	3973	*Indigofera colutea (Sticky Indigo)*			
404.	3974	*Indigofera georgei (Bovine Indigo)*			
405.	3980	*Indigofera linifolia*			
406.	3981	*Indigofera linnaei (Birdsville Indigo)*			
407.	3982	*Indigofera monophylla*			
408.	-14158	*Inimicus sinensis*			
409.	6624	*Ipomoea costata (Rock Morning Glory, Kanti)*			
410.	11312	*Ipomoea pes-caprae subsp. brasiliensis*			
411.	6638	*Ipomoea quamoclit (Cupid's Flower)*	Y		
412.	459	*Iseilema eremaeum*			
413.	-17501	*Istiblennius meleagris*			
414.	-18116	*Lactoria cornuta*			
415.	-16069	*Lactoria diaphana*			
416.	24367	*Lalage tricolor (White-winged Triller)*			
417.	25637	*Larus novaehollandiae (Silver Gull)*			
418.	4960	*Lawrencia viridigrisea*			
419.	-14433	*Leiognathus decorus*			
420.	-17490	*Leiognathus equulus*			
421.	3032	*Lepidium muelleri-ferdinandii*			
422.	3039	*Lepidium platypetalum (Slender Peppercress)*			
423.	25124	*Lerista baynesi*			
424.	25125	*Lerista bipes*			
425.	30928	*Lerista clara*			
426.	25133	*Lerista elegans*			
427.	25158	*Lerista onsloviana*			
428.	25176	*Lerista uniduo (Spotted Broad-blazed Slider, skink)*			
429.	-15669	*Lethrinus sp.*			
430.	3613	*Leucaena leucocephala (Leucaena)*	Y		
431.	25005	*Lialis burtonis*			
432.	25661	*Lichmera indistincta (Brown Honeyeater)*			
433.	24582	*Lichmera indistincta subsp. indistincta (Brown Honeyeater)*			
434.	25380	*Litoria caerulea (Green Tree Frog)*			
435.	25392	*Litoria rubella (Little Red Tree Frog)*			
436.	-16365	*Liza melinoptera*			
437.	-16315	*Liza sp.*			
438.	-16074	*Liza subviridis*			
439.	-15122	*Liza vaigiensis*			
440.	-16483	*Lophiocharon trisignatus*			
441.	4061	*Lotus cruentus (Redflower Lotus)*			
442.	30933	*Lucasium stenodactylum*			
443.	-14969	*Lutjanus argentimaculatus*			
444.	-15508	*Lutjanus erythropterus*			
445.	-17009	*Lutjanus fulviflamma*			
446.	-16509	*Lutjanus malabaricus*			
447.	-18157	*Lutjanus russellii*			

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448.	25489	*Macropus robustus (Euro)*			
449.	24136	*Macropus rufus (Red Kangaroo, Marlu)*			
450.	2548	*Maireana lobiflora*			
451.	25651	*Malurus lamberti (Variegated Fairy-wren)*			
452.	25652	*Malurus leucopterus (White-winged Fairy-wren)*			
453.	4962	*Malvastrum americanum (Spiked Malvastrum)*	Y		
454.	24583	*Manorina flavigula (Yellow-throated Miner)*			
455.	-17112	*Megalaspis cordyla*			
456.	-17628	*Megalops cyprinoides*			
457.	24736	*Melopsittacus undulatus (Budgerigar)*			
458.	-14960	*Mene maculata*			
459.	25184	*Menetia greyii*			
460.	25542	*Milvus migrans (Black Kite)*			
461.	24298	*Milvus migrans subsp. affinis (Black Kite)*			
462.	7082	*Mimulus gracilis*			
463.	25545	*Mirafra javanica (Horsfield's Bushlark, Singing Bushlark)*			
464.	24302	*Mirafra javanica subsp. horsfieldii (Horsfield's Bushlark, Singing Bushlark)*			
465.	-18105	*Monocentris japonicus*			
466.	25193	*Morethia ruficauda subsp. exquisita*			
467.	25194	*Morethia ruficauda subsp. ruficauda*			
468.	6490	*Muellerolimon salicorniaceum*			
469.	-17809	*Mugil cephalus*			
470.	-15406	*Muraenesox cinereus*			
471.	1311	*Murchisonia volubilis*			
472.	24223	*Mus musculus (House Mouse)*	Y		
473.	17158	*Myoporum montanum (Native Myrtle)*			
474.	17925	*Myriocephalus oldfieldii*			
475.	8121	*Myriocephalus rudallii*			
476.	-17866	*Nematalosa come*			
477.	-17803	*Nematalosa sp.*			
478.	-16036	*Nematalosa vlaminghi*			
479.	2573	*Neobassia astrocarpa*			
480.	25422	*Neobatrachus aquilonius (Northern Burrowing Frog)*			
481.	25424	*Neobatrachus fulvus (Tawny Trilling Frog)*			
482.	25685	*Neochmia ruficauda (Star Finch)*			
483.	-16151	*Neopomacentrus filamentosus*			
484.	25497	*Nephrurus levis*			
485.	24968	*Nephrurus levis subsp. occidentalis*			
486.	24969	*Nephrurus levis subsp. pilbarensis*			
487.	-16373	*Netuma thalassina*			Y
488.	11856	*Nicotiana occidentalis subsp. occidentalis*			
489.	24095	*Ningaui timealeyi (Pilbara Ningaui)*			
490.	25748	*Ninox novaeseelandiae (Boobook Owl)*			
491.	25430	*Notaden nichollsi (Desert Spadefoot)*			
492.	24224	*Notomys alexis (Spinifex Hopping-mouse)*			
493.	24742	*Nymphicus hollandicus (Cockatiel)*			
494.	24407	*Ocyphaps lophotes (Crested Pigeon)*			
495.	16347	*Oenothera laciniata*	Y		
496.	42024	*Olearia sp. Kennedy Range (G. Byrne 66)*			
497.	-14206	*Omobranchus punctatus*			
498.	-17299	*Ophichthus cephalozona*			
499.	24618	*Oreoica gutturalis (Crested Bellbird)*			
500.	24085	*Oryctolagus cuniculus (Rabbit)*	Y		
501.	24620	*Pachycephala lanioides (White-breasted Whistler)*			
502.	24299	*Pandion haliaetus subsp. cristatus (Osprey)*			
503.	503	*Panicum decompositum (Native Millet, Kaltu-kaltu)*			
504.	-17036	*Paracentropogon vespa*			
505.	-17047	*Parachaeturichthys polynema*			
506.	11232	*Paractaenum novae-hollandiae subsp. novae-hollandiae*			
507.	514	*Paractaenum refractum*			
508.	-17561	*Paraplagusia bilineata*			
509.	-15407	*Paraplotosus albilabris*			
510.	-18165	*Parastromateus niger*			
511.	24627	*Pardalotus rubricatus (Red-browed Pardalote)*			
512.	3673	*Parkinsonia aculeata (Parkinsonia)*	Y		
513.	24642	*Passer montanus (Eurasian Tree Sparrow)*	Y		
514.	-17571	*Pelates octolineatus*			
515.	24648	*Pelecanus conspicillatus (Australian Pelican)*			
516.	-15456	*Pellona ditchela*			
517.	-16486	*Pentapodus sp.*			

