



# PHOENIX

ENVIRONMENTAL SCIENCES

Flora and vegetation survey for the Beyondie Potash Project

Prepared for Kalium Lakes Ltd

March 2017

Draft Report



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Draft Report

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## EXECUTIVE SUMMARY

Kalium Lakes Potash Pty Ltd (Kalium) proposes to develop the Beyondie Potash Project (the Project), located approximately 150 km south-southeast of Newman on the border of the Little Sandy Desert and Gascoyne bioregions. In February 2015, Phoenix Environmental Sciences Pty Ltd (Phoenix) was commissioned to conduct a flora and vegetation survey for the Project, which was undertaken over several field trips between April and November 2015.

The objective of the survey was to define the flora and vegetation values of the study area, in particular with respect to conservation significant species and communities to inform planning and an environmental impact assessment of the Project.

The study area for the survey covered 19,113.4 ha and included riparian vegetation fringing Beyondie Lakes, Ten Mile Lake and Lake Sunshine. Beyondie Lakes consists of a western freshwater marsh connected to two circular salt playas in line in the east. Ten Mile Lake is a large salt playa located about six kilometres to the south with several claypans located around the lakes that are not hydrologically connected to it. Lake Sunshine another large salt playa and claypans, is located approximately 24 km north east of the Beyondie Lakes.

Survey intensity varied across the study area. A Level 2 flora and vegetation survey was conducted around Beyondie Lakes, a northern portion of Ten Mile Lake and along proposed transport corridors (collectively the northern section) and at Lake Sunshine. The remainder of the study area around Ten Mile Lake (southern section) was limited to transects in riparian vegetation (for *Tecticornia*).

A desktop review of relevant databases, literature and spatial data preceded the field survey to identify potential flora species and vegetation communities in the study area.

A total of 131 sites comprising 86 quadrats, 21 relevés and 24 *Tecticornia* transects were sampled across the study area, with all quadrats and relevés located in the northern section and Lake Sunshine, and *Tecticornia* transects conducted in all three sections.

The first phase survey of the northern and southern sections was conducted following substantial rainfall events. A high number of annual and short-lived plant species were present with the majority of plant species were flowering and/or fruiting enabling identification. The second phase survey of the northern and southern sections was conducted in spring following a dry period of below average rainfall. The presence of flowers and/or fruiting bodies during the second phase facilitated identification of some species not identifiable to species level during the first phase. The survey of Lake Sunshine was conducted during the spring second phase and subsequently at a sub-optimal time for annual species following a dry period of below average rainfall.

Quadrat and relevé data were analysed and sites grouped by hierarchical cluster analyses (UPGMA) as implemented in the software package PATN. Vegetation types were then defined by clusters of quadrats supplemented by field observations based on species composition, structure, and dominance at the stratum level.

The field survey was conducted in accordance with relevant Environmental Protection Authority (EPA) guidance that was current at the time of the surveys, including Position Statement No. 3: *Terrestrial biological surveys as an element of biodiversity protection* and Guidance Statement No. 51: *Terrestrial flora and vegetation surveys for environmental impact assessment in Western Australia*. Where appropriate, this report was updated to reflect the new EPA guidance for the environmental factor flora and vegetation, specifically *Environmental Factor Guideline: Flora and vegetation* and *Technical Guidance: Flora and vegetation surveys for environmental impact assessment*.

The desktop review identified 643 taxa that potentially occur in the study area, of which 38 were conservation significant flora. This included one Threatened species (*Thryptomene wittweri*) (VU – EPBC; S1 – WC Act/VU – DPaW) and 37 Priority species. Four introduced flora<sup>1</sup> species were returned in the desktop review (\**Aerva javanica*, \**Bidens bipinnata*, \**Malvastrum americanum* and \**Setaria verticillata*).

The Lee Steere Range vegetation complexes (banded ironstone formation) (Priority 1) was the only State listed Priority Ecological Community (PEC) that was identified in the desktop review. The 90 km buffer zone of this PEC intersects the study area; however, no banded ironstone formation occurs within the study area. No Threatened Ecological Communities (TEC) or Environmentally Sensitive Areas (ESAs) were located within close proximity to the study area. Previous flora surveys reviewed for the desktop study did not define any vegetation units described as locally or regionally significant.

A total of 487 flora taxa representing 57 families and 181 genera were recorded during the field survey comprised of 478 native species and nine introduced flora. The recorded flora included 354 perennial species and 133 annual/short-lived species. The most prominent families recorded were the Fabaceae, Chenopodiaceae, Poaceae, Malvaceae, Asteraceae, Goodeniaceae and Amaranthaceae.

Four conservation significant flora were recorded within the study area, all Priority 1 *Tecticornia* species:

- *Tecticornia globulifera*
- *Tecticornia* sp. Christmas Creek (K.A. Shepherd & T. Colmer *et. al.* KS 1063)
- *Tecticornia* sp. Little Sandy Desert (K.A. Shepherd & C. Wilkins KS 830)
- *Tecticornia* sp. Sunshine Lake (K.A. Shepherd *et al.* KS 867).

Two unidentified taxa collected, *Tecticornia* sp. nov. 1 (aff. *pruinosa/laevigata*) and *Tecticornia* sp. nov. 2 (aff. *pruinosa/undulata*), potentially represent undescribed taxa and therefore may be considered locally significant as they exhibit anomalous features.

The survey records represented range extensions for 29 species, of which nine exceeded 100 km.

None of the weed species recorded in the study area is a declared pest or weed of national significance.

A total of 31 taxa could not be identified to species level, as they lacked reproductive structures at the time of the field survey.

A total of 53 vegetation types were defined for the study area comprised of eight woodland communities, 16 shrublands, eight grasslands and 21 samphire shrubland communities comprising *Tecticornia* species. The samphire shrublands, which fringe the salt playas, were mapped as a single mosaic as it was not possible to discern community type boundaries from aerial imagery.

None of the vegetation defined for the study area resembles any listed TECs or PECs.

The condition of vegetation across the study area ranged from good to excellent, with the majority of the study area (67%) mapped as excellent. The condition of vegetation in all the *Tecticornia* shrublands was recorded as excellent with disturbances, where recorded, limited to animal tracks from domestic stock and feral animals.

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<sup>1</sup> Introduced flora are identified with an asterisk (\*) throughout the report.



With the exception of the *Tecticornia* shrublands which are associated with the lake playas and immediate surrounds, each of the remaining vegetation types align with the one or more broad vegetation associations known from Western Australia. Each of these vegetation types are classed as Least Concern as they have in excess 90% of pre-European extent remaining. Therefore, the majority of the vegetation in the study area represents widespread communities, well represented at a regional level.

In summary, the study area features a comparatively diverse flora in a floristically poorly known region as evidenced by a number of range extensions. The *Tecticornia* shrublands on the lake playa and beaches appear to hold the highest conservation value of the vegetation types defined as they represent habitat for conservation significant species and potentially undescribed species.



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# 1 INTRODUCTION

In February 2015, Phoenix Environmental Sciences Pty Ltd (Phoenix) was commissioned by Preston Consulting Pty Ltd (Preston) on behalf of Kalium Lakes Ltd (Kalium) to conduct a flora and vegetation survey for the Beyondie Potash Project (the Project).

## 1.1 BACKGROUND












Kalium is seeking to develop the Project as a sub-surface brine deposit to produce 150–250 ktpa Sulphate of Potash (SOP) product via an evaporation and processing operation. A concept study completed in April 2015 assessed the mine life as being 20 years with considerable upside to extend for many decades.

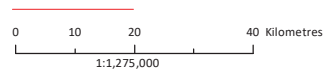
The Project is located approximately 150 km south-southeast of Newman, with access to the Great Northern Highway at Kumarina approximately 65 km to the east (Figure 1-1). The project area spans the border between the Little Sandy Desert and Gascoyne bioregions.

The study area for the survey covered 19,113.4 ha (Figure 1-1). Survey intensity varied between parts of the study area. The northern section around the Beyondie Lakes and the area around Lake Sunshine was systematically surveyed and included detailed vegetation mapping. It covered 14,643.7 ha and also included access tracks to Lake Sunshine and the corridor of a proposed haul road (a 40 m wide upgrade to an existing pastoral track) connecting the Project to the Great Northern Highway at Kumarina. The southern section (4,289.7 ha) largely encompassed Ten Mile Lake and its perimeter (Figure 1-1). In this area, the survey was limited to transects to document the riparian samphire (*Tecticornia* spp.) vegetation and detailed vegetation mapping was not undertaken.

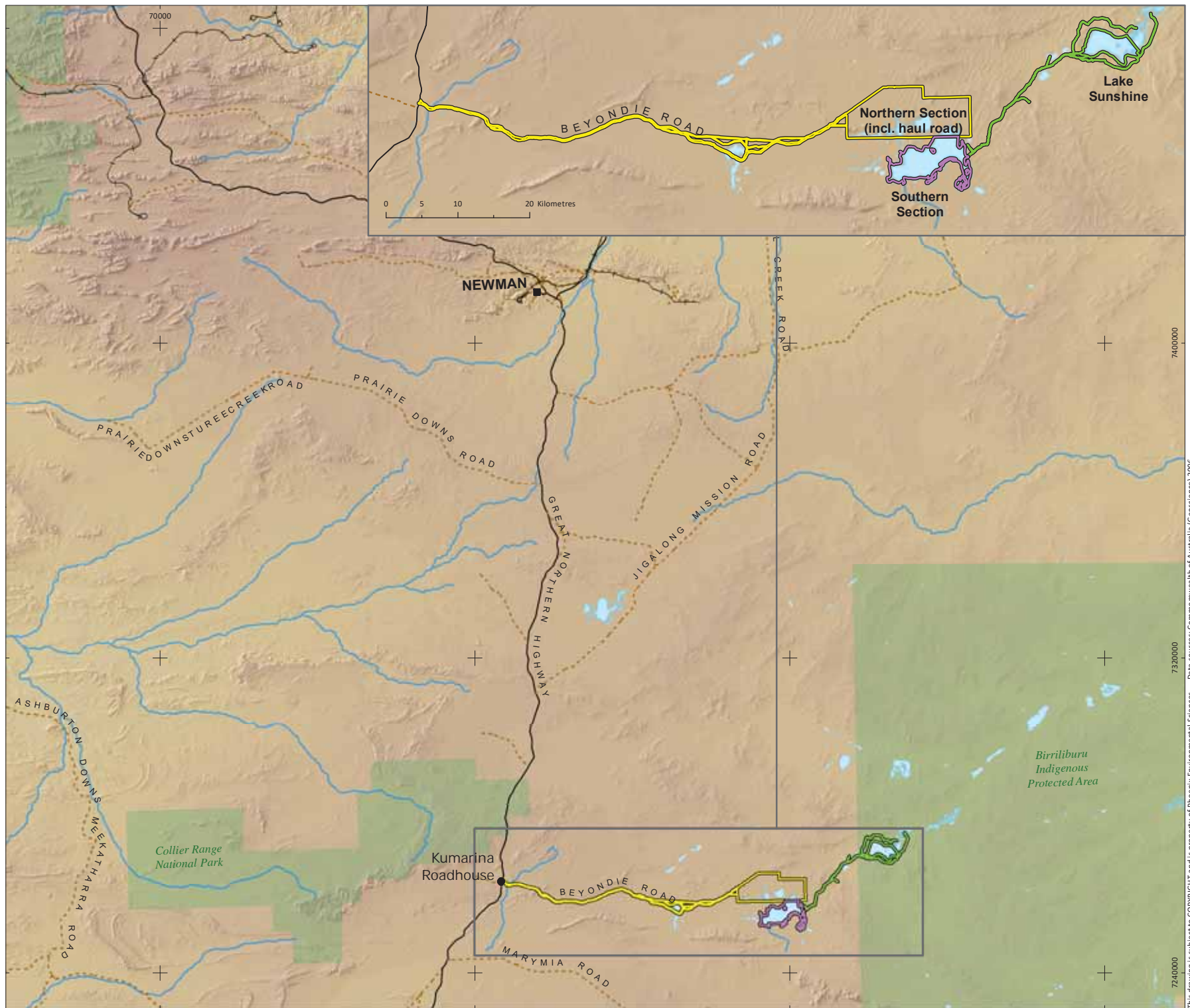
The Beyondie Lakes consist of a western freshwater marsh connected to two circular salt playas in line in the east. Ten Mile Lake is a large salt playa located about six kilometres to the south. Several claypans are located around the lakes but are not hydrologically connected. The Beyondie Lakes salt playas connect with Ten Mile Lake during extreme inundation events. The Lake Sunshine, another large salt playa and claypans, is located approximately 24 km north east of the Beyondie Lakes.

**Figure 1-1**  
**Location of the Beyondie Potash Project and study area for the flora and vegetation survey**

-  Lake Sunshine
-  Northern Section
-  Southern Section
-  Town
-  Railways
-  Principal road
-  Secondary road
-  Minor road
-  Major creeks and rivers
-  Lakes
-  National Parks, Nature Reserves



Client: Kalium Lakes Ltd  
 Project: Beyondie Potash Project  
 Author: KW  
 Date: 15-Mar-17  
 Coordinate System: GDA 1994 MGA Zone 51  
 Projection: Transverse Mercator  
 Datum: GDA 1994



## 1.2 SURVEY OBJECTIVES AND SCOPE OF WORK

The objective of the flora and vegetation survey was to define the botanical values of the study area which will be used to inform planning and an environmental impact assessment for the Project. The scope of work was as follows:

- conduct a desktop review of available technical reports, relevant databases and spatial data to identify the potential flora and vegetation that may be present in the study area
- conduct a two phase Level 2 flora and vegetation survey in the northern section of the Beyondie Lakes and haul road study area, and a single phase Level 2 flora and vegetation survey at Lake Sunshine and access tracks
- identify the vascular plant species present
- conduct targeted searches for and describe populations of plants of conservation significance particularly those recorded in or in close proximity to the study area identified from the database and literature reviews
- conduct targeted searches for and describe populations of exotic plant species (weeds), particularly declared plants
- define and map vegetation types present
- review the local and regional significance of the vegetation types recorded
- record the condition of vegetation
- prepare a comprehensive flora and vegetation technical report and supporting raw and digital data incorporating results of the desktop assessment and the field survey.

The flora and vegetation survey was conducted in accordance with relevant Environmental Protection Authority (EPA) guidance that was current at the time of the surveys, in particular:

- Position Statement No. 3: *Terrestrial biological surveys as an element of biodiversity protection* (EPA 2002)
- Guidance Statement No. 51: *Terrestrial flora and vegetation surveys for environmental impact assessment in Western Australia* (EPA 2004).

Where appropriate, this report was updated to reflect the new EPA guidance for the environmental factor flora and vegetation, specifically:

- *Environmental Factor Guideline: Flora and vegetation* (EPA 2016a)
- *Technical Guidance: Flora and vegetation surveys for environmental impact assessment* (EPA 2016b).

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## 2 LEGISLATIVE CONTEXT

The protection of fauna in Western Australia is principally governed by three acts:

- Commonwealth *Environmental Protection and Biodiversity Conservation Act 1999* (EPBC Act)
- *Wildlife Conservation Act 1950* (WC Act)
- *Environmental Protection Act 1986* (EP Act).

### 2.1 COMMONWEALTH

Under the EPBC Act, actions that have, or are likely to have, a significant impact on a matter of national environmental significance (NES), require approval from the Australian Government Minister for the Environment. The EPBC Act provides for the listing of Threatened native flora and threatened ecological communities (TECs) as matters of NES.

Conservation categories applicable to Threatened Flora under the EPBC Act are as follows:

- Extinct (EX)<sup>2</sup> – there is no reasonable doubt that the last individual has died
- Extinct in the Wild (EW) – taxa known to survive only in captivity
- Critically Endangered (CR) – taxa facing an extremely high risk of extinction in the wild in the immediate future
- Endangered (EN) – taxa facing a very high risk of extinction in the wild in the near future
- Vulnerable (VU) – taxa facing a high risk of extinction in the wild in the medium-term
- Conservation Dependent<sup>2</sup> – taxa whose survival depends upon ongoing conservation measures; without these measures, a conservation dependent taxon would be classified as Vulnerable or more severely threatened.

Ecological communities are defined as ‘naturally occurring biological assemblages that occur in a particular type of habitat’ (1997). There are three categories under which ecological communities can be listed as TECs under the EPBC Act: Critically Endangered, Endangered and Vulnerable.

### 2.2 STATE

#### 2.2.1 Threatened and Priority species and communities

In WA, the WC Act provides for the protection of native flora (Rare or Threatened Flora; T) species which are under identifiable threat of extinction. Rare flora listed under the WC Act receive statutory protection and, under current classifications (Western Australian Government 2015), are assigned to one of four categories (schedules):

- Schedule 1 (S1) – flora that are considered likely to become extinct or rare as Critically Endangered (CR) flora
- Schedule 2 (S2) – flora that are considered likely to become extinct or rare as Endangered (EN) flora

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<sup>2</sup> Species listed as Extinct and Conservation Dependent are not matters of NES and therefore do not trigger the EPBC Act.

- Schedule 3 (S3) – flora that are considered likely to become extinct or rare as Vulnerable (VU) flora
- Schedule 4 (S4) – flora presumed to be extinct (EX).

All listed species are in need of special protection and are declared to be Rare Flora for the purposes of section 23F of the WC Act (Western Australian Government 2015).

The Department of Parks and Wildlife (DPaW) administers the WC Act and also maintains a non-statutory list of Priority Flora species, most recently updated 19 November 2015. Priority species are still considered to be of conservation significance – that is they may be rare or threatened – but cannot be considered for listing under the WC Act until there is adequate understanding of their threat levels. Species on the Priority Flora list are assigned to one of four priority (P) categories, P1 (highest) – P4 (lowest), based on level of knowledge/concern.

The Minister for Environment may also list ecological communities which are at risk of becoming destroyed as ‘threatened’. DPaW maintains a list of ministerially-endorsed TECs as well as a non-statutory list of Priority Ecological Communities (PECs) which are also assigned to one of five categories.

Any activities that are deemed to have a significant impact on listed flora species can trigger referral to the Environmental Protection Authority (EPA) for assessment under the EP Act. The EPA’s position on TECs states that proposals that result in the direct loss of TECs are likely to require formal assessment (EPA 2006).

## 2.2.2 Locally or regionally significant flora and vegetation

Flora and vegetation may be considered significant for a range of reasons other than being Threatened or Priority species or ecological communities, including, but not limited to (EPA 2016b):

- Flora
  - locally endemic or association with a restricted habitat type (e.g. surface water or groundwater dependent ecosystems)
  - new species or anomalous features that indicate a potential new species
  - representative of the range of a species (particularly, at the extremes of range recently, discovered range extensions, or isolated outliers of the main range)
  - unusual species, including restricted subspecies, varieties or naturally occurring hybrids
  - relictual status, being representative of taxonomic groups that no longer occur widely in the broader landscape
- vegetation
  - restricted distribution
  - degree of historical impact from threatening processes
  - a role as a refuge
  - providing an important function required to maintain ecological integrity of a significant ecosystem.

It may be considered that representation of less than one percent of the total study area or vegetation in Excellent or better condition defines locally (i.e. at the scale of the survey) significant vegetation (Shepherd *et al.* 2002).