	Name ID	Species Name	Naturalised	Conservation Code	[1]Endemic To Query Area
518.	-15459	*Pentapodus vitta*			
519.	18463	*Peplidium sp. C Evol. Fl. Fauna Arid Aust. (N.T. Burbidge & A. Kanis 8158)*			
520.	-15808	*Periophthalmus argentilineatus*			
521.	-15455	*Peristrominous dolosus*			
522.	25697	*Phalacrocorax carbo (Great Cormorant)*			
523.	25698	*Phalacrocorax melanoleucos (Little Pied Cormorant)*			
524.	24667	*Phalacrocorax sulcirostris (Little Black Cormorant)*			
525.	25699	*Phalacrocorax varius (Pied Cormorant)*			
526.	24409	*Phaps chalcoptera (Common Bronzewing)*			
527.	1042	*Phoenix dactylifera (Date Palm)*	Y		
528.	5230	*Pimelea ammocharis*			
529.	-14907	*Pisodonophis cancrivorus*			
530.	24101	*Planigale ingrami (Long-tailed Planigale)*			
531.	-15450	*Platax teira*			
532.	-17691	*Platycephalus indicus*			
533.	-17843	*Platycephalus sp.*			
534.	25721	*Platycercus zonarius (Australian Ringneck, Ring-necked Parrot)*			
535.	24751	*Platycercus zonarius subsp. zonarius (Port Lincoln Parrot)*			
536.	-16043	*Plectorhinchus flavomaculatus*			
537.	-16071	*Plectorhinchus gibbosus*			
538.	-17563	*Plectorhinchus polytaenia*			
539.	-17090	*Plotosus lineatus*			
540.	43944	*Pluchea longiseta*			
541.	8168	*Pluchea rubelliflora*			
542.	25510	*Pogona minor (Dwarf Bearded Dragon)*			
543.	24907	*Pogona minor subsp. minor (Dwarf Bearded Dragon)*			
544.	-17831	*Polydactylus multiradiatus*			
545.	-15831	*Polydactylus plebius*			
546.	4572	*Polygala isingii*			
547.	-17575	*Pomadasys argenteus*			
548.	-16782	*Pomadasys kaakan*			
549.	-16267	*Pomatomus saltatrix*			
550.	25706	*Pomatostomus temporalis (Grey-crowned Babbler)*			
551.	24684	*Pomatostomus temporalis subsp. rubeculus (Grey-crowned Babbler)*			
552.	24769	*Porzana fluminea (Australian Spotted Crake)*			
553.	3620	*Prosopis pallida (Mesquite, Algaroba)*	Y		
554.	-14188	*Protonibea diacanthus*			
555.	-15745	*Psammoperca waigiensis*			
556.	-15179	*Psettodes erumei*			
557.	25261	*Pseudechis australis (Mulga Snake)*			
558.	24235	*Pseudomys desertor (Desert Mouse)*			
559.	24237	*Pseudomys hermannsburgensis (Sandy Inland Mouse)*			
560.	42416	*Pseudonaja mengdeni (Western Brown Snake)*			
561.	25263	*Pseudonaja modesta (Ringed Brown Snake)*			
562.	25264	*Pseudonaja nuchalis (Gwardar, Northern Brown Snake)*			
563.	-16788	*Pseudorhombus argus*			
564.	-14256	*Pseudorhombus arsius*			
565.	24390	*Psophodes occidentalis (Western Wedgebill, Chiming Wedgebill)*			
566.	8192	*Pterocaulon sphacelatum (Apple Bush)*			
567.	-17577	*Pterois antennata*			
568.	-18135	*Pterois sp.*			
569.	-14219	*Pterois volitans*			
570.	24173	*Pteropus scapulatus (Little Red Flying-fox)*			
571.	42341	*Ptilotula penicillatus (White-plumed Honeyeater)*			
572.	2699	*Ptilotus axillaris (Mat Mulla Mulla)*			
573.	2738	*Ptilotus latifolius (Tangled Mulla Mulla)*			
574.	2741	*Ptilotus macrocephalus (Featherheads)*			
575.	2746	*Ptilotus nobilis (Tall Mulla Mulla)*			
576.	2751	*Ptilotus polystachyus (Prince of Wales Feather)*			
577.	2766	*Ptilotus villosiflorus*			
578.	25009	*Pygopus nigriceps*			
579.	41063	*Quoya loxocarpa*			
580.	41061	*Quoya paniculata*			
581.	-16025	*Rachycentron canadum*			
582.	25270	*Ramphotyphlops ammodytes*			
583.	25277	*Ramphotyphlops grypus*			
584.	25279	*Ramphotyphlops hamatus*			
585.	25315	*Ramphotyphlops pilbarensis*			
586.	24246	*Rattus tunneyi (Pale Field-rat)*			
587.	24776	*Recurvirostra novaehollandiae (Red-necked Avocet)*			