A vegetation community is considered regionally significant if it is classified as under-represented, that is, there is less than 30% of its original distribution remaining. Several key criteria are applied to vegetation clearing from a biodiversity perspective, as follows (EPA 2000):

- the 'threshold level' below which species loss appears to accelerate exponentially within an ecosystem level is regarded as being at a level of 30% (of the pre-European, i.e. pre-1750 extent of the vegetation type)
- a level of 10% of the original extent is regarded as being a level representing Endangered
- clearing which would result in an increase in the threat level such that it changes the assigned remaining status classification (see below) should be avoided.



Shepherd *et al.* (2002) have assigned the status of vegetation remaining (to pre-European extent) into five classes:

- Presumed Extinct – probably no longer present in the bioregion
- Endangered<sup>3</sup> – <10% of pre-European extent remains
- Vulnerable<sup>3</sup> – 10–30% of pre-European extent exists
- Depleted<sup>3</sup> – >30% and up to 50% of pre-European extent exists
- Least Concern – >50% pre-European extent exists and subject to little or no degradation over a majority of this area.

### 2.2.3 Clearing of native vegetation

The clearing of native vegetation in WA is not generally permitted where the biodiversity values, land conservation and water protection roles of native vegetation would be significantly affected. Any clearing of native vegetation in WA requires a permit under Part V Division 2 of the EP Act, except where an exemption applies under the Act, or is prescribed by the *Environmental Protection (Clearing of Native Vegetation) Regulations 2004* (the Regulations), and the vegetation is not in an Environmentally Sensitive Area (ESA). Permit applications to clear native vegetation require assessment against the '10 Clearing Principles', as outlined in the Regulations.

### 2.2.4 Environmentally Sensitive Areas

Under section 51B of the EP Act the Minister for Environment may declare by notice either a specified area of the State or a class of areas of the State to be an ESA. ESAs are declared in the *Environmental Protection (Environmentally Sensitive Areas) Notice 2005*, which was gazetted on 8 April 2005.

ESAs are generally areas where the vegetation has high conservation value. Several types of areas which are declared ESAs include:

- the area covered by vegetation within 50 m of Threatened Flora, to the extent to which the vegetation is continuous with the vegetation in which the Threatened Flora is located
- the area covered by a TEC
- a defined wetland (Ramsar wetlands, conservation category wetlands and nationally important wetlands) and the area within 50 m of the wetland
- Bush Forever sites.

If a project falls within an ESA, project and clearing approvals enforcements include:

- flora and fauna surveys, regardless of the size of the impact area of the project
- quantified evidence of the extent of impacts.

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<sup>3</sup> or a combination of depletion, loss of quality, current threats and rarity gives a comparable status.



## 2.3 INTRODUCED FLORA

Introduced flora (i.e. weeds) pose threats to biodiversity and natural values by successfully out-competing native species for available nutrients, water, space and sunlight; reducing the natural structural and biological diversity by smothering native plants or preventing them from growing back after clearing, fire or other disturbance; replacing the native plants that animals use for shelter, food and nesting; and altering fire regimes, often making fires hotter and more destructive (AWC 2007).

Management of some weed species is required under State or Federal frameworks. Key weed classifications for significant weeds that are relevant to this report are:

- declared pest – the *Biosecurity and Agriculture Management Act 2007* (BAM Act), Section 22 makes provision for a plant taxon to be listed as a declared pest organism in parts of, or the entire State. Under the *Biosecurity and Agriculture Management Regulations 2013* declared pests are assigned to one of three control categories that dictate level of management required (Table 2-1).
- Weed of National Significance (WoNS) – high impact, established weeds causing major economic, environmental, social and/or cultural impacts in a number of states/territories, and which have strong potential for further spread (Australian Weeds Committee 2012) Management is required in accordance with Department of Agriculture and Food guidelines for particular WoNS.

Throughout this report, introduced flora species are indicated with an asterisk (\*).

Table 2-1 Description of control categories for declared pests (Government of Western Australia 2013)

Control category	Description
C1 Exclusion	If in the opinion of the Minister introduction of the declared pest into an area or part of an area for which it is declared should be prevented.
C2 Eradication	If in the opinion of the Minister eradication of the declared pest from an area or part of an area for which it is declared is feasible.
C3 Management	If in the opinion of the Minister eradication of the declared pest from an area or part of an area for which it is declared is not feasible but that it is necessary to — <ul style="list-style-type: none"> <li>(i) alleviate the harmful impact of the declared pest in the area; or</li> <li>(ii) reduce the number or distribution of the declared pest in the area; or</li> <li>(iii) prevent or contain the spread of the declared pest in the area.</li> </ul>

## 3 EXISTING ENVIRONMENT

### 3.1 INTERIM BIOGEOGRAPHIC REGIONALISATION OF AUSTRALIA

The Interim Biogeographic Regionalisation of Australia (IBRA) defines 'bioregions' as large land areas characterised by broad, landscape-scale natural features and environmental processes that influence the functions of entire (Department of the Environment and Energy 2016; Thackway & Cresswell 1995). They categorise the large-scale geophysical patterns that occur across the Australian continent that are linked to fauna and flora assemblages and processes at the ecosystem scale (Thackway & Cresswell 1995).

Western Australia contains 26 IBRA bioregions and 53 subregions. The study area is situated on the border to two bioregions; the Gascoyne bioregion and Little Sandy Desert bioregion (Figure 3-1). The study area is situated at the junction of the Augustus subregion (GAS3) of the Gascoyne bioregion and Trainor subregion (LSD2) of the Little Sandy Desert bioregion (Figure 3-1).











The Augustus subregion (GAS3) is characterised by (Desmond *et al.* 2001):

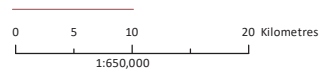
- low Proterozoic sedimentary and granite ranges divided by flat broad valleys
- mulga woodland with *Triodia* on shallow stony loams on rises with mulga parkland on shallow earthy loams over hardpan on the plains
- extensive areas of alluvial deposits
- calcrete aquifers of the Carnegie drainage system
- desert climate with bimodal rainfall.

The Trainor subregion (LSD2) is characterised by (Cowan & Kendrick 2001):

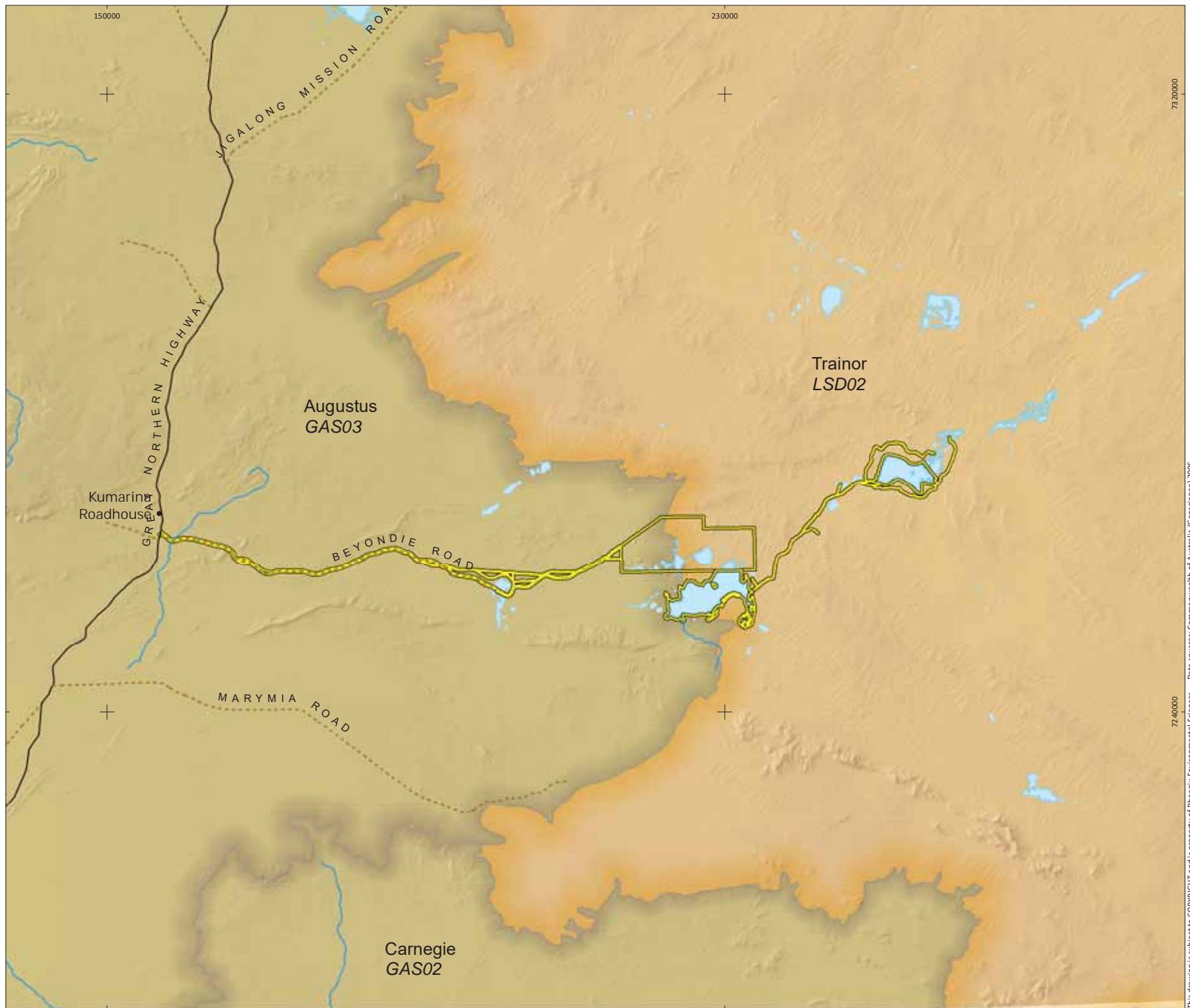
- red centre desert on Neoproterozoic sedimentary basement (Officer Basin)
- red Quaternary dune fields with abrupt Proterozoic sandstone ranges of Bangemall Basin
- shrub steppe of acacias, *Aluta maisonneuvei* and grevilleas over *Triodia schinzii* on sandy surfaces
- sparse shrub-steppe over *Triodia basedowii* on stony hills
- eucalypt and coolabah communities and bunch grasses on alluvial deposits and drainage lines associated with ranges
- arid climate with episodic summer rainfall.

**Figure 3-1**  
**Study area in relation**  
**to IBRA regions and**  
**subregions**

-  Study area
-  Town
-  Railways
-  Principal road
-  Secondary road
-  Minor road
-  Lakes
-  Major creeks and rivers
- IBRA regions
-  Gascoyne
-  Little Sandy Desert



Client: Kalium Lakes Ltd  
 Project: Beyondie Potash Project  
 Author: KW  
 Date: 15-Mar-17  
 Coordinate System: GDA 1994 MGA Zone 51  
 Projection: Transverse Mercator  
 Datum: GDA 1994

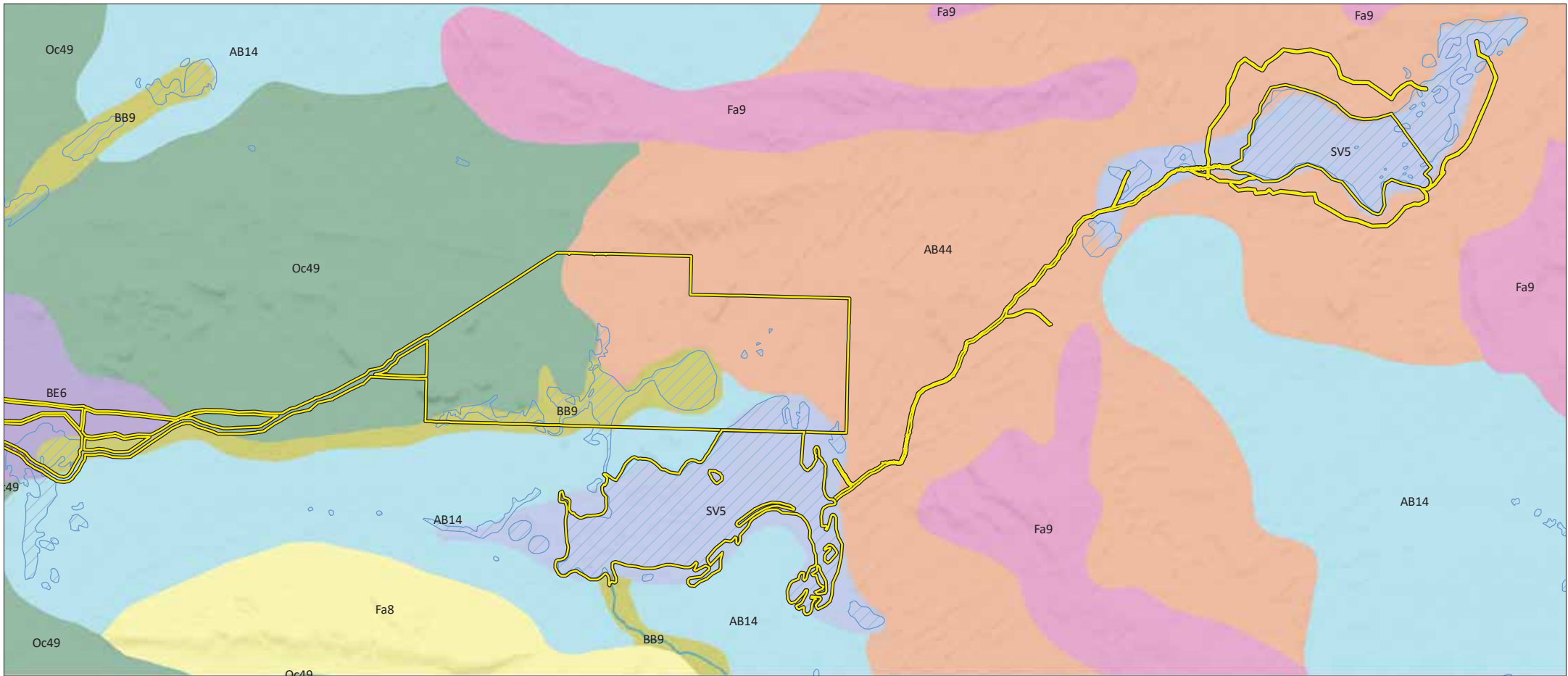
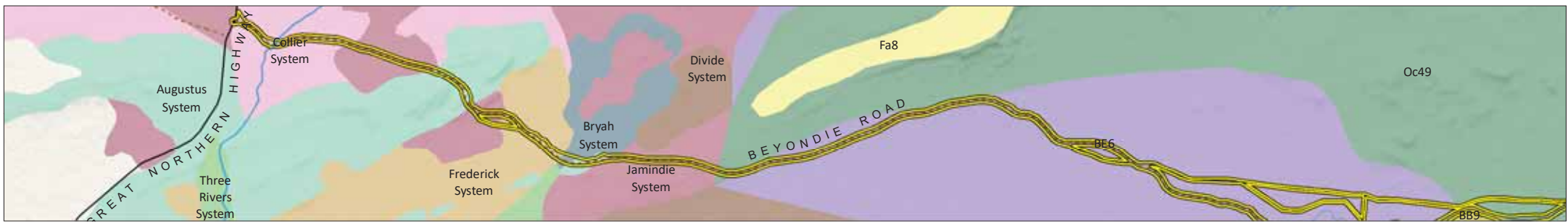


## 3.2 LAND SYSTEMS

The Department of Agriculture and Food (DAFWA) has mapped the land systems in the Little Sandy Desert and Gascoyne bioregions (DAFWA 2014). The study area covers 11 land systems (Table 3-1; Figure 3-2). It is dominated by the AB44, Oc49 and SV5 land systems which together cover approximately 80% of the study area (Table 3-1; Figure 3-2).

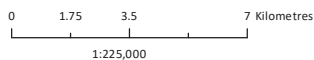
Table 3-1 Land systems of the study area

Land system	Description	Total area (ha)	% of study area
AB14	Upland sandplains with occasional dunes and minor inclusions of associated plains units	626.01	3.28%
AB44	Plains with a variable, but usually high, proportion of longitudinal sand dunes, and with some clay pans; scattered sandstone hills and laterite residuals are fairly common	5,069.99	26.53%
Augustus System	Rugged ranges, hills, ridges and plateaux with skeletal soils supporting mulga and other acacia shrublands in southern parts or hard spinifex grasslands in northern parts	89.46	0.47%
BB9	Narrow plain associated with the major river systems, usually occurring upstream of unit Oc47 and characterized by frequent outcrops of calcrete (kunkar)	1,907.31	9.98%
BE6	Extensive flat and gently sloping plains, which sometimes have a surface cover of gravels and on which red-brown hardpan frequently outcrops	814.75	4.26%
Bryah System	Stony plains and restricted internal drainage flats with sparse tall acacia shrublands and low chenopod shrublands	21.33	0.11%
Collier System	Undulating stony uplands, low hills, ridges, stony plains and drainage floors supporting mulga shrublands and some spinifex	119.14	0.62%
Frederick System	Hardpan wash plains with broad, reticulate mulga groves and wanderrrie banks supporting acacia tall shrublands with grassy understorey	82.95	0.43%
Jamindie System	Stony hardpan plains and rises supporting groved mulga shrublands, occasionally with spinifex understorey	223.72	1.17%
Oc49	Partially dissected pediments with some low stony hills on fine-grained sedimentary rocks and basic dykes, frequently flanking areas of unit Fa8	3,333.25	17.44%
SV5	Saline soils associated with salt lakes; sand and kopi gypsum dunes, and intervening plains	6,825.45	35.71%
<b>Total</b>		<b>19,113.36</b>	<b>100.00%</b>



**Figure 3-2**  
**Land systems of**  
**the study area**

Client: Kalium Lakes Ltd  
 Project: Beyondie Potash Project  
 Author: KW  
 Date: 15-Mar-17  
 Coordinate System: GDA 1994 MGA Zone 50  
 Projection: Transverse Mercator  
 Datum: GDA 1994



- Study area
- Major creeks and rivers
- Principal road
- Secondary road
- Minor road
- Lakes

**Land systems**

- AB14
- AB44
- Augustus System
- BB9
- BE6
- Bryah System
- Collier System
- Divide System
- Fa8
- Fa9
- Frederick System

- George System
- Jamindie System
- Oc49
- SV5
- Three Rivers System





### 3.3 NATIVE VEGETATION EXTENT AND STATUS

Regional vegetation mapping by Shepherd *et al.* (2002) identifies seven vegetation associations in the study area (Table 3-2; Figure 3-3).

The vegetation associations mapped by Shepherd *et al.* (2002) in the study area all have in excess of 90% or pre-European extent remaining (Table 3-2) and therefore have the status of Least Concern.

Table 3-2 Regional vegetation association, extent and status

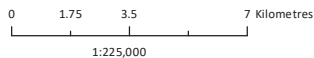
Code	Vegetation association description	Area in study area (ha)	Pre-European extent (ha)	Current extent (ha)	% remaining	% in reserve <sup>1</sup>
18	Low woodland; mulga ( <i>Acacia aneura</i> )	736.0	19,892,305	19,843,727	99.8	2.1
29	Sparse low woodland; mulga, discontinuous in scattered groups	4,735.0	7,903,991	7,900,200	100.0	0.3
39	Shrublands; mulga scrub	89.8	6,613,569	6,602,580	99.8	7.3
111	Hummock grasslands, shrub steppe; <i>Eucalyptus gamophylla</i> over hard spinifex	162.2	762,964	762,326	99.9	5.5
125	Bare areas; salt lakes	7,420.5	3,485,787	3,146,496	90.3	6.0
134	Mosaic: Hummock grasslands, open low tree steppe; desert bloodwood and feathertop spinifex (on) sandhills / Hummock grasslands, shrub steppe; mixed shrubs over spinifex between sandhills	5,739.8	26,026,865	26,022,995	100.0	3.3
178	Hummock grasslands, grass steppe; hard spinifex <i>Triodia basedowii</i>	230.0	578,161	578,161	100.0	0.3

<sup>1</sup>Percentage in pre-European extent in IUCN class I-IV reserves.



**Figure 3-3**  
**Shepherd et al. (2002)**  
 vegetation types of the  
 study area

Client: Kalium Lakes Ltd  
 Project: Beyondie Potash Project  
 Author: KW  
 Date: 15-Mar-17  
 Coordinate System: GDA 1994 MGA Zone 50  
 Projection: Transverse Mercator  
 Datum: GDA 1994



Study area  
 Vegetation type

- 18: Low woodland; mulga (*Acacia aneura*)
- 29: Sparse low woodland; mulga, discontinuous in scattered groups
- 39: Shrublands ; mulga scrub

- 96: Hummock grasslands, shrub steppe; *Acacia* sp. (+*grevillea*) over *Triodia basedowii* often between sand ridges
- 111: Hummock grasslands, shrub steppe; *Eucalyptus gamophylla* over hard spinifex
- 125: Bare areas; salt lakes

- 134: Mosaic: Hummock grasslands, open low tree steppe; desert bloodwood and feathertop spinifex (on) sandhills
- 178: Hummock grasslands, grass steppe; hard spinifex *Triodia basedowii*
- 228: Shrublands ; *Acacia quadrimarginea* scrub

- 676: Succulent steppe; samphire
- 1195: Mosaic: Low woodland; mulga in valleys/Hummock grasslands, shrub steppe; *acacia* species over *Triodia*





### 3.4 CLIMATE AND WEATHER

The Gascoyne bioregion has an arid climate with winter and summer rainfall in the east. Spatially averaged median (1890–2005) rainfall is 202 mm (DEWHA 2008a). The climate of the Little Sandy Desert bioregion is also arid with summer-dominant rainfall. Spatially averaged median (1890–2005) rainfall is 178 mm (DEWHA 2008b). The climate of south-western Little Sandy Desert has also been described as desert tropical with predominant summer rainfall (van Leeuwen 2002).

The nearest Bureau of Meteorology (BoM) weather station with long-term data averages is Three Rivers (No. 7080, Latitude: 25.13°S Longitude: 119.15°E), approximately 120 km to the south-west of the study area. Three Rivers records the highest maximum mean monthly temperature (39.3°C) in January and the lowest maximum mean annual temperature (22.9°C) in June. The lowest mean minimum temperature is recorded in July (6.2°C) and the highest in January (24.9°C). Average annual rainfall is 238.4 mm with January, February and March recording the highest monthly averages (34.9, 43.5, and 36.1 mm respectively) (Figure 3-4).

The nearest BoM weather station with current daily observations is Newman Airport (No. 7176, Latitude: 24.42°S Longitude: 119.80°E), approximately 150 km north-northwest of the study area. Newman records the highest maximum mean monthly temperature (39.2°C) in January and the lowest maximum mean annual temperature (21.0°C) in July. The lowest mean minimum temperature is recorded in July (4.8°C) and the highest in January (24.1°C). Average annual rainfall is 317.1 mm with January, February and March recording the highest monthly averages (65.3, 73.7, and 39.2 mm respectively) (Figure 3-5).

Pan evaporation for the south-western Little Sandy Desert bioregion ranges from 16.1 mm/day in January to 4.5 mm/day in June at an annual daily average of 10.2 mm (van Leeuwen 2002).

During the field survey minimum temperatures recorded at Newman Airport ranged from 9.3 to 20.4 and maximum temperatures ranged from 14.7 to 32.5. Mean temperatures recorded during the field survey were below averages recorded for previous years (Figure 3-5). A total of 68.6 mm of rainfall was recorded during the field survey from 20 to 23 April, with the highest of 50.2 mm recorded on the 22 April. Above average rainfall was recorded during early March with over 140 mm recorded at Newman Airport which resulted in abundant water present in the lakes within the study area.

A total of 68.6 mm of rainfall was recorded during the first field survey in April (rain fell from 20 to 23 April, with the highest of 50.2 mm recorded on the 22 April). Well above average rainfall was recorded during early March with over 170 mm recorded at Newman Airport which resulted in abundant water present in the lakes within the study area (Figure 3-5). Above average rainfall was recorded in May, two months prior to a second field survey in July. Monthly rainfall in the months prior to and during two subsequent field trips in October and November was consistently below average (Figure 3-5).

Mean maximum and minimum temperatures at Newman Airport were below average in the months leading up to and during the April and July surveys, and above average in the months leading up to and during the November survey (Figure 3-5).

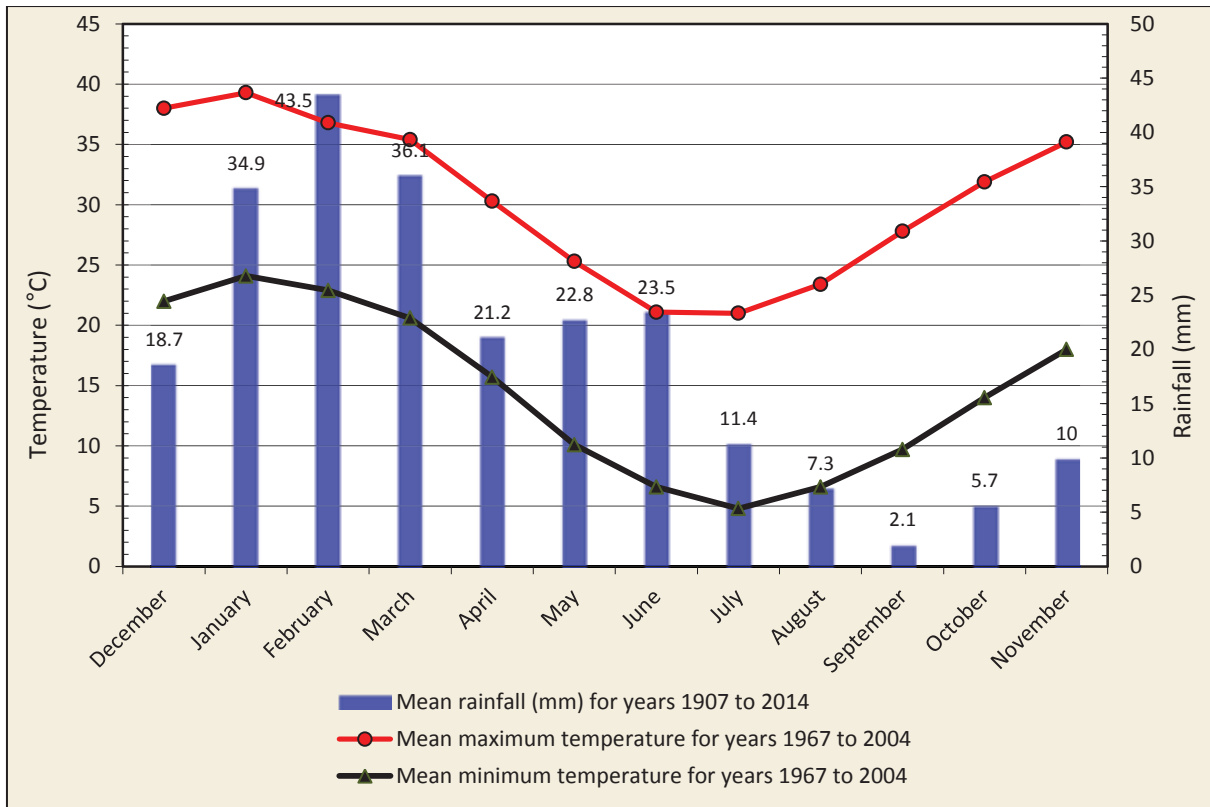


Figure 3-4 Average monthly temperatures and rainfall records for Three Rivers (BoM 2016)

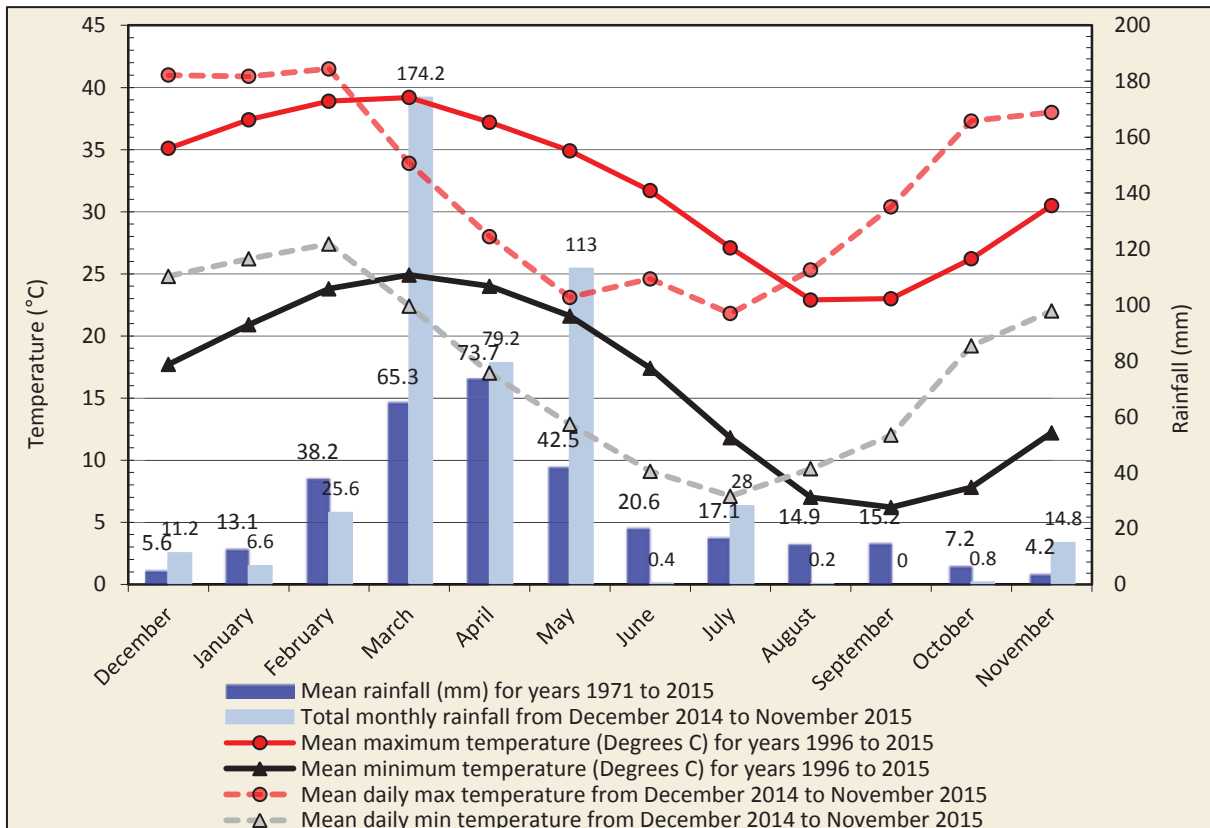


Figure 3-5 Average monthly temperatures and rainfall for Newman Airport (BoM 2016)

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## 3.5 LAND USE

Overall, only 2% of the Little Sandy Desert bioregion is grazed (DEWHA 2008b). In contrast, approximately 80% of the Gascoyne bioregion was grazed between 1992 and 2001 (DEWHA 2008a); however, the study area only partly falls into the western-most part of the latter bioregion and which is therefore much less representative for the Beyondie, Ten Mile and Lake Sunshine.

At a more local scale, little information is available in relation to land use near the study area. It was covered by a biological study of the south-western Little Sandy Desert (van Leeuwen 2002). This area was principally Unallocated Crown Land with one unvested Crown Reserve (No. 1 Vermin Proof Fence). Three pastoral leases abut the south-western Little Sandy Desert, of which the north-eastern part of Marymia intersects the study area (van Leeuwen 2002). Apart from camel harvesting operations and little four-wheel-drive tourism, the area has been described as 'economically inconsequential' (van Leeuwen 2002).

### 3.5.1 Threatening processes

Several threatening processes affect the Gascoyne and Little Sandy Desert bioregions (Cowan & Kendrick 2001; Desmond *et al.* 2001):

- wildfire and alteration of fire regimes
- habitat alteration from grazing pressure
- spread of introduced fauna
- spread of weeds
- habitat destruction through mining and associated developments.

### 3.5.2 Reserves

Collier Range National Park 60 km to the west was established in 1978. The park is little managed with annual wild dog baiting, but otherwise only occasional visits by Karratha staff (Desmond *et al.* 2001). Giles Nature Reserve covering the south-western parts of the Little Sandy Desert was proposed in 2002 (van Leeuwen 2002). This proposed A-class reserve does not cover the study area; however, is likely to provide refugial habitats for local and regional fauna and flora. The Birriliburu Indigenous Protected Area includes the Lake Sunshine study area and the sandstone Carnarvon Ranges (Anonymous 2013).

## 3.6 BIOLOGICAL CONTEXT

A comprehensive biological survey conducted in the south-western Little Sandy Desert by the Department of Conservation and Land Management (now DPaW) between 1995 and 1999 aimed to describe the floral and faunal diversity within the region (van Leeuwen 2002) and provided a benchmark for environmental assessment studies within a small portion of the bioregion.

It was considered that the biology of the Little Sandy Desert was poorly known and with just 5% of the biogeographical region in conservation estate reservation is inadequate and does not provide adequate representation of the biota (van Leeuwen 2002). The flora was largely unknown due to a paucity of survey effort and documentation of surveys in the area.

The flora of the Little Sandy Desert is comparatively diverse with 522 taxa recorded more than a decade ago (van Leeuwen 2002). Many taxa are of biological and conservation significance and are

at the limits of their distributional range or disjunct outliers of northern and southern ranges. Several species collected have not been described previously and represent new species to science. The flora was dominated by central arid zone species but as the area is transitional between major phytogeographical elements in the Australian flora southern and tropical arid zone groups are also present (van Leeuwen 2002).

## 4 METHODS

### 4.1 DESKTOP REVIEW

Database searches and literature reviews of relevant publications were undertaken to compile a list of conservation significant flora species and ecological communities that may occur within the study area based on the proximity of previous records.

The following database searches were undertaken for a quadrat of approximate 100 km length with the diagonal coordinates of -24.31222°S, 119.78444°E (NW point) and -25.23472°S, 120.7808°E (SE point):

- EPBC Act Protected Matters Search Tool (Department of the Environment 2015)
- DPaW/WA Museum NatureMap (DPaW 2015b).
- DPaW Threatened Flora, Fauna and Ecological Communities database searches (DPaW 2015c)
- Department of Agriculture and Food, Western Australia Organism List search for Declared Plants under the *Biosecurity and Agriculture Management Act 2007*
- Department of Environment weeds database.

A literature search was conducted for accessible reports of flora and vegetation surveys conducted within the vicinity of the Project to build on the potential species lists developed from the database searches. Two flora and vegetation surveys have been conducted near the study area or within the desktop review search area and were accessed for the desktop review (Table 4-1). Other than these surveys and the regional biodiversity survey undertaken by DPaW (van Leeuwen 2002), there was a paucity of previous survey effort and information within close proximity to the study area.

**Table 4-1 Flora and vegetation surveys examined as part of the desktop review**

Author	Survey	Project	Client
Van Leeuwen (2002)	Terrestrial flora and fauna survey	Little Sandy Desert Biodiversity Survey	Department of Parks and Wildlife
Enviroworks (EnviroWorks 2010a, b)	Terrestrial flora and fauna survey	Beyondie Magnetite Project	Emergent Resources Ltd

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## 4.2 FIELD SURVEY

The first phase of a two phase Level 2 flora and vegetation field survey for Beyondie and Ten Mile Lakes was undertaken from 13–23 April 2015 and complemented from 22–23 July 2015 in response to changes in the proposed project layout. The first phase of a two phase Level 2 flora and vegetation field survey for Lake Sunshine was undertaken between 02–09 November 2015. Field assessment methodology involved a combination of sampling within vegetation quadrats, and relevés, targeted searches for conservation significant flora species, as well as recording additional flora taxa (including introduced flora) encountered whilst traversing the study area. Samphire (*Tecticornia* spp.) were surveyed in specific transect in the riparian zone of the salt playas and pans. The location of all quadrats, relevés, transects and Threatened or Priority listed flora was recorded using a hand-held Global Positioning System (GPS) or personal data assistant (PDA) device.

The survey methods included a description of the flora species present, dominant vegetation types and their height and vegetation condition. Prior to the commencement of the field survey, all known data (including aerial photography and pre-selected vegetation quadrats) were loaded onto either a PDA unit or GPS device to allow points of interest and vegetation boundaries electronically captured in the field.

The second phase of Level 2 flora and vegetation field survey for Beyondie and Ten Mile Lakes was undertaken from 07 to 14 October 2015 and included additional areas not surveyed previously. Survey methods from April 2015 survey were repeated in the new areas. Further groundtruthing of boundaries of vegetation associations and vegetation condition classified in the first season survey was also conducted. In the targeted searches for conservation significant flora more detailed survey effort was employed in vegetation associations that had records from the first season survey.

### 4.2.1 Quadrat, transect and relevé selection

A total of 131 sites comprising 86 quadrats, 21 relevés and 24 *Tecticornia* transects were sampled across the study area (Table 4-2; Figure 4-1).

Survey effort in the first phase survey in the northern section comprised 45 quadrats, 12 relevés and 14 *Tecticornia* transects. All quadrats were resampled in the second phase survey and an additional 17 quadrats and three relevés were surveyed providing a total of 62 quadrats, 15 relevés and 17 transects for the northern section (Table 4-2; Figure 4-1).

In the southern section survey effort was limited to three transects in the riparian vegetation on the lake boundary which were surveyed in both the first and second phases.

Survey effort at Lake Sunshine comprised 24 quadrats, 6 relevés and 7 *Tecticornia* transects which were surveyed once during the phase two survey.

Quadrats were typically 50 m x 50 m, but were occasionally different dimensions to fit different vegetation habitats (e.g. riparian vegetation, sand dunes) with an overall area of 2,500 m<sup>2</sup> maintained. Relevés were unbounded survey areas (Table 4-2).