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588.	11240	*Rhagodia preissii subsp. obovata*			
589.	25614	*Rhipidura leucophrys (Willie Wagtail)*			
590.	24457	*Rhipidura phasiana (Mangrove Grey Fantail)*			
591.	13246	*Rhodanthe humboldtiana*			
592.	13297	*Rhodanthe psammophila*			
593.	24982	*Rhynchoedura ornata (Western Beaked Gecko)*			
594.	4191	*Rhynchosia minima (Rhynchosia)*			
595.	12088	*Rostellularia adscendens var. clementii*			
596.	30434	*Salsola australis*			
597.	6484	*Samolus repens (Creeping Brookweed)*			
598.	14027	*Samolus sp. Millstream (M.I.H. Brooker 2076)*			
599.	2357	*Santalum lanceolatum (Northern Sandalwood, Yarnguli)*			
600.	-16488	*Sardinella albella*			Y
601.	-17129	*Sardinella gibbosa*			
602.	-16176	*Sargocentron praslin*			
603.	-15689	*Sargocentron rubrum*			
604.	-18085	*Saurida nebulosa*			
605.	4711	*Sauropus trachyspermus*			
606.	7595	*Scaevola anchusifolia*			
607.	7606	*Scaevola crassifolia (Thick-leaved Fan-flower)*			
608.	7608	*Scaevola cunninghamii*			
609.	12584	*Scaevola pulchella*			
610.	7643	*Scaevola sericophylla*			
611.	7644	*Scaevola spinescens (Currant Bush, Maroon)*			
612.	41660	*Schenkia australis*			
613.	962	*Schoenoplectus dissachanthus*			
614.	16257	*Schoenoplectus subulatus*			
615.	11650	*Sclerolaena bicornis var. bicornis (Goathead Burr)*			
616.	2633	*Sclerolaena uniflora (Two-spined Saltbush)*			
617.	-15176	*Scomberoides commersonnianus*			
618.	-14232	*Scomberoides lysan*			
619.	-15367	*Scomberoides lysan?*			Y
620.	-17276	*Scomberoides tol*			
621.	-17604	*Scomberomorus commerson*			
622.	-17073	*Scomberomorus queenslandicus*			
623.	-15813	*Scomberomorus semifasciatus*			
624.	-14159	*Selaroides leptolepis*			
625.	-16998	*Selenotoca multifasciata*			
626.	4196	*Sesbania cannabina (Sesbania Pea)*			
627.	4198	*Sesbania formosa (White Dragon Tree)*			
628.	613	*Setaria verticillata (Whorled Pigeon Grass)*	Y		
629.	18149	*Sida rohlenae subsp. rohlenae*			
630.	-15730	*Siganus fuscescens*			
631.	-17473	*Sillago analis*			
632.	-16459	*Sillago burrus*			
633.	-15537	*Sillago ingenuua?*			Y
634.	-17815	*Sillago lutea*			
635.	-17601	*Sillago sihama*			
636.	25305	*Simoselaps anomalus (Desert Banded Snake)*			
637.	30948	*Smicrornis brevirostris (Weebill)*			
638.	24116	*Sminthopsis macroura (Stripe-faced Dunnart)*			
639.	24120	*Sminthopsis youngsoni (Lesser Hairy-footed Dunnart)*			
640.	7018	*Solanum lasiophyllum (Flannel Bush, Mindjulu)*			
641.	8231	*Sonchus oleraceus (Common Sowthistle)*	Y		
642.	619	*Sorghum plumosum (Plume Canegrass)*			
643.	-17196	*Sphyraena barracuda*			
644.	625	*Spinifex longifolius (Beach Spinifex)*			
645.	633	*Sporobolus mitchellii (Ratstail Couch)*			
646.	635	*Sporobolus virginicus (Marine Couch)*			
647.	-16358	*Stegostoma fasciatum*			
648.	17295	*Stemodia sp. Onslow (A.A. Mitchell 76/148)*			
649.	24519	*Sterna (albifrons) sinensis (White-shafted Little Tern, Little Tern)*			
650.	24522	*Sterna bergii (Crested Tern)*			
651.	30949	*Sterna nilotica (Gull-billed Tern)*			
652.	-14538	*Stolephorus carpentariae*			
653.	-14332	*Stolephorus commersonii*			
654.	8238	*Streptoglossa liatroides*			
655.	8239	*Streptoglossa macrocephala*			
656.	12492	*Striga squamigera*			
657.	-14958	*Strongylura strongylura*			