Table 4-2 Geographic coordinates (GDA94) and type of survey for each survey site

Site	Latitude	Longitude	Survey type <sup>1</sup>	Survey section	Phase
PTSH001	-24.7481	120.279	Relevé (unbounded)	Northern	First and second season L2
PTSH002	-24.7288	120.2852	Quadrat	Northern	First and second season L2
PTSH004	-24.7212	120.3292	Quadrat	Northern	First and second season L2
PTSH006	-24.7325	120.2363	Quadrat	Northern	First and second season L2
PTSH007	-24.7399	120.2562	Quadrat	Northern	First and second season L2
PTSH009	-24.7517	120.2512	Quadrat	Northern	First and second season L2
PTSH010	-24.7181	120.2798	Relevé (unbounded)	Northern	First and second season L2
PTSH011	-24.7228	120.2981	Quadrat (25 m x 100 m)	Northern	First and second season L2
PTSH012	-24.7287	120.2706	Quadrat	Northern	First and second season L2
PTSH014	-24.7336	120.2249	Quadrat	Northern	First and second season L2
PTSH016	-24.7411	120.298	Quadrat	Northern	First and second season L2
PTSH017	-24.764	120.2819	Quadrat	Northern	First and second season L2
PTSH018	-24.762	120.2875	Quadrat	Northern	First and second season L2
PTSH019	-24.7438	120.3169	Relevé (unbounded)	Northern	First and second season L2
PTSH020	-24.7322	120.3129	Quadrat	Northern	First and second season L2
PTSH021	-24.7222	120.3132	Quadrat (25 m x 100 m)	Northern	First and second season L2
PTSH023	-24.7405	120.2177	Quadrat	Northern	First and second season L2
PTSH024	-24.763	120.2623	Quadrat (42 m x 58 m)	Northern	First and second season L2
PTSH025	-24.763	120.3211	Quadrat	Northern	First and second season L2
PTSH026	-24.755	120.3183	Quadrat	Northern	First and second season L2
PTSH027	-24.7642	120.3054	Quadrat	Northern	First and second season L2
PTSH028	-24.7536	120.3283	Relevé (unbounded)	Northern	First and second season L2
PTSH029	-24.7597	120.3464	Quadrat	Northern	First and second season L2
PTSH030	-24.7517	120.3481	Quadrat	Northern	First and second season L2
PTSH033	-24.7386	120.3578	Relevé (unbounded)	Northern	First and second season L2
PTSH034	-24.7304	120.3681	Quadrat	Northern	First and second season L2
PTSH036	-24.7282	120.3242	Quadrat	Northern	First and second season L2
PTSH038	-24.7314	120.2473	Quadrat	Northern	First and second season L2
PTSH039	-24.7184	120.251	Quadrat	Northern	First and second season L2
PTSH040	-24.7255	120.2613	Relevé (unbounded)	Northern	First and second season L2
PTSH041	-24.7521	120.2218	Quadrat	Northern	First and second season L2
PTSH042	-24.7107	120.2747	Quadrat	Northern	First and second season L2
PTSH045	-24.7711	120.1254	Quadrat	Northern	First and second season L2
PTSH046	-24.7764	120.0848	Quadrat	Northern	First and second season L2
PTSH047	-24.7841	120.0377	Quadrat	Northern	First and second season L2
PTSH048	-24.7319	119.9056	Quadrat	Northern	First and second season L2
PTSH049	-24.741	119.8697	Quadrat	Northern	First and second season L2



Site	Latitude	Longitude	Survey type <sup>1</sup>	Survey section	Phase
PTSH050	-24.7534	119.8403	Quadrat	Northern	First and second season L2
PTSH051	-24.7576	119.794	Quadrat	Northern	First and second season L2
PTSH054	-24.7412	119.7149	Quadrat	Northern	First and second season L2
PTSH055	-24.7351	119.7013	Quadrat	Northern	First and second season L2
PTSH056	-24.7162	119.6495	Quadrat	Northern	First and second season L2
PTSH057	-24.7163	119.6284	Relevé (unbounded)	Northern	First and second season L2
PTSH058	-24.7119	119.6167	Quadrat	Northern	First and second season L2
PTSH059	-24.7733	120.0168	Quadrat	Northern	First and second season L2
PTSH100	-24.7452	120.2189	Quadrat	Northern	First and second season L2
PTSH103	-24.7624	120.2316	Relevé (unbounded)	Northern	First and second season L2
PTSH104	-24.7076	120.2587	Relevé (unbounded)	Northern	First and second season L2
PTSH201	-24.7062	120.2828	Quadrat	Northern	First and second season L2
PTSH202	-24.729	120.2967	Relevé (unbounded)	Northern	First and second season L2
PTSH203	-24.7415	120.2261	Relevé (unbounded)	Northern	First and second season L2
PTSH204	-24.7477	120.3199	Relevé (unbounded)	Northern	First and second season L2
PTSH205	-24.7617	120.2319	Quadrat	Northern	First and second season L2
TPQ001	-24.7491	120.3518	Quadrat	Northern	First and second season L2
TPQ002	-24.7495	120.3568	Quadrat	Northern	First and second season L2
TPQ003	-24.7436	120.3509	Quadrat	Northern	First and second season L2
TPQ004	-24.7489	120.3641	Quadrat	Northern	First and second season L2
TEC001	-24.7431	120.2676	Transect (1 section, 1 Relevé-unbounded)	Northern	First and second season L2
TEC002	-24.7642	120.2694	Transect (2 sections, 2 Relevés-unbounded)	Northern	First and second season L2
TEC003	-24.7531	120.2638	Transect (1 section, 1 Relevé-unbounded)	Northern	First and second season L2
TEC004	-24.7376	120.3046	Transect (2 sections, 2 Relevés-unbounded)	Northern	First and second season L2
TEC005	-24.7598	120.3051	Transect (2 sections, 2 Relevés-unbounded)	Northern	First and second season L2
TEC006	-24.7489	120.3153	Transect (3 sections, 3 Relevés-unbounded)	Northern	First and second season L2
TEC007	-24.7555	120.2801	Transect (3 sections, 3 Relevés-unbounded)	Northern	First and second season L2
TEC008	-24.7461	120.2891	Transect (3 sections, 3 Relevés-unbounded)	Northern	First and second season L2
TEC009	-24.7597	120.2536	Transect (2 sections, 2 Relevés-unbounded)	Northern	First and second season L2
TEC010	-24.7619	120.2463	Transect (1 section, 1 Relevé-unbounded)	Northern	First and second season L2
TEC011	-24.7627	120.2255	Transect (4 sections, 4 Relevés-unbounded)	Northern	First and second season L2
TEC012	-24.7608	120.2122	Transect (1 section, 1 Relevé-unbounded)	Northern	First and second season L2

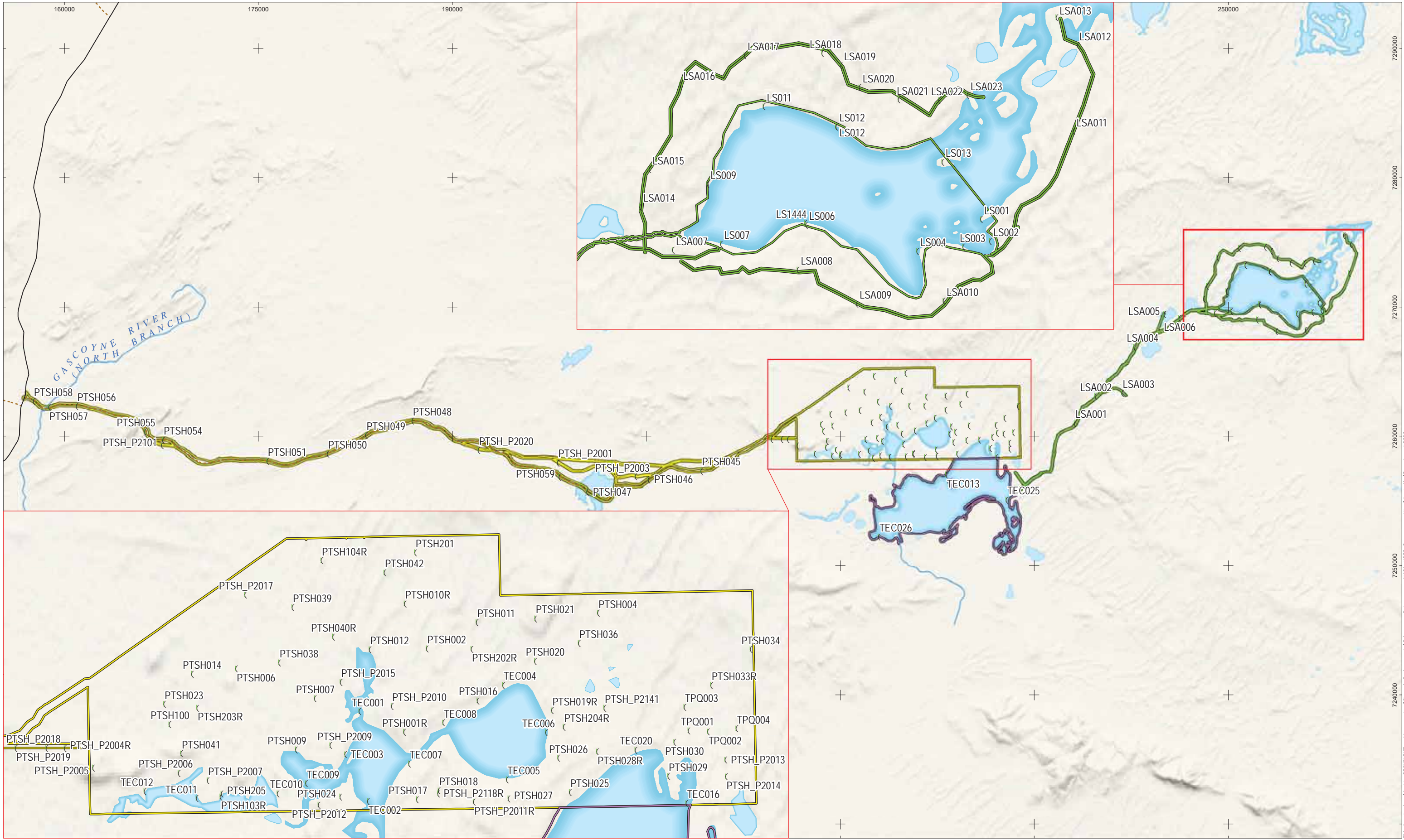
Site	Latitude	Longitude	Survey type <sup>1</sup>	Survey section	Phase
TEC013	-24.7773	120.3125	Transect (2 sections, 2 Relevés-unbounded)	Southern	First and second season L2
TEC016	-24.7661	120.351	Transect (3 sections, 3 Relevés-unbounded)	Northern	First and second season L2
TEC020	-24.7534	120.3382	Transect (3 sections, 3 Relevés-unbounded)	Northern	First and second season L2
TEC025	-24.7957	120.3582	Transect (4 sections, 4 Relevés-unbounded)	Southern	First and second season L2
TEC026	-24.8196	120.2598	Transect (2 sections, 2 Relevés-unbounded)	Southern	First and second season L2
LS001R	-24.6623	120.599	Relevé (unbounded)	Lake Sunshine	First season L2
LS006R	-24.6629	120.5542	Relevé (unbounded)	Lake Sunshine	First season L2
LS007R	-24.667	120.5324	Relevé (unbounded)	Lake Sunshine	First season L2
LS009	-24.6528	120.5291	Quadrat	Lake Sunshine	First season L2
LS012	-24.64	120.5624	Quadrat	Lake Sunshine	First season L2
LS013	-24.6487	120.5894	Quadrat	Lake Sunshine	First season L2
LS1444R	-24.6624	120.554	Relevé (unbounded)	Lake Sunshine	First season L2
LSA001	-24.7432	120.4114	Quadrat	Lake Sunshine Access Track	First season L2
LSA002R	-24.7245	120.4275	Relevé (unbounded)	Lake Sunshine Access Track	First season L2
LSA003	-24.7227	120.448	Quadrat	Lake Sunshine Access Track	First season L2
LSA004	-24.6907	120.4579	Quadrat	Lake Sunshine Access Track	First season L2
LSA005	-24.6681	120.4814	Quadrat	Lake Sunshine Access Track	First season L2
LSA006	-24.6712	120.4926	Quadrat	Lake Sunshine Access Track	First season L2
LSA007	-24.6682	120.52	Quadrat	Lake Sunshine Access Track	First season L2
LSA008	-24.6733	120.5518	Quadrat	Lake Sunshine Access Track	First season L2
LSA009	-24.6815	120.5667	Quadrat	Lake Sunshine Access Track	First season L2
LSA010	-24.6812	120.5891	Quadrat	Lake Sunshine Access Track	First season L2
LSA011	-24.6421	120.623	Quadrat	Lake Sunshine Access Track	First season L2
LSA012	-24.622	120.6245	Quadrat	Lake Sunshine Access Track	First season L2
LSA013	-24.6153	120.6192	Quadrat	Lake Sunshine Access Track	First season L2
LSA014	-24.658	120.5118	Quadrat	Lake Sunshine Access Track	First season L2
LSA015	-24.6492	120.5143	Quadrat	Lake Sunshine Access Track	First season L2
LSA016	-24.6295	120.5226	Quadrat	Lake Sunshine Access Track	First season L2

Site	Latitude	Longitude	Survey type <sup>1</sup>	Survey section	Phase
LSA017	-24.6229	120.5392	Quadrat	Lake Sunshine Access Track	First season L2
LSA018R	-24.6227	120.5591	Relevé (unbounded)	Lake Sunshine Access Track	First season L2
LSA019	-24.6256	120.5638	Quadrat	Lake Sunshine Access Track	First season L2
LSA020	-24.6309	120.5685	Quadrat	Lake Sunshine Access Track	First season L2
LSA021	-24.6339	120.5784	Quadrat	Lake Sunshine Access Track	First season L2
LSA022	-24.6343	120.5888	Quadrat	Lake Sunshine Access Track	First season L2
LSA023	-24.6331	120.5961	Quadrat	Lake Sunshine Access Track	First season L2
LS002R	-24.6674	120.6012	<i>Tecticornia</i> Transect (2 sections of 2 Relevés-unbounded)	Lake Sunshine	First season L2
LS003R	-24.6686	120.5944	<i>Tecticornia</i> Relevé (unbounded)	Lake Sunshine	First season L2
LS004R	-24.6695	120.5825	<i>Tecticornia</i> Relevé (unbounded)	Lake Sunshine	First season L2
LS005R	-24.6696	120.5711	<i>Tecticornia</i> Transect (3 sections of 3 Relevés-unbounded)	Lake Sunshine	First season L2
LS008	-24.6643	120.523	<i>Tecticornia</i> Quadrat	Lake Sunshine	First season L2
LS010R	-24.64	120.5362	<i>Tecticornia</i> Transect (2 sections of 2 Relevés-unbounded)	Lake Sunshine	First season L2
LS011R	-24.635	120.5438	<i>Tecticornia</i> Relevé (unbounded)	Lake Sunshine	First season L2
PTSH_P2141	-24.7434	120.3304	Quadrat	Northern	Second season L2
PTSH_P2001	-24.7633	120.0158	Quadrat	Northern	Second season L2
PTSH_P2003	-24.7743	120.0749	Quadrat	Northern	Second season L2
PTSH_P2004 R	-24.7503	120.1919	Relevé (unbounded)	Northern	Second season L2
PTSH_P2005	-24.755	120.1991	Quadrat	Northern	Second season L2
PTSH_P2006	-24.7567	120.221	Quadrat	Northern	Second season L2
PTSH_P2007	-24.7586	120.2284	Quadrat	Northern	Second season L2
PTSH_P2009	-24.7509	120.2601	Quadrat	Northern	Second season L2
PTSH_P2010	-24.742	120.2759	Quadrat	Northern	Second season L2
PTSH_P2011 R	-24.7648	120.2965	Relevé (unbounded)	Northern	Second season L2
PTSH_P2012	-24.7648	120.2567	Quadrat	Northern	Second season L2
PTSH_P2013	-24.7561	120.3611	Quadrat	Northern	Second season L2
PTSH_P2014	-24.7601	120.3612	Quadrat	Northern	Second season L2
PTSH_P2015	-24.7362	120.263	Quadrat	Northern	Second season L2
PTSH_P2017	-24.7153	120.239	Quadrat	Northern	Second season L2

Site	Latitude	Longitude	Survey type <sup>1</sup>	Survey section	Phase
PTSH_P2018	-24.7502	120.1872	Quadrat	Northern	Second season L2
PTSH_P2019	-24.7501	120.1794	Quadrat	Northern	Second season L2
PTSH_P2020	-24.7533	119.9555	Quadrat	Northern	Second season L2
PTSH_P2101	-24.7449	119.7139	Quadrat	Northern	Second season L2
PTSH_P2118 R	-24.7627	120.2874	Relevé (unbounded)	Northern	Second season L2

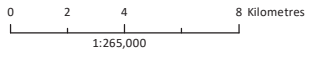
<sup>1</sup>Quadrats are 50 m x 50 m unless otherwise stated.





**Figure 4-1**  
**Location of survey quadrats**  
**and relevés in the study area**

Client: Kalium Lakes Ltd  
 Project: Beyondie Potash Project  
 Author: KW  
 Date: 15-Mar-17  
 Coordinate System: GDA 1994 MGA Zone 51  
 Projection: Transverse Mercator  
 Datum: GDA 1994



- Lake Sunshine
- Northern Section
- Southern Section
- ⌋ Flora sites
- Lakes
- Major creeks and rivers
- Principal road
- Secondary road
- - - Minor road



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*Tecticornia* shrubland communities that inhabit the lake playas and beaches were defined from 24 transects. Transects were of varying length, with each transect either commencing at the water's edge (Beyondie Lakes) or where vegetation started from within the dry lake (Ten Mile Lake, Lake Sunshine) and terminated where the communities ceased in the riparian zone. Transects were divided into sections where changes in vegetation types were observed (Table 4-2). Cover and density data for all species present was collected in sequential 1 m x 1 m quadrats in each section. The number of sections at each transect varied depending on the number of different vegetation types present (Table 4-2).

Survey locations were selected to ensure that an adequate representation of the major vegetation types and flora present within the northern section of the study area was sampled. This was achieved by pre-selecting locations of sampling quadrats based on apparent changes in the vegetation visible in aerial images for ground-truthing on foot, selecting additional quadrats in different vegetation types and targeting different landforms during field surveys. Relevés were selected during the field survey where the vegetation type present was matched to a previous quadrat location to facilitate mapping of vegetation type boundaries.

The following information was recorded for each quadrat and relevé:

- location – the coordinates of the quadrat were recorded in GDA 94 projection utilising a hand-held Garmin GPS
- description of vegetation – in accordance to the latest technical guide for flora and vegetation surveys (EPA & DPaW 2015) a description at Level V – Association utilising the structural formation and height classes based on NVIS (2003) (Appendix 2)
- habitat – a brief description of landform and habitat
- soil – a broad description of surface soil type and rocks
- disturbance history – a brief description of any observed disturbance including an estimate of time since last fire, weed invasions, soil disturbance and animal grazing
- vegetation condition – the condition of the vegetation was recorded utilising the condition scale of Trudgen (Trudgen 1991) (Table 4-3)
- height and foliage cover – a visual estimate of the canopy cover of each species present was recorded as was the total vegetation cover, cover of shrubs and trees >2m tall, cover of shrubs <2m, total grass cover and total herb cover
- photograph – a colour photograph of the vegetation within each quadrat
- species list – the name of every species present in the quadrat; where species were located that were unknown to the botanist conducting the survey, a specimen was collected and pressed for later identification.

Table 4-3 Vegetation condition rating scale (Trudgen 1991)

Code	Rating	Description
E	Excellent	Pristine or nearly so; no obvious signs of damage caused by activities of European man.
VG	Very Good	Some relatively slight signs of damage caused by activities of European man. For example, some signs of damage to tree trunks caused by repeated fire, the presence of some relatively nonaggressive weeds.
G	Good	More obvious signs of damage caused by activities of European man, including some obvious signs of impact on the vegetation structure such as that caused by low levels of grazing or by selective logging. Weeds as above, possibly some more aggressive species.
P	Poor	Still retains basic vegetation structure or ability to regenerate to it after very obvious activities of European man, such as grazing, partial clearing (chaining) or frequent fires. Weeds as above, probably plus some aggressive species.
VP	Very Poor	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 including very aggressive species.

#### 4.2.2 Targeted flora searches

Searches for conservation significant flora and declared plants were undertaken simultaneously with the flora and vegetation survey to determine whether any of the conservation significant species or declared plants identified from the desktop review occur in the study area.

Prior to the survey field, guides for conservation significant flora and declared plants that may occur in each the study area were compiled from photos available on FloraBase and photographs of specimens at the WA Herbarium.

For each population of conservation significant flora encountered, the following information was documented:

- location (as points for individual plants or as polygons for populations)
- description of the floristic community in which the species was located and population size estimate
- voucher collection for lodgement at the WA Herbarium.

For each population of declared plant recorded, the following information was documented:

- location (as points for individual plants or as polygons for populations)
- population size estimate.



### 4.3 VEGETATION MAPPING

The vegetation descriptions from quadrats and relevés from the current survey were grouped according to similarity of floristic composition (i.e. canopy levels), species composition and the prevalent community structure (i.e. woodland, shrubland, etc.).

To support delineation of vegetation types, a cluster analysis was conducted based on species presence/absence in each quadrat. The fusion strategy for the site classification was flexible UPGMA with a beta value of -0.1 and Bray Curtis association measure in the software package PATN (Belbin 2003). In accordance with the technical guide (EPA & DPaW 2015) floristically similar vegetation were classified into 'super groups' for a broad scale classification and 'floristic groups' at a finer scale from the clusters of quadrats on a dendrogram that confirmed field observations. The floristic groups were then defined at the local scale as vegetation types.

The vegetation boundaries were mapped utilising ArcGIS imagery (year of capture: 2015 and 2016) and from vegetation boundaries recorded on GPS during the field survey.

### 4.4 TAXONOMY AND NOMENCLATURE

Species that were well known to the survey botanists were identified in the field, while species that were unknown were collected and assigned a unique number to facilitate tracking. All plant species collected during the field program were dried and frozen in accordance with the requirements of the WA Herbarium. Plant species were identified using local and regional flora keys and comparisons with named species held at the WA Herbarium. Plant taxonomists who are considered to be an authority on a particular plant group were consulted, when necessary (see section 4.5).

The conservation status of all recorded flora was compared against the current entries on FloraBase (DPaW 2015a) and the EPBC Act Protected Matters database (Department of the Environment 2015). Nomenclature for flora and vegetation follows FloraBase (DPaW 2015a) and the WA Herbarium.

### 4.5 PROJECT PERSONNEL

The personnel involved in the survey are presented in Table 4-4.

Table 4-4 Project team

Name	Qualifications	Role/s
Dr Grant Wells <sup>1</sup>	Ph.D. (Botany)	Project manager, field survey, taxonomy, reporting
Dr Grace Wells <sup>1</sup>	Ph.D. (Botany)	Field survey, reporting, GIS
Ms Emily Ager <sup>1</sup>	BSc Zoology	Field survey
Ms Sophie Fox <sup>1</sup>	BSc Zoology	Field survey
Ms Anna Leung <sup>1</sup>	BSc. (Env. Sci.) (Hons)	GIS
Kathryn Wyatt	B. IT, Grad. Cert. GIS	GIS & data analyses
Dr Kelly Shepherd <sup>3</sup>	Ph. D. (Botany)	Taxonomy ( <i>Tecticornia</i> )
Dr Volker Framenau <sup>1,2</sup>	M.Sc. (Cons. Biol.), Ph.D. (Zool.)	Report review

<sup>1</sup>Phoenix Environmental Sciences; <sup>2</sup>Research Associate WA Museum; <sup>3</sup>DPaW.

## 5 RESULTS

### 5.1 DESKTOP REVIEW

#### 5.1.1 Flora

The combined literature reviews and database searches identified 643 species that may occur in the study area, including 639 native species and four introduced species (Appendix 3).

##### 5.1.1.1 Conservation significant flora

A total of 38 conservation significant flora species were identified in the desktop review as potentially occurring in the study area, including one Threatened species (*Thryptomene wittweri*; EPBC – VU, WA Act VU) (Table 5-1).

None of these species were recorded in the Northern or Southern sections of the study area, with closest records of Priority Flora located at least 8 km from any part these study areas (Figure 5-1). One species of Threatened flora, *Thryptomene wittweri* (VU) was recorded approximately 25 km south-east of Ten Mile lakes (Southern section).

Two Priority species, *Tecticornia* sp. Sunshine Lake, P1 (K.A. Shepherd et al. KS 867) and *Stackhousia clementii* (P3) were recorded within Lake Sunshine section of the study area, with other closest records of Priority Flora located approximately 1.5 km from this section.

Table 5-1 Conservation significant flora species identified through the desktop review

Family and species	Conservation status <sup>1</sup>		
	EPBC Act	WC Act	DPaW list
<b>Aizoaceae</b>			
<i>Gunnipopsis</i> sp. Lake Kerrylyn (N. Gibson et al. NG 7028)			P1
<b>Amaranthaceae</b>			
<i>Ptilotus chrysocomus</i>			P1
<i>Ptilotus daphne</i>			P1
<i>Ptilotus tetrandrus</i>			P1
<b>Asparagaceae</b>			
<i>Thysanotus</i> sp. Desert East of Newman (R.P. Hart 964)			P2
<b>Asteraceae</b>			
<i>Minuria</i> sp. Little Sandy Desert 1 (SVL 4919)			P1
<b>Celastraceae</b>			
<i>Stackhousia clementii</i>			P3
<b>Chenopodiaceae</b>			
<i>Tecticornia</i> sp. Christmas Creek (K.A. Shepherd & T. Colmer et al. KS 1063)			P1
<i>Maireana prosthecochoeta</i>			P3
<i>Tecticornia bibenda</i>			P1

Family and species	Conservation status <sup>1</sup>		
	EPBC Act	WC Act	DPaW list
<i>Tecticornia</i> sp. Sunshine Lake (K.A. Shepherd et al. KS 867)			P1
<b>Cyperaceae</b>			
<i>Fimbristylis sieberiana</i>			P3
<b>Elaeocarpaceae</b>			
<i>Tetralochea chapmanii</i>			P1
<b>Euphorbiaceae</b>			
<i>Euphorbia sarcostemmoides</i>			P1
<i>Euphorbia stevenii</i>			P3
<b>Fabaceae</b>			
<i>Daviesia arthropoda</i>			P3
<b>Frankeniaceae</b>			
<i>Frankenia glomerata</i>			P4
<b>Goodeniaceae</b>			
<i>Dampiera atriplicina</i>			P3
<i>Goodenia modesta</i>			P3
<b>Haloragaceae</b>			
<i>Gonocarpus pycnostachyus</i>			P3
<b>Lamiaceae</b>			
<i>Hemigenia tysonii</i>			P3
<b>Malvaceae</b>			
<i>Hibiscus</i> sp. Carnarvon (S. van Leeuwen 5110)			P1
<b>Meliaceae</b>			
<i>Owenia acidula</i>			P3
<b>Myrtaceae</b>			
<i>Thryptomene wittweri</i>	VU	S3	
<i>Eucalyptus semota</i>			P1
<i>Micromyrtus mucronulata</i>			P1
<i>Calytrix praecipua</i>			P3
<b>Poaceae</b>			
<i>Aristida jerichoensis</i> var. <i>subspinulifera</i>			P3
<b>Polygalaceae</b>			
<i>Comesperma pallidum</i>			P3
<i>Comesperma viscidulum</i>			P4
<b>Scrophulariaceae</b>			
<i>Eremophila anomala</i>			P1

Family and species	Conservation status <sup>1</sup>		
	EPBC Act	WC Act	DPaW list
<i>Eremophila appressa</i>			P1
<i>Eremophila</i> sp. Katjarra South (N. Gibson et al. NG 7149)			P1
<i>Eremophila</i> sp. Mt Methwin (B. Backhouse et al. BEMJ 74)			P1
<i>Eremophila arachnoides</i> subsp. <i>arachnoides</i>			P3
<i>Eremophila fasciata</i>			P3
<i>Eremophila lanata</i>			P3
<i>Eremophila rigida</i>			P3

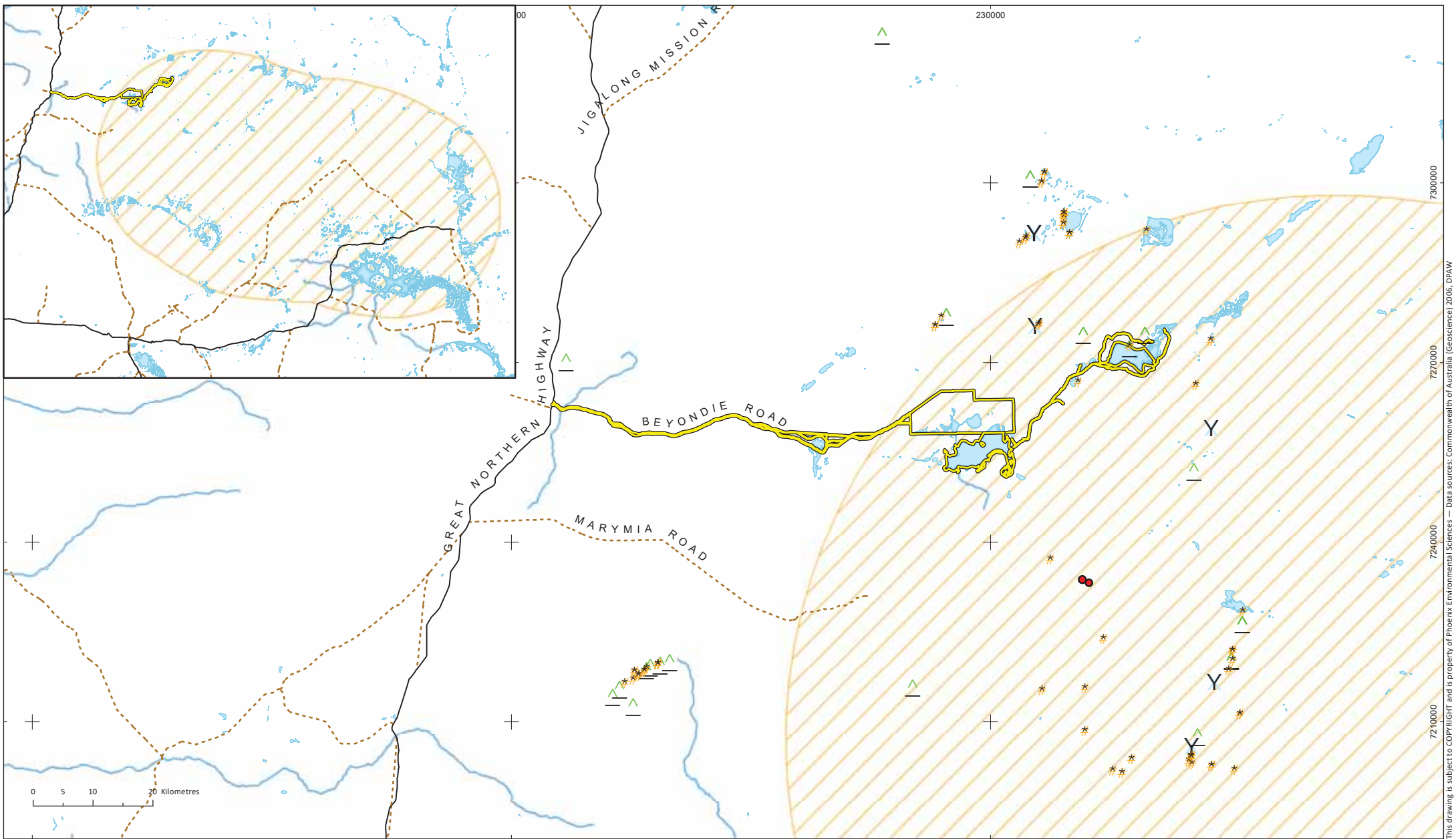
<sup>1</sup> VU – Vulnerable; S3 – Schedule 3; P1 – Priority 1; P3 – Priority 3; P4 – Priority 4.

### 5.1.1.2 Introduced flora

A total of four introduced flora species are likely to be present in the desktop review area (Table 5-2). None of these are declared pests and/or a WoNS.

**Table 5-2 Introduced flora species identified through the desktop review**

Genus and species	Reference
* <i>Aerva javanica</i>	Van Leeuwen (2002)
* <i>Bidens bipinnata</i>	Van Leeuwen (2002)
* <i>Malvastrum americanum</i>	EnviroWorks (2010b)
* <i>Setaria verticillata</i>	Van Leeuwen (2002)



**Figure 5-1**  
**Location of conservation significant flora and vegetation from the desktop review**

Client: Kalium Lakes Ltd  
 Project: Beyondie Potash Project

Author: KW  
 Date: 21-Mar-17

Coordinate System: GDA 1994 MGA Zone 51  
 Projection: Transverse Mercator  
 Datum: GDA 1994

- |                         |  |
|-------------------------|--|
| Study area              | <b>Priority flora</b>                    |
| Principal road          | Threatened                               |
| Secondary road          | Priority 1                               |
| Minor road              | Priority 3                               |
| Major creeks and rivers | Priority 4                               |
| Lakes                   | Lee Steere Range BIF (PEC, 90 km buffer) |



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## 5.1.2 Vegetation

A single State listed PEC (Priority 1) was identified in the desktop review, Lee Steere Range vegetation complexes (banded ironstone formation). The 90 km buffer zone of this PEC passes through the study area (Figure 5-1); however, no banded ironstone formations occur within the study area.

No TECs or ESAs were located within close proximity to the study area.

Van Leeuwen (van Leeuwen 2002) defined seven broad species assemblages, but did not define distinct vegetation groups for a survey in the southwestern Little Sandy Desert. No discussion regarding the conservation significance of the species assemblages in terms of regional or local significance was provided.

In two different studies, EnviroWorks (2010a, b) defined nine and seven vegetation types respectively in proximity to the study area (Table 5-3; Table 5-4); however, EnviroWorks (2010a, b) did not discuss the conservation significance of these vegetation groups/communities.

Table 5-3 Vegetation communities recorded near the study area by EnviroWorks (2010a)

Vegetation communities	Characterisation
Open <i>Acacia</i> — <i>Corymbia</i> shrubland—low woodland, <i>Triodia</i> grassland	Grasslands of <i>Triodia basedowii</i> and <i>Triodia schinzii</i> with very occasional trees (e.g. <i>Corymbia terminalis</i> ), open shrubland (e.g. <i>Hakea lorea</i> , <i>Corymbia deserticola</i> <i>Codonocarpus cotinifolius</i> ) and low shrubs ( <i>Alyogyne pinoniana</i> , <i>Kennedia prorepens</i> , <i>Keraudrenia velutina</i> , <i>Leptosema chambersii</i> )
Open <i>Acacia</i> — <i>Corymbia</i> Shrubland—low woodland, <i>Triodia</i> grassland	Sparse low scrub (to 4m) of <i>Acacia rhodophloia</i> , <i>Acacia pyrifolia</i> var. <i>pyrifolia</i> , <i>Hakea lorea</i> and <i>Psyrax latifolia</i> over a sparse low mixed species shrub layer (to 1.5m) over <i>Triodia</i> spp.
Open <i>Acacia</i> Shrubland—low woodland, <i>Triodia</i> grassland	Low scrub (to 4 m) of <i>Acacia ayersiana</i> <i>Hakea lorea</i> and <i>Psyrax latifolia</i> over a sparse low mixed shrub species layer (to 1.5 m) over <i>Triodia</i> spp.
Open <i>Acacia aneura</i> — <i>A. pruinocarpa</i> shrubland—low woodland	Open low scrub (to 4 m) of <i>Acacia aneura</i> var. <i>aneura</i> , <i>Acacia pruinocarpa</i> , <i>Acacia aneura</i> var. <i>argentea</i> and <i>Psyrax latifolia</i> over an open low mixed species shrub layer (to 1.5 m) over sparse <i>Triodia</i> spp.
Open <i>Acacia aneura</i> shrubland—low woodland	Open mixed species shrubland and low <i>Acacia aneura</i> var. <i>aneura</i> woodland over sparse low shrubs and sparse grasses
Open <i>Acacia aneura</i> , <i>A. craspedocarpa</i> , <i>Eremophila</i> spp. shrubland—low woodland	Low, open woodland of <i>Acacia aneura</i> over mixed shrubs to 1.5 m which include <i>Acacia craspedocarpa</i> , <i>Acacia tetragonophylla</i> and <i>Eremophila galeata</i>
Open <i>Acacia aneura</i> , <i>Grevillea stenobotrya</i> , <i>Eremophila</i> spp. shrubland—low woodland	Very open low woodland/shrubland of <i>Acacia aneura</i> , <i>Grevillea stenobotrya</i> , <i>Eremophila galeata</i> over mostly bare gravelly loam with occasional low shrubs (e.g. <i>Acacia tetragonophylla</i> , <i>Lawrencina squamata</i> , <i>Grevillea deflexa</i> , <i>Ptilotus rotundifolius</i> ) and grasses ( <i>Aristida contorta</i> , <i>Enneapogon avenaceus</i> )



Table 5-4 Vegetation types recorded near the study area by EnviroWorks (2010b)

Vegetation type	Characterisation
<i>Triodia</i> grassland	Grassland of <i>Triodia basedowii</i> and <i>Triodia schinzii</i> with very occasional trees (e.g. <i>Corymbia terminalis</i> ), shrubs (e.g. <i>Acacia rhodophloia</i> , <i>Alyogyne pinoniana</i> , <i>Codonocarpus cotinifolius</i> ) and forbs (e.g. <i>Podolepis kendallii</i> , <i>Waitzia acuminata</i> )
Sparse shrubs over <i>Triodia</i>	Sparse low scrub (to 4 m) of <i>Acacia aneura</i> , <i>Acacia pyrifolia</i> var. <i>pyrifolia</i> , <i>Acacia rhodophloia</i> , <i>Hakea lorea</i> and <i>Psydrax latifolia</i> over a sparse low mixed species shrub layer (to 1.5 m) over <i>Triodia</i> spp.
Shrubs over <i>Triodia</i>	Low scrub (to 4 m) of <i>Acacia aneura</i> , <i>Acacia pyrifolia</i> var. <i>pyrifolia</i> , <i>Acacia rhodophloia</i> , <i>Acacia tetragonophylla</i> , <i>Hakea lorea</i> and <i>Psydrax latifolia</i> over a sparse low mixed shrub species layer (to 1.5 m) over <i>Triodia</i> spp.
Shrubs over sparse grasses	Open low scrub (to 4 m) of <i>Acacia pyrifolia</i> var. <i>pyrifolia</i> , <i>Acacia rhodophloia</i> , <i>Acacia tetragonophylla</i> , <i>Eremophila fraseri</i> subsp. <i>galeata</i> and <i>Psydrax latifolia</i> over an open low mixed species shrub layer (to 1.5 m) over sparse <i>Triodia</i> spp.
Tall eucalypts	Large (to 15 m tall) trees of (for example) <i>Eucalyptus victrix</i> , <i>Corymbia terminalis</i> over an understorey which includes components of adjacent communities
Drainage lines	Drainage lines within the shrub/grassland mosaic may exhibit a distinctive shrub flora comprised of (for example) <i>Eucalyptus lucasii</i> and <i>Eucalyptus pachyphylla</i> ; within the narrow channels small ephemeral species occur amongst the rocks, though the understorey is similar to that in the surrounding community types
Breakaways	Distinctive flora generally dominated by small to medium-sized shrubs (to 2 m); shrub species found in the breakaways include <i>Calytrix carinata</i> , <i>Dodonaea microzyga</i> var. <i>acrolobata</i> and <i>Micromyrtus flaviflora</i>
Floodplains	Community consists of shrubs, many of which occur elsewhere (e.g. <i>Acacia tetragonophylla</i> ), over sparse low grasses (e.g. <i>Aristida contorta</i> , <i>Enneapogon</i> spp.) or bare ground
Riparian woodland	Large trees of <i>Eucalyptus camaldulensis</i> var. <i>obtusa</i> and tall shrubs (e.g. <i>Acacia aneura</i> ) over a degraded shrub understorey (e.g. <i>Sarcostemma australe</i> , <i>Stemodia linophylla</i> )

## 5.2 FIELD SURVEY

### 5.2.1 Flora

A total of 487 flora species and subspecies (478 native and nine introduced) representing 57 families and 181 genera were recorded during the field survey (Appendix 4). These included 354 perennial species and 133 annual/short-lived species.