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658.	24932	*Strophurus jeanae*			
659.	24942	*Strophurus spinigerus subsp. spinigerus*			
660.	24946	*Strophurus strophurus*			
661.	3182	*Stylobasium spathulatum (Pebble Bush)*			
662.	2638	*Suaeda arbusculoides*			
663.	25307	*Suta punctata (Spotted Snake)*			
664.	4242	*Swainsona pterostylis*			
665.	-16279	*Synanceia horrida*			
666.	13339	*Synaptantha tillaeacea var. tillaeacea*			
667.	25705	*Tachybaptus novaehollandiae (Australasian Grebe, Black-throated Grebe)*			
668.	24207	*Tachyglossus aculeatus (Short-beaked Echidna)*			
669.	24185	*Tadarida australis (White-striped Freetail-bat)*			
670.	30870	*Taeniopygia guttata (Zebra Finch)*			
671.	-12762	*Tamopsis occidentalis*			
672.	-17160	*Tathicarpus butleri*			
673.	33236	*Tecticornia halocnemoides (Shrubby Samphire)*			
674.	33238	*Tecticornia halocnemoides subsp. tenuis*			
675.	33319	*Tecticornia indica subsp. bidens*			
676.	33318	*Tecticornia indica subsp. leiostachya (Samphire)*			
677.	19531	*Tephrosia rosea var. clementii*			
678.	15947	*Tephrosia sp. B Kimberley Flora (C.A. Gardner 7300)*			
679.	41815	*Tephrosia sp. Carnarvon (J.H. Ross 2681)*			
680.	39422	*Tephrosia sp. Onslow (K.R. Newbey 10571)*			
681.	-16492	*Terapon jarbua*			
682.	-14222	*Terapon puta*			
683.	-18073	*Terapon thaeraps*			Y
684.	-14971	*Terapon theraps*			
685.	2644	*Threlkeldia diffusa (Coast Bonefruit)*			
686.	24845	*Threskiornis spinicollis (Straw-necked Ibis)*			
687.	-16799	*Thryssa mystax?*			
688.	-17522	*Thryssa scratchleyi?*			
689.	-16447	*Thryssa setirostris*			
690.	25202	*Tiliqua multifasciata (Central Blue-tongue)*			
691.	25548	*Todiramphus chloris (Collared Kingfisher)*			
692.	42351	*Todiramphus pyrrhopygius (Red-backed Kingfisher)*			
693.	25549	*Todiramphus sanctus (Sacred Kingfisher)*			
694.	-15650	*Trachinotus baillonii*			
695.	19053	*Trachymene pilbarensis*			
696.	-15661	*Triacanthus biaculeatus*			
697.	4377	*Tribulus hirsutus*			
698.	4378	*Tribulus hystrix*			
699.	4380	*Tribulus occidentalis (Perennial Caltrop)*			
700.	6727	*Trichodesma zeylanicum (Camel Bush, Kumbalin)*			
701.	13559	*Trichodesma zeylanicum var. grandiflorum*			
702.	8252	*Tridax procumbens (Tridax)*	Y		
703.	145	*Triglochin hexagona (Six-point Arrowgrass)*			
704.	13131	*Triodia epactia*			
705.	706	*Triraphis mollis (Needle Grass)*			
706.	24851	*Turnix velox (Little Button-quail)*			
707.	30954	*Tursiops aduncus (Indo-Pacific Bottlenose Dolphin)*			
708.	25762	*Tyto alba (Barn Owl)*			
709.	27348	*Udotea argentea*			
710.	11321	*Urochloa holosericea subsp. velutina*			
711.	-13161	*Urodacus varians*			
712.	30716	*Vachellia farnesiana (Mimosa Bush)*	Y		
713.	25209	*Varanus acanthurus (Spiny-tailed Monitor)*			
714.	25210	*Varanus brevicauda (Short-tailed Pygmy Monitor)*			
715.	25211	*Varanus caudolineatus*			
716.	25212	*Varanus eremius (Pygmy Desert Monitor)*			
717.	25218	*Varanus gouldii (Bungarra or Sand Monitor)*			
718.	25524	*Varanus panoptes (Yellow-spotted Monitor)*			
719.	25223	*Varanus panoptes subsp. rubidus*			
720.	25526	*Varanus tristis (Racehorse Monitor)*			
721.	6081	*Verticordia forrestii (Forrest's Featherflower)*			
722.	31391	*Vigna sp. Hamersley Clay (A.A. Mitchell PRP 113)*			
723.	24040	*Vulpes vulpes (Red Fox)*	Y		
724.	728	*Whiteochloa cymbiformis*			
725.	-13199	*Wydundra kennedy*			
726.	-18129	*Xyrichtys sp.*			
727.	-15802	*Yongeichthys nebulosus*			

	Name ID	Species Name	Naturalised	Conservation Code	[1]Endemic To Query Area
728.	-15439	*Zabidius novemaculeatus*			
729.	4847	*Ziziphus mauritiana (Zornia)*	Y		
730.	25765	*Zosterops lateralis (Grey-breasted White-eye, Silvereye)*			
731.	24857	*Zosterops luteus (Yellow White-eye)*			

Conservation Codes
T - Rare or likely to become extinct
X - Presumed extinct
IA - Protected under international agreement
S - Other specially protected fauna
1 - Priority 1
2 - Priority 2
3 - Priority 3
4 - Priority 4
5 - Priority 5

[1] For NatureMap's purposes, species flagged as endemic are those whose records are wholely contained within the search area. Note that only those records complying with the search criterion are included in the calculation. For example, if you limit records to those from a specific datasource, only records from that datasource are used to determine if a species is restricted to the query area.

APPENDIX 3

Flora Inventory

APPENDIX 3: Flora Inventory

This list of flora species has been adapted from Biota (2010a) and ENV (2012a) and is a compilation of all species recorded for all flora surveys undertaken for the Study Area to date.

* Denotes a weed species
P Denotes a Priority species

Family		Species
ACANTHACEAE		*Rostellularia adscendens* var. *clementii*
		Trianthema glossostigma
		Trianthema pilosa
		Trianthema triquetra
		Trianthema turgidifolia
AMARANTHACEAE	*	*Aerva javanica*
		Alternanthera nana
		Alternanthera nodiflora
		Amaranthus mitchellii
		Gomphrena affinis subsp. *pilbarensis*
		Gomphrena cunninghamii
		Gomphrena sordida
		Hemichroa diandra
		Ptilotus appendiculatus var. *appendiculatus*
		Ptilotus arthrolasius
		Ptilotus astrolasius var. *astrolasius*
		Ptilotus axillaris
		Ptilotus exaltatus var. *exaltatus*
		Ptilotus fusiformis
		Ptilotus gomphrenoides
		Ptilotus gomphrenoides var. *conglomeratus*
		Ptilotus latifolius
		Ptilotus macrocephalus
		Ptilotus murrayi
		Ptilotus obovatus
		Ptilotus polystachyus var. *polystachyus*
		Ptilotus villosiflorus
ANTHERICACEAE		*Corynotheca flexuosissima*
		Corynotheca pungens
		Murchisonia volubilis
APIACEAE		*Trachymene pilbarensis*
APOCYNACEAE		*Sarcostemma viminale* subsp. *australe*
ASTERACEAE		*Angianthus acrohyalinus*
		Angianthus milnei
		Blumea tenella
		Brachyscome cheilocarpa
		Brachyscome ciliocarpa
		Brachyscome iberidifolia
		Calotis plumulifera
		Centipeda minima subsp. *macrocephala*
		Decazesia hecatocephala
	*	*Flaveria trinervia*
		Minuria cunninghamii
		Olearia dampieri subsp. *dampieri*
		Pluchea dentex
		Pluchea dunlopii
		Pluchea ferdinandi-muelleri
		Pluchea rubelliflora
		Pluchea sp. B Kimberly Flora (K.F.Kenneally 9526A)