The most prominent families recorded in the study area included the Chenopodiaceae, Fabaceae, Poaceae, Malvaceae, Scrophulariaceae, Goodeniaceae, Amaranthaceae, Asteraceae, Myrtaceae and Lamiaceae (Table 5-5).

Table 5-5 Dominant floristic families recorded during the field survey in the study area

Family	No of recorded species
Fabaceae	73
Chenopodiaceae	71
Poaceae	60
Malvaceae	36
Asteraceae	29
Goodeniaceae	21
Amaranthaceae	21
Scrophulariaceae	16
Myrtaceae	16
Lamiaceae	12

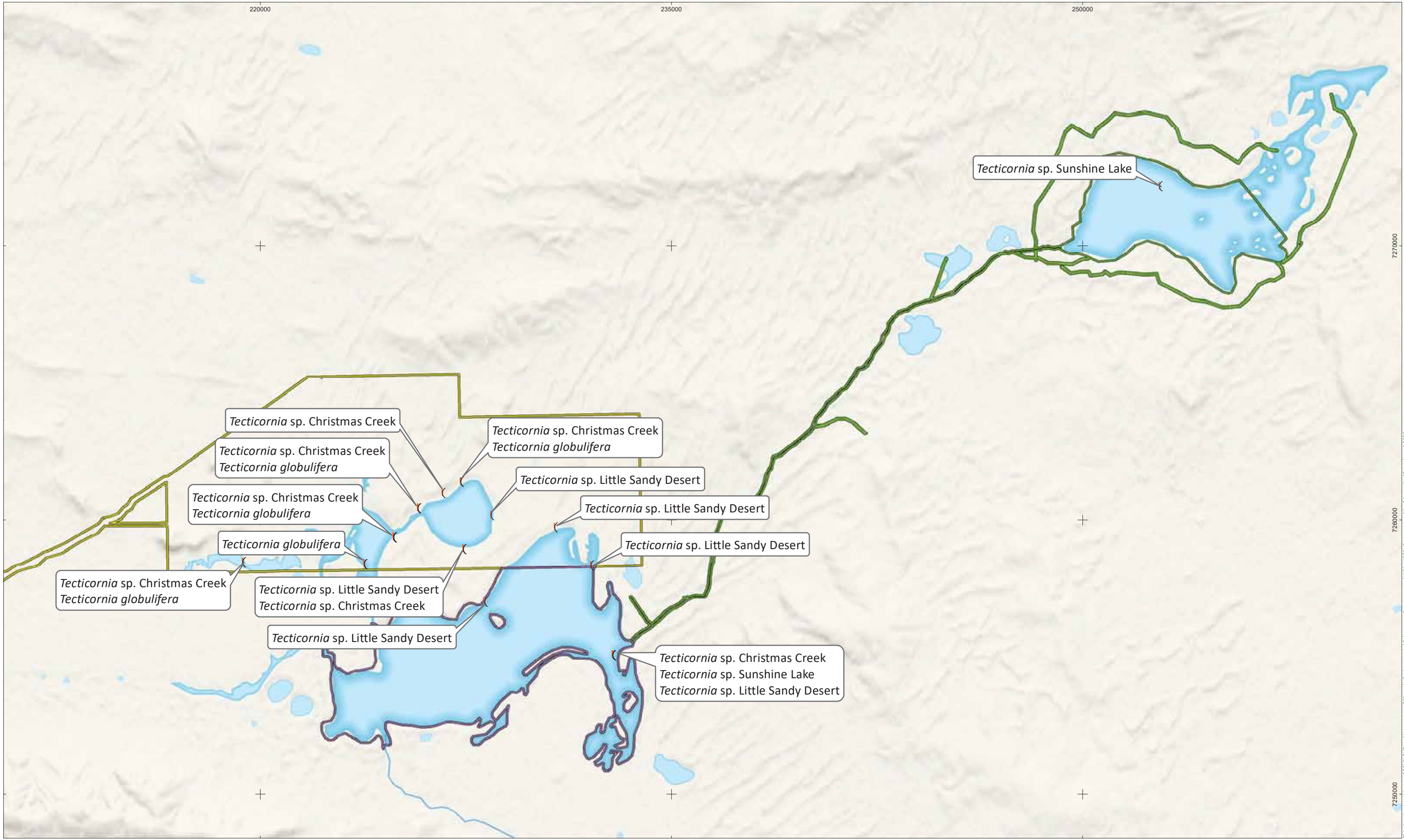
### 5.2.1.1 Conservation significant species recorded in the study area

No Federal or State listed threatened flora were recorded in the survey.

Four Priority 1 flora species, all *Tecticornia* spp., were recorded in the study area (Table 5-6; Figure 5-2). *Tecticornia* sp. Christmas Creek was recorded at one location on the sand dune adjacent Lake Beyondie. All remaining records for this species and the three other Priority Flora were located on the lakes (Beyondie, Ten Mile and Sunshine) playa. Further details on records for each species are provided below.

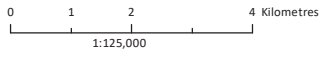
Table 5-6 Conservation significant flora species recorded during the field survey

Genus and species	Conservation status
<i>Tecticornia globulifera</i>	P1
<i>Tecticornia</i> sp. Christmas Creek (K.A. Shepherd & T. Colmer <i>et. al.</i> KS 1063)	P1
<i>Tecticornia</i> sp. Little Sandy Desert (K.A. Shepherd & C. Wilkins KS 830)	P1
<i>Tecticornia</i> sp. Sunshine Lake (K.A. Shepherd <i>et al.</i> KS 867)	P1



**Figure 5-2**  
**Location of conservation significant flora recorded during the field survey**

Client: Kalium Lakes Ltd  
 Project: Beyondie Potash Project  
 Author: KW  
 Date: 15-Mar-17  
 Coordinate System: GDA 1994 MGA Zone 51  
 Projection: Transverse Mercator  
 Datum: GDA 1994



- ( Priority flora (P1)
- Lake Sunshine
- Northern Section
- Southern Section
- Lakes



7250000 7260000 7270000  
 This drawing is subject to COPYRIGHT and is property of Phoenix Environmental Sciences - Data sources: NASA, USGS, Commonwealth of Australia (Geoscience) 2006

#### 5.2.1.1.1 *Tecticornia globulifera*

Status: Priority 1 (DPaW)

Distribution and ecology: Previously recorded in the Augustus subregion of the Gascoyne bioregion and the Fortescue subregion of the Pilbara bioregion (DPaW 2015a). The species is known from 12 records (ALA 2015), with habitat descriptions including:

- flat floodway, approximately 900 m from man-made channel; red clayey sand; samphire flats with low *Acacia* shrubs, *Typha* spp. around the edge of the channel
- variable-drained, red, saline clay loam; extensive salt flat
- northern edge of large salt lake
- undulating saline flat on northern edge of large salt lake
- approximately 1.5 km from the shoreline; flat floodplain; red clayey sand
- on the lake bed a few 100 m from the shoreline; red clayey sand.

Records and distribution in the study area: The specimens were collected from five locations at Beyondie Lakes (Figure 5-2), representing almost half of the sites surveyed and as such it is highly likely that further populations of the species are present within the study area. The species was recorded on salt lake playa and on the salt lake beach in red-orange clay, brown sandy loam and red-orange sand in *Tecticornia* spp. dominated shrubland.

The species was not identified in the field and therefore the size and distribution of the populations was not recorded. Cover values recorded for the species ranged from 0.3–13% with cover values exceeding 5% recorded at two locations indicating potentially large populations of the species. It is highly likely that further populations are present in the study area.

#### 5.2.1.1.2 *Tecticornia* sp. Christmas Creek

Status: Priority 1 (DPaW)

Distribution and ecology: Previously recorded in the Trainor subregion of the Little Sandy Desert bioregion and the Fortescue subregion of the Pilbara bioregion (DPaW 2015a). The species is known from 19 records (ALA 2015)) with habitat descriptions including:

- open depression; moist brown/grey clay; seasonally inundated
- hill; dry brown loam; well drained
- flat floodway near river; red clayey sand; exposed shale
- salt flats near lake shoreline; red brown sandy clay
- brown rocky sand on a plain within 100 m of the edge of 14 mile pool
- samphire covered claypan, low in landscape, swale, clay playa comprising moist gypsiferous light brown grey soil
- saline flat, northern apron to Fortescue Marsh, flat terrain very gentle southern slope, saline stony clay soil
- red sandy-clay
- 1 km from the shoreline; flat floodplain; red clayey sand.

Records and distribution in the study area: *Tecticornia* sp. Christmas Creek was recorded at six locations in the study area, five locations at Beyondie Lakes and one location on Ten Mile Lake (Figure 5-2). The species was recorded in red-brown sandy clay to red-brown sandy loam on salt lake playa and in the riparian zone in *Tecticornia* spp. dominated shrubland.

The species was not identified in the field and therefore the size and distribution of the populations were not recorded. Cover values recorded for the species ranged from 0.1–12% with cover values exceeding 5% recorded at two locations, one sites at Beyondie Lakes and one location at Ten Mile Lake indicating potentially large populations of the species. It is highly likely that further populations are present in the study area.

#### 5.2.1.1.3 *Tecticornia* sp. Little Sandy Desert

Status: Priority 1 (DPaW)

Distribution and ecology: Previously recorded at just three locations from Western Australia only in the Trainor subregion of the Little Sandy Desert bioregion (DPaW 2015a) on the NW edge of Yanneri Lake and at Willie soak (ALA 2015). The recorded habitats comprised:

- on edge of bare salt flats, red sandy clay over sandstone, salt crystals on exposed soil surface
- shoreline of samphire flats, red-brown sandy clay
- claypan, low in landscape, swale, clay playa comprising moist gypsiferous light brown-grey soil.

Records and distribution in the study area: The specimens were collected from six locations on the beach and fringes of the lake playa on lakes Beyondie and Ten Mile. The species was recorded in *Tecticornia* spp. dominated shrublands in red-orange/red-brown/whitish sandy loam to sandy clay soils.

The species was not identified in the field and as such the size and distribution of the populations were not recorded. Cover values for the species ranged from 0.1% (scattered individuals) to 18%, with the species dominant in the community. It is highly likely that further populations are present in the study area.

#### 5.2.1.1.4 *Tecticornia* sp. Sunshine Lake

Status: Priority 1 (DPaW)

Distribution and ecology: Previously recorded in the Eastern Murchison subregion of the Murchison bioregion and Trainor subregion of the Little Sandy Desert bioregion (DPaW 2015a). The species is known from 11 records (ALA 2015) with habitat descriptions including:

- salt lake shoreline with salt crust and red-brown clay loam soil
- margin of salt lake, salt encrusted surface, brown clay
- lake bed, level that would occasionally be inundated, grey loamy clay sand
- island in the middle of Lake Sunshine, Little Sandy Desert.

Records and distribution in the study area: The species was recorded at two locations, one on the playa of Ten Mile Lake in red-orange sand to sandy clay in *Tecticornia* spp. dominated shrubland, and the other on the playa of Lake Sunshine, confirming a previous desktop record for the species (Figure 5-2).



The species was not identified in the field and as such the size and distribution of the populations were not recorded. Cover values of 9% and 10% recorded for the species at Ten Mile Lake, and 14% at Lake Sunshine, indicate potentially large populations. It is possible that the species may occur elsewhere on the lake playa.

Notably, the species co-occurred with *Tecticornia* sp. Christmas Creek both of which were recorded at the same location at Willie Soak approximately 25 km to the north.

### 5.2.1.2 Introduced flora

Most of the vegetation in the study area was free of introduced flora; however, nine introduced species were recorded in the study area (Table 5-7). These species all have wide distributions in WA and there were no apparent range extensions (Table 5-8). None of the introduced species recorded are declared pests.

*Bidens bipinnata* was the most widespread species recorded at ten sites and at times with cover values high enough to downgrade the vegetation condition of the site from excellent to good or very good. This species was most prevalent in mulga woodlands.

Table 5-7 Introduced flora species recorded during the field survey

Genus and species	No. of survey locations
* <i>Bidens bipinnata</i>	10
* <i>Cenchrus ciliaris</i>	1
* <i>Chloris virgata</i>	1
* <i>Citrullus colocynthis</i>	1
* <i>Citrullus lanatus</i>	1
* <i>Digitaria ciliaris</i>	1
* <i>Malvastrum americanum</i>	2
* <i>Setaria verticillata</i>	2
* <i>Sigesbeckia orientalis</i>	1



### 5.2.1.3 Range extensions

The survey records represented range extensions for 29 species, of which nine exceeded 100 km (Table 5-8).

Table 5-8 Apparent range extensions for species recorded in the study area

Species	Approximate distance of range extension (km)	Direction
<i>Acacia coriacea</i>	< 50	South-west
<i>Acacia tenuissima</i>	< 100	South-west
<i>Bergia pedicellaris</i>	< 100	South-east
<i>Cephalopterum drummondii</i>	150	North-east
<i>Corymbia hamersleyana</i>	50	South
<i>Cynodon convergens</i>	150	South
<i>Dodonaea coriacea</i>	25	South
<i>Eremophila spectabilis</i>	100	North
<i>Fimbristylis simulans</i>	200	South
<i>Gomphrena affinis</i>	50	South
<i>Goodenia pascua</i>	< 100	South
<i>Iseilema vaginiflorum</i>	100	South
<i>Maytenus</i> sp. Mt Windell (S. van Leeuwin 846)	< 50	South
<i>Mimulus repens</i>	< 50	North
<i>Olearia subspicata</i>	200	North
<i>Portulaca filifolia</i>	200	South
<i>Portulaca intraterranea</i>	200	South
<i>Ptilotus aphyllus</i>	< 50	South
<i>Ptilotus carinatus</i>	50	South
<i>Rhagodia drummondii</i>	150	North
<i>Scaevola basedowii</i>	< 100	North-west
<i>Sida trichopoda</i>	250	South-east
<i>Sida</i> sp. sand dunes (A.A. Mitchall PRP1208)	50	South-west
<i>Synaptantha tillaeacea</i> var. <i>hispidula</i>	< 50	South-west
<i>Tecticornia calyptrata</i>	150	North-west
<i>Tecticornia globulifera</i>	100	South
<i>Tecticornia</i> sp. Christmas Creek (K.A. Shepherd & T. Colmer <i>et. al.</i> KS 1063)	< 20	South
<i>Tecticornia</i> sp. Little Sandy Desert (K.A. Shepherd & C. Wilkins KS 830)	25	South
<i>Tecticornia</i> sp. Sunshine Lake (K.A. Shepherd <i>et al.</i> KS 867)	25	West

### 5.2.1.4 Unidentified flora

A total of 31 taxa could not be identified to species level, in most instances due to insufficient taxonomic characters as plants were sterile (lacking reproductive structures); notably this includes a large number of *Tecticornia* species (Table 5-9). Two of the unidentified *Tecticornia*, *Tecticornia* sp. nov. 1 (aff. *pruinosa/laevigata*) and *Tecticornia* sp. nov. 2 (aff. *pruinosa/undulata*), potentially represent undescribed taxa.

None of the unnamed taxa closely resemble any of the Priority Flora identified by the desktop review.

Table 5-9 Unidentified flora taxa recorded during the field survey

Unidentified taxon	Comments
<i>Acacia</i> sp.	Sterile shrub
<i>Atriplex</i> sp.	Sterile herb
<i>Calandrinia</i> sp.	Sterile prostrate herb
<i>Eremophila</i> ? <i>clarkei</i>	Sterile shrub
<i>Eremophila</i> sp.	Sterile shrub
<i>Eucalyptus</i> ? <i>victrix</i>	Sterile tree
<i>Eucalyptus</i> sp.	Sterile mallee
Goodeniaceae sp.	Sterile leafless woody herb
<i>Grevillea</i> sp.	Sterile shrub
<i>Haloragis</i> sp.	Sterile seedling
<i>Hibiscus</i> sp.	Sterile shrub insufficient material to distinguish between closely related species
Poaceae sp. (seedling)	Sterile seedling
Poaceae sp. (seedling)	Sterile seedling
<i>Sclerolaena</i> sp.	Specimen dried insufficient material for definitive identification
<i>Sida</i> sp.	Sterile shrub insufficient material to distinguish between closely related species
<i>Sida</i> sp.	Sterile shrub insufficient material to distinguish between closely related species
<i>Solanum</i> sp.	Sterile shrub insufficient material to distinguish between closely related species
Solonaceae sp.	Sterile shrub
<i>Tecticornia</i> aff sp. Dennys Crossing (KS 5521)	Insufficient material
<i>Tecticornia</i> sp.	Sterile shrub
<i>Tecticornia</i> sp. (Group 3 Or 5)	Sterile shrub
<i>Tecticornia</i> sp. (sterile) ? [group 6]	Sterile shrub
<i>Tecticornia</i> sp. (sterile) [group 1]	Sterile shrub
<i>Tecticornia</i> sp. (sterile) [group 2]	Sterile shrub
<i>Tecticornia</i> sp. (sterile) [group 3]	Sterile shrub
<i>Tecticornia</i> sp. (sterile) [group 4]	Sterile shrub
<i>Tecticornia</i> sp. (sterile) [group 5]	Sterile shrub
<i>Tecticornia</i> sp. nov. 1 (aff. <i>pruinosa/laevigata</i> )	Insufficient material
<i>Tecticornia</i> sp. nov. 2 (aff.	Insufficient material

Unidentified taxon	Comments
pruinosa/undulata)	
<i>Trachymene</i> sp.	Specimen dried insufficient material for definitive identification
<i>Triodia</i> sp.	Sterile tussock

## 5.2.2 Vegetation

### 5.2.2.1 Vegetation types

A total of 53 vegetation types were defined for the study area (Figure 5-3; Figure 5-4). These comprise eight woodlands, 16 shrublands, eight grasslands and 21 samphire shrublands of *Tecticornia* species present on the lake playas and beaches (Figure 5-3; Table 5-10). The samphire shrublands were mapped as a single mosaic (Figure 5-4) as it was not possible to discern community type boundaries from aerial imagery.