Family		Species
		Pterocaulon sphacelatum
		Pterocaulon sphaeranthoides
		Rhodanthe floribunda
		Rhodanthe humboldtiana
		Rhodanthe stricta
		Streptoglossa adscendens
		Streptoglossa bubakii
		Streptoglossa decurrens
		Streptoglossa liatroides
		Streptoglossa macrocephala
		Streptoglossa odora
		Streptoglossa sp.
AVICENNIACEAE		*Avicennia marina*
		Avicennia marina subsp. *Marina*
BORAGINACEAE		*Heliotropium crispatum*
		Heliotropium curassavicum
		Heliotropium diversifolium
		Heliotropium inexplicitum
		Heliotropium ovalifolium
		Heliotropium pachyphyllum
		Heliotropium sp.
		Trichodesma zeylanicum var. *grandiflorum*
		Trichodesma zeylanicum var. *zeylanicum*
BRASSICACEAE		*Lepidium pholidogynum*
		Lepidium platypetalum
CAMPANULACEAE		*Wahlenbergia tumidifructa*
CARYOPHYLLACEAE		*Polycarpaea corymbosa* var. *corymbosa*
CHENOPODIACEAE		*Atriplex amnicola*
		Atriplex bunburyana
		Atriplex codonocarpa
		Atriplex semilunaris
		Dissocarpus paradoxus
		Dysphania Kalpari
		Dysphania plantaginella
		Dysphania platycarpa
		Dysphania rhadinostachya
		Enchylaena tomentosa var. *tomentosa*
		Maireana georgei
		Maireana lanosa
		Maireana planifolia
		Maireana sp.
		Maireana tomentosa
		Maireana tomentosa subsp. *tomentosa*
		Neobassia astrocarpa
		Rhagodia eremaea
		Rhagodia preissii subsp. *obovata*
		Salsola tragus
		Sclerolaena aff. *parviflora*
		Sclerolaena costata
		Sclerolaena cuneata
		Sclerolaena densiflora
		Sclerolaena glabra
		Sclerolaena recurvicuspis
		Sclerolaena uniflora
		Tecticornia ? auriculata
		Tecticornia ? halocnemoides subsp. *tenuis*
		Tecticornia ? sp. Dennys Crossing (K.A. Shepherd & J. English KS 552)
		Tecticornia auriculata

Family		Species
		Tecticornia doleiformis
		Tecticornia halocnemoides
		Tecticornia halocnemoides subsp. tenuis
		Tecticornia indica subsp. ? (intergrade between *leiostachya/bidens/julacea*)
		Tecticornia indica subsp. aff. *bidens*
		Tecticornia indica subsp. *leiostachya*
		Tecticornia pergranulata
		Tecticornia pergranulata subsp. *elongata*
		Tecticornia pergranulata subsp. *pergranulata*
		Tecticornia pruinosa
		Tecticornia pterygosperma subsp. *denticulata*
		Tecticornia sp.
		Tecticornia sp. (WH40-04) (T. halocnemoides completed)
		Tecticornia sp. (WHPH-15) (T. halocnemoides completed)
		Threlkeldia sp.
CLEOMACEAE		*Cleome viscosa*
		Cleome uncifera subsp. *uncifera*
CONVOLVULACEAE		*Bonamia* aff. *linearis*
		Bonamia erecta
		Bonamia linearis
		Bonamia rosea
		Convolvulus angustissimus subsp. *angustissimus*
		Cressa australis
		Evolvulus alsinoides var. *decumbens*
		Evolvulus alsinoides var. *villosicalyx*
		ipomoea coptica
		Ipomoea costata
		Ipomoea muelleri
		Ipomoea polymorpha
CUCURBITACEAE		*Cucumis maderaspatanus*
	*	*Cucumis melo* subsp. *agrestis*
CYPERACEAE		*Cyperus bulbosus*
		Cyperus iria
		Cyperus rigidellus
		Cyperus squarrosus
	P3/VU	*Eleocharis papillosa*
		Fimbristylis dichotoma
		Fimbristylis rara
		Schoenoplectus dissachanthus
ELATINACEAE		*Bergia pedicellaris*
		Bergia perennis
		Bergia perennis subsp. *exigua*
		Bergia perennis subsp. *perennis*
		Bergia trimera
EUPHORBIACEAE		*Adriana tomentosa* var. *tomentosa*
		Euphorbia aff. *coghlanii*
		Euphorbia alsiniflora
		Euphorbia australis
		Euphorbia australis (mid-green form)
		Euphorbia biconvexa
		Euphorbia boophthona
		Euphorbia coghlanii
		Euphorbia drummondii subsp. *drummondii*
		Euphorbia myrtoides
		Euphorbia sharkoensis
		Euphorbia tannensis subsp. *eremophila*
		Euphorbia wheeleri
		Phyllanthus erwinii

Family		Species
		Phyllanthus maderaspatensis
FABACEAE		*Acacia ancistrocarpa*
		Acacia bivenosa
		Acacia colei var. *colei*
		Acacia coriacea subsp. *coriacea*
		Acacia coriacea subsp. *pendens*
		Acacia inaequilatera
		Acacia ligulata
		Acacia pyrifolia
		Acacia rostellifera
		Acacia sclerosperma
		Acacia sclerosperma hybrid
		Acacia sclerosperma subsp. *sclerosperma*
		Acacia sericophylla
		Acacia sphaerostachya
		Acacia stellaticeps
		Acacia synchronicia
		Acacia tetragonophylla
		Acacia trachycarpa
		Acacia trudgeniana
		Acacia tumida var. *pilbarensis*
		Acacia victoriae
		Acacia wanyu
		Acacia xiphophylla
		Aenictophyton aff. *reconditum* subsp. Onslow
		Aeschynomene indica
		Alysicarpus muelleri
		Canavalia rosea
		Crotalaria cunninghamii subsp. *sturtii*
		Crotalaria medicaginea var. *neglecta*
		Crotalaria ramosissima
		Crotalaria sp.
		Cullen cinereum
		Cullen graveolens
		Cullen lachnostachys
		Cullen leucanthum
		Cullen leucanthum (Cape Preston form; M59.9)
		Cullen leucochaites
		Cullen martinii
		Cullen pogonocarpum
		Desmodium filiforme
		Indigofera boviperda subsp. *boviperda*
		Indigofera colutea
		Indigofera georgei
		Indigofera linifolia
		Indigofera linnaei
		Indigofera monophylla
		Indigofera monophylla (Burrup form)
		Indigofera trita
		Isotropis atropurpurea
		Lotus cruentus
		Neptunia dimorphantha
	*	*Petalostylis cassioides*
	*	*Prosopis glandulosa*
	*	*Prosopis pallida*
		Rhynchosia minima
		Senna aff. oligophylla (thinly sericeous) *x helmsii*
		Senna artemisioides
		Senna artemisioides subsp. *oligophylla*

Family		Species
		Senna glutinosa
		Senna glutinosa x luerssenii
		Senna luerssenii
		Senna notabilis
		Senna oligophylla
		Senna oligophylla (thinly sericeous MET 15,035)
		Senna oligophylla x helmsii
		Senna pruinosa
		Sesbania cannabina
		Swainsona kingii
		Swainsona pterostylis
		Tephrosia aff. *supina* (HD133-20)
		Tephrosia aff. *supina* (MET 12,357)
		Tephrosia gardneri
		Tephrosia remotiflora
		Tephrosia rosea var. *clementii*
		Tephrosia sp. B Kimberley Flora (C.A.Gardner 7300)
		Tephrosia supina
		Tephrosia uniovulata
	*	*Vachellia farnesiana*
		Vigna lanceolata
	P2	*Vigna* sp. central (M.E. Trudgen 1626)
		Vigna sp. Hamersley Clay (A.A. Mithcell PRP 113)
FRANKENIACEAE		*Frankenia ambita*
		Frankenia pauciflora
GENTIANACEAE		*Centaurium clementii*
		Centaurium spicatum
GERANIACEAE		*Erodium cygnorum*
GOODENIACEAE		*Goodenia forrestii*
		Goodenia lamprosperma
		Goodenia microptera
		Scaevola cunninghamii
		Scaevola pulchella
		Scaevola sericophylla
		Scaevola spinescens
		Scaevola spinescens (broad form)
GYROSTEMONACEAE		*Codonocarpus cotinifolius*
		Gyrostemon ramulosus
HALORAGACEAE		*Haloragis gossei* var. *gossei*
		Haloragis gossei var. *inflata*
HEMEROCALLIDACEAE		*Tricoryne corynothecoides*
LAMIACEAE		*Dicrastylis cordifolia*
		Pityrodia loxocarpa
		Pityrodia paniculata
LAURACEAE		*Cassytha aurea* var. *aurea*
		Cassytha capillaris
LYTHRACEAE		*Rotala diandra*
MALVACEAE		*Abutilon* aff. lepidum (1) (MET 15 352)
		Abutilon aff. lepidum (4)
		Abutilon cunninghamii
		Abutilon dioicum
		Abutilon fraseri
		Abutilon lepidum
		Abutilon otocarpum
		Abutilon otocarpum (acute leaf form)
		Abutilon oxycarpum subsp. *prostratum*
		Abutilon sp.
		Abutilon uncinatum
		Alyogyne pinoniana

Family		Species
		Corchorus tectus
		Gossypium australe (Burrup Peninsula form)
		Hannafordia quadrivalvis subsp. *recurva*
		Hibiscus brachychlaenus
		Hibiscus brachysiphonius
		Hibiscus leptocladus
		Hibiscus sturtii var. *campylochlamys*
		Hibiscus sturtii var. *platychlamys*
		Lawrencia viridigrisea
	*	*Malvastrum americanum*
		Sida aff. *fibulifera*
		Sida aff. *fibulifera* (B64-13B)
		Sida aff. *fibulifera* (M69.12)
		Sida arsiniata
		Sida echinocarpa
		Sida pilbarensis (ferruginous form)
		Sida rohlenae subsp. *rohlenae*
	P3	*Triumfetta echinata* Halford
MARSILEACEAE		*Marsilea drummondii*
		Marsilea exarata
		Marsilea hirsuta
MELIACEAE		*Owenia reticulata*
MENISPERMACEAE		*Tinospora smilacina*
MOLLUGINACEAE		*Mollugo molluginea*
MYRTACEAE		*Corymbia candida*
		Corymbia hamersleyana
		Corymbia zygophylla
		Eucalyptus camaldulensis var. *obtusa*
		Eucalyptus victrix
		Eucalyptus xerothermica
		Melaleuca argentea
		Melaleuca glomerata
		Verticordia forrestii
NYCTAGINACEAE		*Boerhavia burbidgeana*
		Boerhavia coccinea
PASSIFLORACEAE	*	*Passiflora foetida* var. *hispida*
PHRYMACEAE		*Mimulus gracilis*
		Mimulus uvedaliae
		Peplidium aithocheilum
PLANTAGINACEAE		*Stemodia grossa*
		Stemodia sp. Onslow (A.A. Mithcell 76/148)
PLUMBAGINACEAE		*Muellerolimon salicorniaceum*
POACEAE		*Aristida contorta*
		Aristida holathera var. *holathera*
		Aristida holathera var. *latifolia*
		Aristida latifolia
		Astrebla elymoides
		Astrebla pectinata
		Brachyachne convergens
		Brachyachne prostrata
	*	*Cenchrus ciliaris*
	*	*Cenchrus setiger*
		Chloris pectinata
		Chloris pumilio
		Chrysopogon fallax
		Cymbopogon ambiguus
		Cymbopogon obtectus
		Cymbopogon procerus
		Dactyloctenium radulans