Figure 5-3 Dendrogram of hierarchical cluster analysis (UPGMA) based on species composition of survey sites – left, terrestrial vegetation; right, samphire shrublands

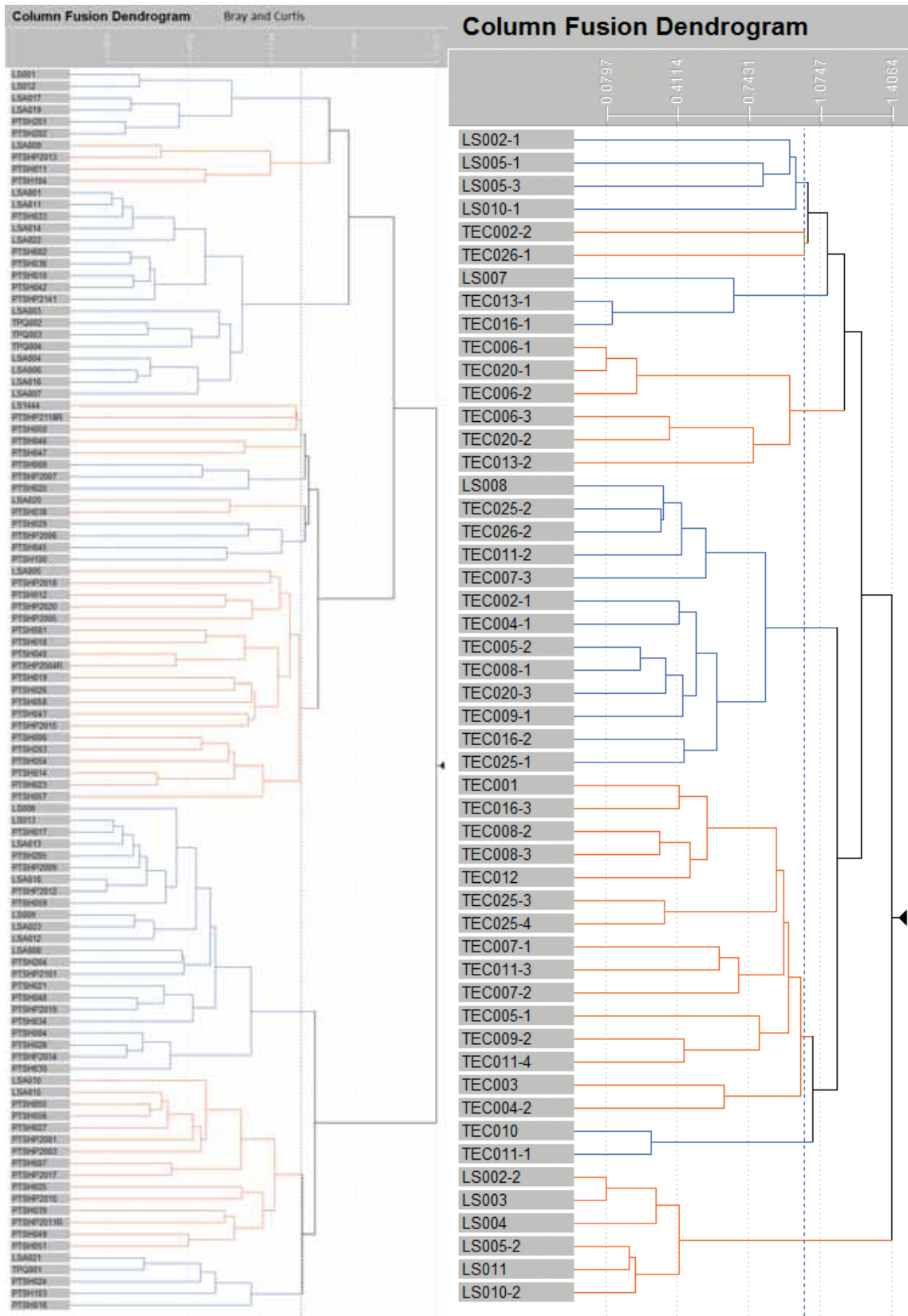












Table 5-10 Vegetation types within the study area



Vegetation type	Vegetation description	Vegetation type photos		Site
Woodland 1	Low <i>Acacia</i> spp. (Mulga) woodland over low to mid <i>Eremophila</i> and <i>Senna</i> spp. shrubland over isolated low grasses to open low mixed tussock grassland and isolated low mixed forbs.			PTSH001, PTSH018, PTSH040, PTSH012, PTSH019, PTSH026, PTSH058, PTSH041, PTSH018, PTSH020, PTSH02005, PTSH02004R, PTSH02015, LSA002R
Woodland 2	Low <i>Acacia</i> spp. (Mulga) woodland occasionally with <i>Corymbia hamersleyana</i> trees over low to mid <i>Eremophila</i> spp., frequently <i>E. galeata</i> and <i>Senna</i> spp. shrubland over low mixed tussock grassland and low * <i>Bidens bipinnata</i> forbland.			PTSH006, PTSH014, PTSH203, PTSH023, PTSH054






Vegetation type	Vegetation description	Vegetation type photos	Site
Woodland 3	Mid <i>Eucalyptus camaldulensis</i> woodland over open low <i>Acacia aneura</i> and <i>A. pteraneura</i> forest over sparse mid <i>Acacia</i> spp. shrubland over open low <i>*Bidens bipinnata</i> and <i>*Malvastrum americanum</i> forbland and isolated low mixed tussock grasses.		PTSH057R
Woodland 4	Low <i>Acacia</i> spp. (Mulga) woodland over low to mid <i>Eremophila</i> spp. shrubland over low <i>Triodia basedowii</i> hummock grassland.	 	PTSH2001, PTSH2003, PTSH2017, PTSH007



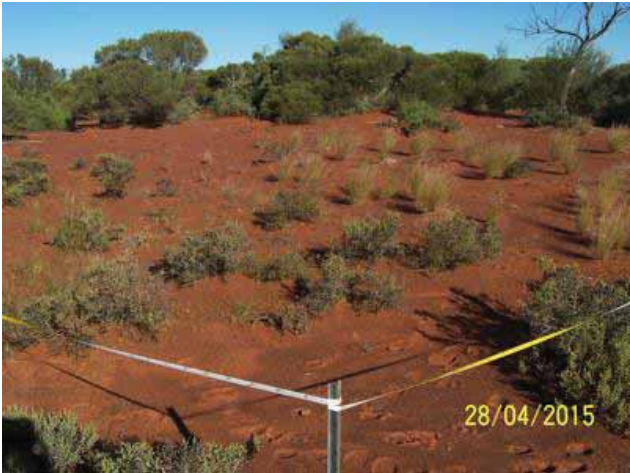






Vegetation type	Vegetation description	Vegetation type photos		Site
Woodland 5	Low <i>Acacia mulganeura</i> , <i>A. incurvaneura</i> and <i>Grevillea berryana</i> woodland over open low <i>Eremophila margarethae</i> shrubland over open low <i>Triodia melvillei</i> tussock grassland.			LSA020
Woodland 6	Low <i>Acacia</i> spp. (Mulga) and <i>A. subcontorta</i> woodland over sparse to open mid <i>Acacia</i> spp. and <i>Eremophila</i> spp. shrubland over sparse to open low <i>Triodia basedowii</i> hummock grassland.			PTSH039, PTSH049, PTSH051, PTSHP2011R

Vegetation type	Vegetation description	Vegetation type photos	Site
Woodland 7	Low <i>Acacia aneura</i> and <i>A. macraneura</i> woodland over open mid <i>Eremophila forrestii</i> subsp. <i>forrestii</i> and <i>Senna artemisioides</i> subsp. <i>helmsii</i> shrubland over mid <i>Triodia basedowii</i> hummock grassland.		PTSH204
Woodland 8	Low <i>Acacia pruinocarpa</i> woodland over isolated tall <i>Acacia aptaneura</i> shrubs over open mid <i>Eremophila forrestii</i> subsp. <i>forrestii</i> , <i>E. margarethae</i> and <i>Senna artemisioides</i> subsp. <i>x sturtii</i> shrubland over low <i>Triodia basedowii</i> hummock grassland and isolated low mixed forbs.		PTSH059





Vegetation type	Vegetation description	Vegetation type photos		Site
Shrubland 1	Low <i>Tecticornia indica</i> subsp. <i>bidens</i> shrubland over low mixed tussock grassland, mixed <i>Cyperus</i> spp. sedgeland and isolated low mixed forbs.			PTSH009, PTSH020, PTSH2007
Shrubland 2	Mid <i>Acacia ligulata</i> shrubland over isolated low <i>Aluta maisonneuvei</i> subsp. <i>maisonneuvei</i> , <i>Eremophila forrestii</i> and <i>Seringia elliptica</i> shrubs over mid <i>Triodia basedowii</i> , <i>T. schinzii</i> and <i>Eragrostis eriopoda</i> hummock/tussock grassland over isolated clumps of low <i>Euphorbia boophthona</i> and <i>Goodenia triodiophila</i> forbs.			PTSH004







Vegetation type	Vegetation description	Vegetation type photos		Site
Shrubland 3	Low isolated trees to open woodland of <i>Acacia</i> spp. or occasionally <i>Eucalyptus gamophylla</i> mallee over <i>Eremophila forrestii</i> , <i>Eremophila</i> spp. and <i>Senna</i> spp. shrubland over low <i>Triodia basedowii</i> hummock grassland.			PTSH048, PTSH021, PTSH034, PTSH2101, PTSH2019
Shrubland 4	Mid to tall <i>Melaleuca interioris</i> shrubland over isolated low mixed shrubs over isolated mixed grasses to sparse low mixed grassland and isolated low mixed forbs			LSA024, PTSH024, TPQ001, PTSH103, PTSH016



Vegetation type	Vegetation description	Vegetation type photos		Site
Shrubland 5	Tall open <i>Acacia balsamea</i> , <i>A. ligulata</i> and <i>A. tetragonophylla</i> shrubland over open mid <i>Senna artemisioides</i> subsp. <i>petiolaris</i> shrubland over open <i>Triodia basedowii</i> and <i>Eragrostis eriopoda</i> hummock tussock grassland and isolated clumps of low mixed forbs.			PTSH025
Shrubland 6	Sparse tall to tall <i>Acacia burkittii</i> shrubland over sparse mid <i>Acacia tetragonophylla</i> and <i>Senna artemisioides</i> subsp. <i>petiolaris</i> shrubland over isolated low <i>Eragrostis</i> spp. and <i>Enneapogon caerulescens</i> tussock grasses and isolated low mixed forbs.			PTSH029, PTSH2006




Vegetation type	Vegetation description	Vegetation type photos		Site
Shrubland 7	Low to mid <i>Aluta maisonneuvei</i> subsp. <i>maisonneuvei</i> shrubland over low open <i>Triodia schinzii</i> tussock grassland.			LSA017, PTSH201, PTSH202
Shrubland 8	Isolated low <i>Acacia</i> spp. trees over <i>Eremophila</i> spp. shrubland over low <i>Eriachne pulchella</i> , <i>Tripogon loliiformis</i> and <i>Perotis rara</i> tussock grasses and isolated low mixed forbs.			PTSH045, PTSH100









Vegetation type	Vegetation description	Vegetation type photos		Site
Shrubland 9	Isolated low trees to low open <i>Corymbia chippendalei</i> and <i>Eucalyptus gamophylla</i> woodland over low mixed shrubland over isolated low grasses to low open <i>Triodia schinzii</i> and <i>Aristida</i> spp. tussock grassland.			LSA009, PTSH011, PTSH104, PTSH2013
Shrubland 10	Isolated mid <i>Eucalyptus</i> spp. mallee and isolated mid to tall mixed shrubs over open low to low <i>Aluta maisonneuvei</i> subsp. <i>maisonneuvei</i> shrubland over sparse to open low <i>Triodia basedowii</i> hummock grassland.			LS001, LS012, LSA019

Vegetation type	Vegetation description	Vegetation type photos	Site
Shrubland 11	Isolated tall <i>Callitris columellaris</i> shrubs over isolated low mixed shrubs and forbs.		LS1444
Shrubland 12	Mid <i>Corynotheca pungens</i> shrubland over isolated low <i>Eragrostis pegracilis</i> and <i>E. dielsii</i> tussock grasses and isolated low <i>Marsilea hirsuta</i> and <i>Bergia pedicellaris</i> forbs.		PTSHP2118R




Vegetation type	Vegetation description	Vegetation type photos		Site
Shrubland 13	Isolated tall <i>Acacia aneura</i> and <i>A. tetragonophylla</i> shrubs over low <i>Eremophila margarethae</i> and <i>E. galeata</i> shrubland over low <i>Eriachne pulchella</i> and <i>Tripogon loliiformis</i> tussock grassland and isolated low mixed forbs.			PTSH038
Shrubland 14	Isolated low <i>Eucalyptus</i> spp. mallee over mid open <i>Acacia ligulata</i> shrubland over low <i>Triodia basedowii</i> hummock grassland.			LS009, LSA023, LSA012





Vegetation type	Vegetation description	Vegetation type photos	Site
Shrubland 15	Open tall <i>Acacia rhodophloia</i> and <i>A. kempeana</i> shrubland over isolated low <i>Eucalyptus</i> sp. Little Sandy Desert mallee over isolated mixed shrubs over low <i>Triodia basedowii</i> hummock grassland.		LSA008
Shrubland 16	Isolated tall <i>Acacia kempeana</i> shrubs over open mid <i>Acacia doreta</i> , <i>Eremophila galeata</i> and <i>E. margarethae</i> shrubland over sparse low <i>Seringia elliptica</i> and <i>Halgania glabra</i> shrubland over sparse mid <i>Triodia basedowii</i> and <i>T. schinzii</i> hummock/tussock grassland.		PTSHP2010

Vegetation type	Vegetation description	Vegetation type photos		Site
Grassland 1	Isolated mixed trees and shrubs over closed low <i>Eragrostis</i> spp., <i>Eriachne flaccida</i> and <i>Enteropogon ramosus</i> tussock grassland.			PTSH046, PTSH047
Grassland 2	Isolated trees and shrubs over mid <i>Triodia basedowii</i> and <i>T. shinzii</i> hummock/tussock grassland.			LS006, LS013, PTSH017, LSA013, PTSH205, PTSH2009, LSA018, PTSH2012








Vegetation type	Vegetation description	Vegetation type photos		Site
Grassland 3	Isolated trees and shrubs over low open <i>Triodia basedowii</i> hummock grassland.			PTSH028, PTSH030, PTSH2014, LSA010, LSA015
Grassland 4	Isolated mixed shrubs over emergent <i>Triodia basedowii</i> hummock grassland.			PTSH050

Vegetation type	Vegetation description	Vegetation type photos		Site
Grassland 5	Isolated mixed shrubs to open shrubland over low <i>Triodia schinzii</i> , <i>Aristida holathera</i> and <i>Eragrostis</i> spp. tussock grassland.			LSA001, LSA003, LSA004, LSA006, LSA007, LSA011, LSA014, LSA016, LSA022, PTSH036, PTSH010R, PTSH033, PTSH042, PTSH002, PTSHP2141, TPQ002, TPQ003, TPQ004

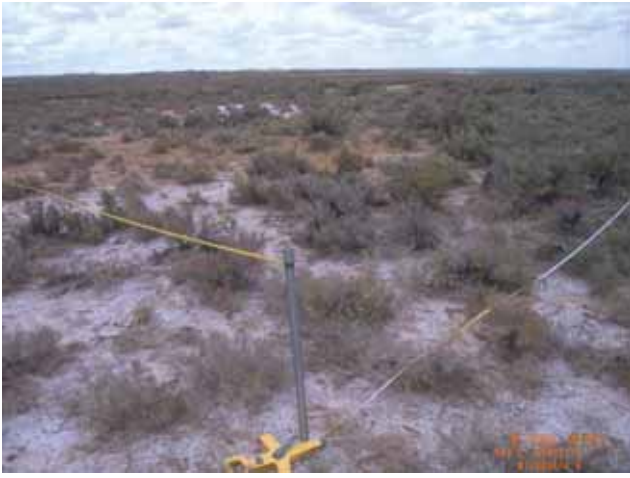

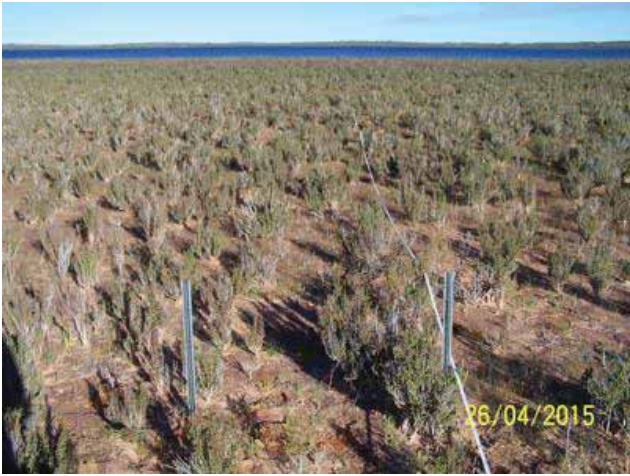

Vegetation type	Vegetation description	Vegetation type photos	Site
Grassland 6	Isolated low <i>Casuarina pauper</i> trees over sparse low <i>Tecticornia</i> spp. chenopod shrubland over open low <i>Eragrostis</i> spp. tussock grassland.		LSA005
Grassland 7	Sparse mid <i>Acacia</i> spp. and <i>Eremophila galeata</i> shrubland over isolated low mixed shrubs over open low <i>Triodia basedowii</i> hummock grassland.	 	PTSH055, PTSH056