Family		Species
		Dichanthium sericeum subsp. *humilius*
		Digitaria brownii
		Enneapogon caerulescens
		Enneapogon polyphyllus
		Enteropogon ramosus
		Eragrostis aff. *falcata*
		Eragrostis aff. *setifolia*
		Eragrostis cumingii
		Eragrostis dielsii
		Eragrostis eriopoda
		Eragrostis falcata
		Eragrostis leptocarpa
		Eragrostis pergracilis
		Eragrostis tenellula
		Eragrostis xerophila
		Eriachne aff. *benthamii*
		Eriachne aristidea
		Eriachne benthamii
		Eriachne gardneri
		Eriachne helmsii
		Eriachne mucronata
		Eriachne obtusa
		Eriachne pulchella subsp. *dominii*
		Eriochloa pseudoacrotricha
		Eulalia aurea
		Iseilema dolichotrichum
		Iseilema eremaeum
		Iseilema macratherum
		Iseilema membranaceum
		Leptochloa digitata
		Leptochloa fusca subsp. *muelleri*
		Panicum decompositum
		Panicum laevinode
		Paraneurachne muelleri
		Paspalidium clementii
		Setaria dielsii
	*	*Setaria verticillata*
		Sorghum plumosum
		Spinifex longifolius
		Sporobolus australasicus
		Sporobolus mitchellii
		Sporobolus virginicus
		Triodia brizoides
		Triodia epactia
		Triodia lanigera
		Triodia pungens
		Triodia schinzii
		Tripogon loliiformis
		Triraphis mollis
		Urochloa holosericea subsp. *velutina*
		Urochloa occidentalis var. *occidentalis*
		Urochloa piligera
		Whiteochloa airoides
		Yakirra australiensis var. *australiensis*
POLYGALACEAE		*Polygala* aff. *isingii*
		Polygala isingii
PORTULACACEAE		*Calandrinia ptychosperma*
	*	*Portulaca oleracea*
		Portulaca pilosa

Family		Species
PRIMULACEAE		*Samolus* sp. Millstream (M.I.H. Brooker 2076)
		Samolus sp. Shark Bay (M.E. Trudgen 7410)
PROTEACEAE		*Grevillea eriostachya*
		Grevillea stenobotrya
		Grevillea wickhamii subsp. *hispidula*
		Hakea lorea subsp. *lorea*
		Hakea stenophylla subsp. *stenophylla*
RHIZOPHORACEAE		*Ceriops tagal*
RUBIACEAE		*Synaptantha tillaeacea* var. *tillaeacea*
SANTALACEAE		*Santalum lanceolatum*
SAPINDACEAE		*Diplopeltis eriocarpa*
SCROPHULARIACEAE		*Eremophila cuneifolia*
		Eremophila forrestii subsp. *forrestii*
	P3	*Eremophila forrestii* subsp. *viridis*
		Eremophila longifolia
		Myoporum montanum
SOLANACEAE		*Nicotiana occidentalis*
		Nicotiana occidentalis subsp. *occidentalis*
		Nicotiana rosulata subsp. *rosulata*
		Nicotiana sp.
		Solanum diversiflorum
		Solanum ellipticum
		Solanum horridum
		Solanum lasiophyllum
		Solanum phlomoides
		Solanum sturtianum
STACKHOUSIACEAE		*Stackhousia muricata*
STERCULIACEAE		*Melhania oblongifolia*
		Waltheria indica
SURIANACEAE		*Stylobasium spathulatum*
THYMELAEACEAE		*Pimelea ammocharis*
TILIACEAE		*Corchorus* aff. *laniflorus*
		Corchorus sidoides subsp. vermicularis
		Corchorus tridens
		Triumfetta aff. chaetocarpa (H123-10)
		Triumfetta aff. chaetocarpa (PAN3/4)
		Triumfetta clementii
		Triumfetta echinata
		Triumfetta sp.
VIOLACEAE		*Hybanthus aurantiacus*
ZYGOPHYLLACEAE		*Tribulus astrocarpus*
		Tribulus hirsutus
		Tribulus hystrix
		Tribulus macrocarpus
		Tribulus occidentalis

RPS

Appendix C
Flora inventory

Appendix C Flora inventory

Table C-1 Vascular terrestrial flora taxa recorded in the survey area for the current survey

Family	Weed	Name
AIZOACEAE		*Trianthema pilosa*
		Trianthema turgidifolia
AMARANTHACEAE		*Ptilotus gomphrenoides*
		Ptilotus latifolius
		Ptilotus macrocephalus
		Ptilotus polystachyus
APIACEAE		*Trachymene pilbarensis*
APOCYNACEAE		*Cynanchum viminale* subsp. *australe*
ASTERACEAE		*Angianthus* ? *acrohyalinus*
		Angianthus acrohyalinus
		Calotis plumulifera
		Centipeda minima
		Decazesia hecatocephala
	*	*Flaveria trinervia*
		Gnephosis brevifolia
		Gnephosis sp.
		Myriocephalus rudallii
		Pterocaulon sphacelatum
		Rhodanthe humboldtiana
		Rhodanthe psammophila
		Rhodanthe stricta
		Roebuckiella cheilocarpa var. *cheilocarpa*
		Streptoglossa ? *bubakii*
		Streptoglossa decurrens
		Streptoglossa macrocephala
BORAGINACEAE		*Heliotropium crispatum*
		Trichodesma zeylanicum var. ?
BRASSICACEAE		*Lepidium muelleri-ferdinandii*

Family	Weed	Name
		Lepidium phlebopetalum
		Lepidium platypetalum
		Stenopetalum pedicellare
CAMPANULACEAE		*Wahlenbergia tumidifructa*
CHENOPODIACEAE		*Atriplex codonocarpa*
		Atriplex semilunaris
		Atriplex sp.
		Dysphania rhadinostachya subsp. *inflata*
		Enchylaena tomentosa
		Maireana georgei
		Maireana tomentosa
		Neobassia astrocarpa
		Rhagodia preissii subsp. *obovata*
		Salsola australis
		Sclerolaena costata
		Sclerolaena recurvicuspis
		Sclerolaena uniflora
		Tecticornia ? auriculata
		Tecticornia auriculata
		Tecticornia halocnemoides subsp. *tenuis*
		Tecticornia indica subsp. leiostachya
CONVOLVULACEAE		*Bonamia erecta*
		Evolvulus alsinoides var. *decumbens*
		Ipomoea muelleri
CUCURBITACEAE	*	*Cucumis melo*
		Cucumis variabilis
CYPERACEAE		*Bulbostylis barbata*
		Cyperus ? bulbosus
		Cyperus bulbosus
		Fimbristylis dichotoma
ELATINACEAE		*Bergia trimera*
EUPHORBIACEAE		*Adriana tomentosa* var. *tomentosa*
		Euphorbia boophthona

Family	Weed	Name
		Euphorbia myrtoides
FABACEAE		*Acacia bivenosa*
		Acacia bivenosa x *sclerosperma* subsp. *sclerosperma*
		Acacia colei var. *colei*
		Acacia coriacea subsp. *coriacea*
		Acacia sclerosperma subsp. *sclerosperma*
		Acacia sphaerostachya
		Acacia stellaticeps
		Acacia synchronicia
		Acacia tetragonophylla
		Acacia trachycarpa
		Crotalaria cunninghamii
		Cullen cinereum
		Cullen graveolens
		Cullen lachnostachys
		Indigofera ? *linifolia*
		Indigofera boviperda subsp. *boviperda*
		Indigofera colutea
	*	*Indigofera sessiliflora*
		Lotus cruentus
		Neptunia dimorphantha
	*	*Prosopis pallida*
		Rhynchosia minima
		Senna artemisioides subsp. *oligophylla*
		Senna artemisioides subsp. *oligophylla* x?
		Senna glutinosa subsp. *chatelainiana*
		Swainsona kingii
		Swainsona pterostylis
		Tephrosia rosea var. *clementii*
		Tephrosia sp. B. Kimberley Flora (C.A. Gardner 7300)
		Tephrosia sp. Onslow (K.R. Newbey 10571)
	*	*Vachellia farnesiana*
FRANKENIACEAE		*Frankenia ambita*

Family	Weed	Name
GERANIACEAE		*Erodium cygnorum*
GOODENIACEAE		*Goodenia corynocarpa*
		Goodenia forrestii
		Goodenia lamprosperma
		Scaevola sericophylla
		Scaevola spinescens
		Scaevola spinescens (broad leaf variant)
HALORAGACEAE		*Haloragis gossei* var.?
HEMEROCALLIDACEAE		*Corynotheca pungens*
LAMIACEAE		*Quoya loxocarpa*
LAURACEAE		*Cassytha capillaris*
MALVACEAE		*Abutilon lepidum*
		Abutilon sp. Dioicum (A.A. Mitchell PRP 1618)
		Alyogyne pinoniana
		Hibiscus ? *sturtii* var. *campylochlamys*
		Hibiscus sturtii var. *platychlamys*
		Lawrencia viridigrisea
		Seringa nephrosperma
		Sida fibulifera
		Sida rohlenae subsp. *rohlenae*
MARSILEACEAE		*Marsilea* ? *exarata*
MONTIACEAE		*Calandrinia* ? *polyandra*
		Calandrinia polyandra
		Calandrinia ptychosperma
MYRTACEAE		*Eucalyptus victrix*
		Verticordia forrestii
PHRYMACEAE		*Mimulus gracilis*
PLANTAGINACEAE		*Stemodia* sp. Onslow (A.A. Mitchell 76/148)
POACEAE		*Aristida contorta*
		Aristida latifolia
		Astrebla elymoides
	*	*Cenchrus ciliaris*
	*	*Cenchrus setiger*

Family	Weed	Name
		Chloris pectinata
		Chloris pumilio
		Chrysopogon fallax
		Dactyloctenium radulans
		Dichanthium sericeum subsp. *humilius*
		Enteropogon ramosus
		Eragrostis ? falcata
		Eragrostis dielsii
		Eragrostis eriopoda
		Eragrostis falcata
		Eragrostis pergracilis
		Eragrostis setifolia
		Eriachne benthamii
		Eriochloa pseudoacrotricha
		Eulalia aurea
		Iseilema dolichotrichum
		Iseilema vaginiflorum
		Panicum ? laevinode
		Paraneurachne muelleri
		Sporobolus mitchellii
		Sporobolus virginicus
		Triodia ? avenoides
		Triodia epactia
		Urochloa occidentalis var. *occidentalis*
		Whiteochloa airoides
POLYGALACEAE		*Polygala isingii*
PORTULACACEAE	*	*Portulaca oleracea*
PROTEACEAE		*Grevillea eriostachya*
		Grevillea stenobotrya
		Hakea stenophylla subsp. *stenophylla*
SAPINDACEAE		*Diplopeltis eriocarpa*
SCROPHULARIACEAE		*Eremophila forrestii* subsp. *viridis* (P3)
		Eremophila longifolia

Family	Weed	Name
SOLANACEAE		*Nicotiana rosulata* subsp. *rosulata*
		Solanum lasiophyllum
SURIANACEAE		*Stylobasium spathulatum*
ZYGOPHYLLACEAE		*Tribulus occidentalis*