Vegetation type	Vegetation description	Vegetation type photos		Site
Grassland 8	Sparse mid <i>Acacia ligulata</i> , <i>Grevillea</i> spp. and <i>Senna artemisioides</i> subsp. <i>helmsii</i> shrubland over open mid <i>Triodia basedowii</i> hummock grassland.			PTSH027
Samphire shrubland 1	Open to closed low <i>Tecticornia calyptrata</i> , <i>T. laevigata</i> and <i>T. sp.</i> Dennys Crossing chenopod shrubland occasionally with isolated low forbs.			LS002-1, LS005-1, LS005-3, LS010-1



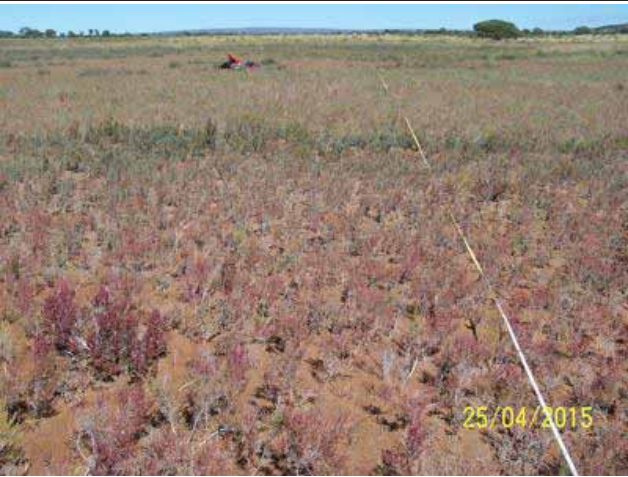

Vegetation type	Vegetation description	Vegetation type photos	Site
Samphire shrubland 2	Open low <i>Tecticornia globulifera</i> , <i>Muellerolimon salicorniaceum</i> and <i>Scaevola collaris</i> shrubland over isolated low <i>Eragrostis kennedyae</i> tussock grasses and isolated low <i>Goodenia pascua</i> forbs.		TEC002-2
Samphire shrubland 3	Sparse low <i>Tecticornia pruinosa</i> chenopod shrubland over isolated clumps of <i>Eragrostis pergracilis</i> tussock grasses.		TEC026-1




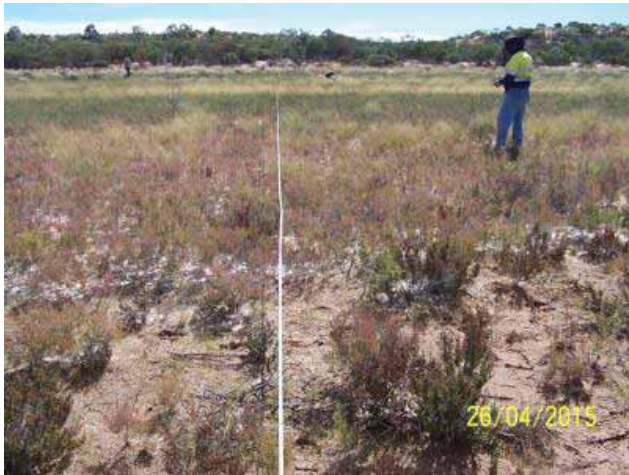


Vegetation type	Vegetation description	Vegetation type photos		Site
Samphire shrubland 4	Open low <i>Tecticornia</i> spp. chenopod shrubland with <i>Tecticornia</i> sp. (sterile) [group 3] dominant over isolated low <i>Eragrostis pergracilis</i> tussock grasses and isolated low mixed forbs.			LS007, TEC013-1, TEC016-1
Samphire shrubland 5	Open low <i>Tecticornia peltata</i> chenopod shrubland over isolated low <i>Eragrostis pergracilis</i> tussock grasses and <i>Dysphania kalpari</i> forbs.			TEC006-1, TEC020-1, TEC006-2

Vegetation type	Vegetation description	Vegetation type photos		Site
Samphire shrubland 6	Open low to mid <i>Tecticornia</i> sp. Little Sandy Desert, <i>T. peltata</i> and <i>T. undulata</i> chenopod shrubland over isolated low <i>Eragrostis pergracilis</i> tussock grasses and <i>Dysphania kalpari</i> forbs.			TEC006-3, TEC020-2
Samphire shrubland 7	Sparse low <i>Tecticornia</i> sp. Little Sandy Desert, <i>T.</i> sp. (sterile) [group 3] and <i>Scaevola collaris</i> shrubland over isolated low <i>Eragrostis kennedyae</i> and <i>E. pergracilis</i> tussock grasses and isolated low <i>Dysphania kalpari</i> and <i>Lawrenzia densiflora</i> forbs.			TEC013-2







Vegetation type	Vegetation description	Vegetation type photos		Site
Samphire shrubland 8	Open low to mid <i>Tecticornia</i> sp. Dennys Crossing chenopod shrubland over isolated low <i>Eragrostis kennedeyae</i> tussock grasses to low open tussock grassland over isolated low <i>Dysphania kalpari</i> and <i>Swainsona laciniata</i> forbs.			LS008, TEC025-2, TEC026-2, TEC011-2, TEC007-3
Samphire shrubland 9	Open low <i>Tecticornia peltata</i> , <i>T. undulata</i> and <i>T. sp.</i> Dennys Crossing chenopod shrubland over isolated low <i>Eragrostis kennedeyae</i> tussock grasses and <i>Dysphania kalpari</i> forbs.			TEC002-1, TEC004-1









Vegetation type	Vegetation description	Vegetation type photos		Site
Samphire shrubland 10	Open low <i>Tecticornia indica</i> subsp. <i>bidens</i> , <i>T. undulata</i> and <i>T. sp.</i> Dennys Crossing chenopod shrubland over isolated low <i>Eragrostis kennedeyae</i> and <i>E. pergracilis</i> tussock grasses over isolated low <i>Dysphania kalpari</i> and <i>Swainsona laciniata</i> forbs.			TEC005-2, TEC008-1, TEC020-3, TEC009-1
Samphire shrubland 11	Sparse to open low <i>Tecticornia</i> spp. chenopod shrubland with <i>T. sp.</i> Dennys Crossing dominant over isolated low <i>Eragrostis pergracilis</i> tussock grasses and <i>Dysphania kalpari</i> forbs.			TEC016-2, TEC025-1






Vegetation type	Vegetation description	Vegetation type photos		Site
Samphire shrubland 12	Sparse to open low <i>Tecticornia indica</i> subsp. <i>bidens</i> and <i>T. sp.</i> Dennys Crossing chenopod shrubland, frequently with <i>Frankenia laxiflora</i> shrubs, over isolated low mixed tussock grasses and Cyperaceae spp. sedges and isolated low mixed forbs			TEC001, TEC016-3, TEC008-2, TEC008-3, TEC012
Samphire shrubland 13	Sparse to open mid <i>Tecticornia</i> sp. Sunshine Lake chenopod shrubland over sparse to open <i>T. indica</i> subsp. <i>bidens</i> and <i>T. sp.</i> Christmas creek chenopod shrubland over isolated low <i>Eragrostis</i> spp. tussock grasses and <i>Dysphania kalpari</i> and <i>Swainsona laciniata</i> forbs.			TEC025-4



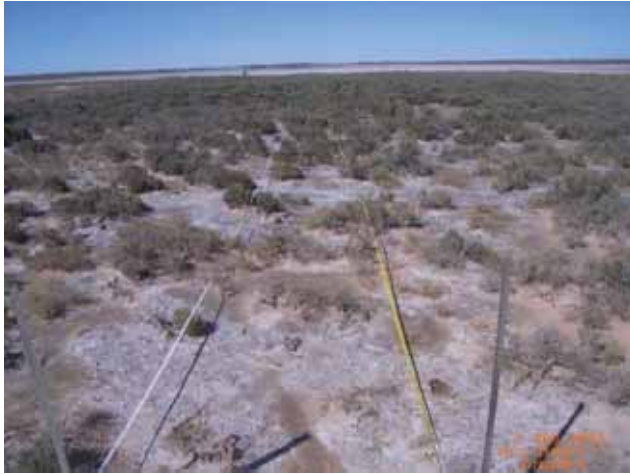



Vegetation type	Vegetation description	Vegetation type photos		Site
Samphire shrubland 14	Sparse to open low <i>Tecticornia globulifera</i> , <i>T. indica</i> subsp. <i>bidens</i> and <i>T. sp.</i> Dennys Crossing chenopod shrubland over isolated low mixed forbs.			TEC007-1, TEC011-3, TEC007-2
Samphire shrubland 15	Sparse low <i>Tecticornia undulata</i> , <i>T. sp.</i> Dennys Crossing and <i>T. sp.</i> Little Sandy Desert chenopod grassland over isolated low <i>Eragrostis kennedeyae</i> and <i>E. pergracilis</i> tussock grasses and <i>Dysphania kalpari</i> and <i>Swainsona laciniata</i> forbs.			TEC005-1

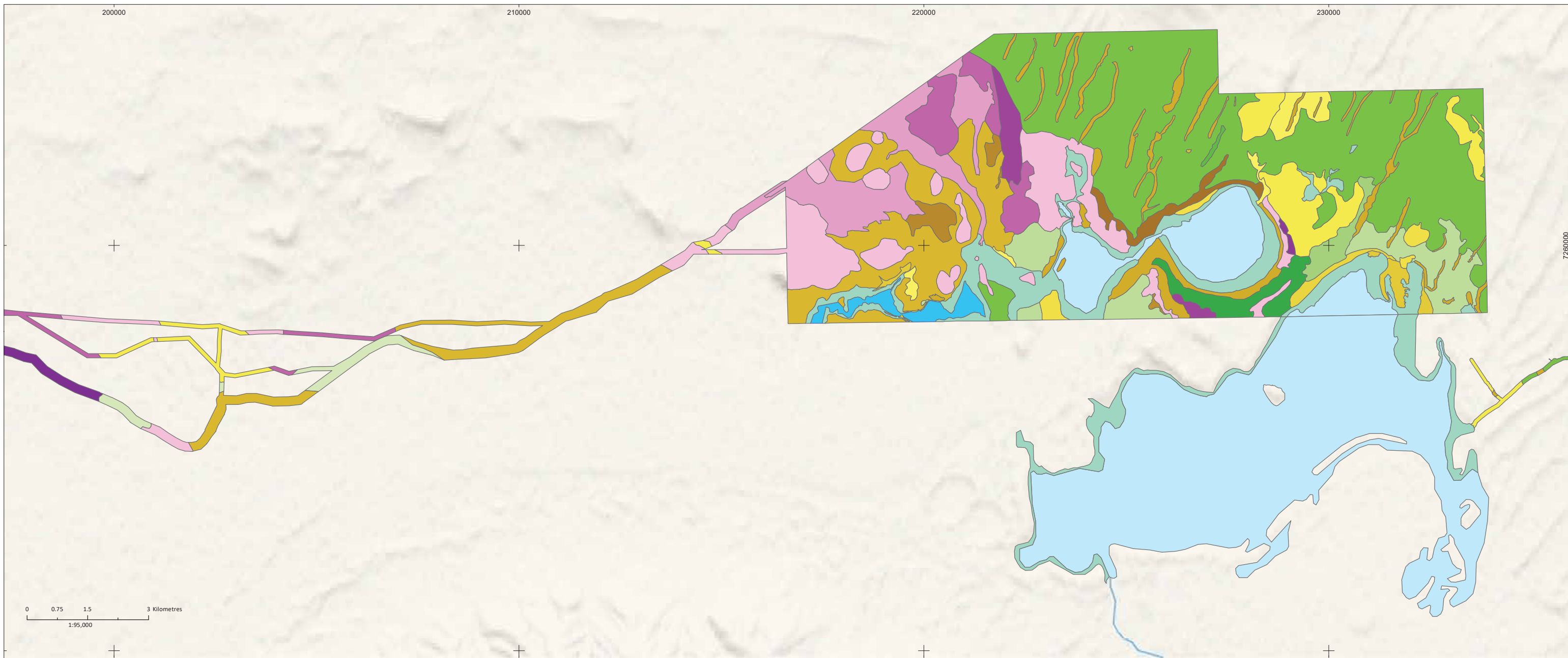
Vegetation type	Vegetation description	Vegetation type photos		Site
Samphire shrubland 16	Low <i>Tecticornia</i> spp. chenopod shrubland with <i>T. indica</i> subsp. <i>bidens</i> dominant over isolated low mixed tussock grasses and forbs.			TEC009-2, TEC011-4
Samphire shrubland 17	Sparse low <i>Frankenia laxiflora</i> , <i>Tecticornia indica</i> subsp. <i>bidens</i> and <i>T. sp. Dennys</i> crossing shrubland over isolated low <i>Aristida holathera</i> tussock grasses and <i>Cyperus iria</i> sedges over open low <i>Goodenia pascua</i> and <i>Dysphania kalpari</i> forbland.			TEC003



Vegetation type	Vegetation description	Vegetation type photos		Site
Samphire shrubland 18	Low <i>Tecticornia</i> sp. sterile [group 3], <i>T.</i> sp. Christmas creek and <i>Frankenia laxiflora</i> shrubland over isolated low <i>Goodenia pascua</i> forbs.			TEC004-2
Samphire shrubland 19	Sparse low <i>Tecticornia</i> spp. and <i>Frankenia laxiflora</i> shrubland, with <i>T. pergranulata</i> subsp. <i>pergranulata</i> dominant, over isolated low <i>Eragrostis kennedeyae</i> tussock grasses and mixed forbs.			TEC010, TEC011-1

Vegetation type	Vegetation description	Vegetation type photos		Site
Samphire shrubland 20	Low <i>Tecticornia laevigata</i> chenopod shrubland over isolated low <i>Eragrostis pergracilis</i> tussock grasses and <i>Surreya diandra</i> forbs.			LS002-2, LS003, LS004
Samphire shrubland 21	Low <i>Tecticornia laevigata</i> and <i>T. sp.</i> Dennys Crossing chenopod shrubland over isolated low <i>Lawrencina glomerata</i> and <i>Surreya diandra</i> forbs.			LS005-2, LS011, LS010-2





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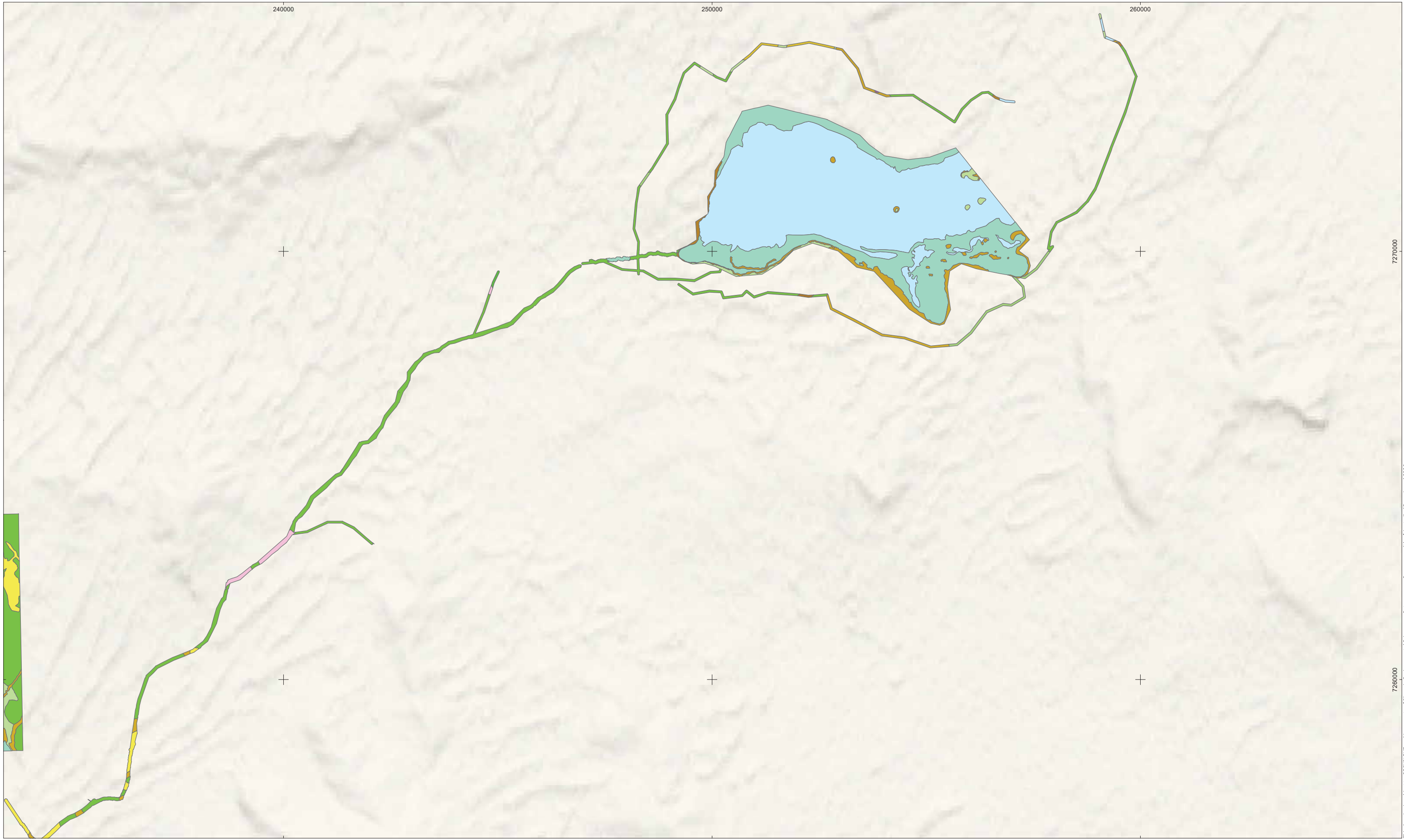
**Figure 5–4a**  
**Vegetation types**  
**of the study area**



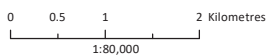
Client: Kalium Lakes Ltd  
Project: Beyondie Potash Project  
  
Author: KW  
Date: 01-Mar-17  
  
Coordinate System: GDA 1994 MGA Zone 51  
Projection: Transverse Mercator  
Datum: GDA 1994

Vegetation associations	Grassland 3	Shrubland 1	Shrubland 6	Shrubland 13	Woodland 6
Salt Lake	Grassland 5	Shrubland 2	Shrubland 7	Shrubland 16	Woodland 7
Fresh water Lake	Grassland 6	Shrubland 3	Shrubland 8	Woodland 1	Woodland 8
Grassland 1	Grassland 8	Shrubland 4	Shrubland 9	Woodland 2	
Grassland 2	Sapphire Shrublands	Shrubland 5	Shrubland 12	Woodland 4	





















**Figure 5-4b**  
**Vegetation types**  
**of the study area**



Client: Kalium Lakes Ltd  
 Project: Beyondie Potash Project

Author: KW  
 Date: 01-Mar-17

Coordinate System: GDA 1994 MGA Zone 51  
 Projection: Transverse Mercator  
 Datum: GDA 1994

Vegetation associations	
	Salt Lake
	Grassland 2
	Grassland 3
	Grassland 5
	Grassland 6
	Samphire Shrublands
	Shrubland 3
	Shrubland 4
	Shrubland 7
	Shrubland 9
	Shrubland 10
	Shrubland 11
	Shrubland 14
	Shrubland 15
	Woodland 1
	Woodland 5



### 5.2.2.2 Vegetation condition

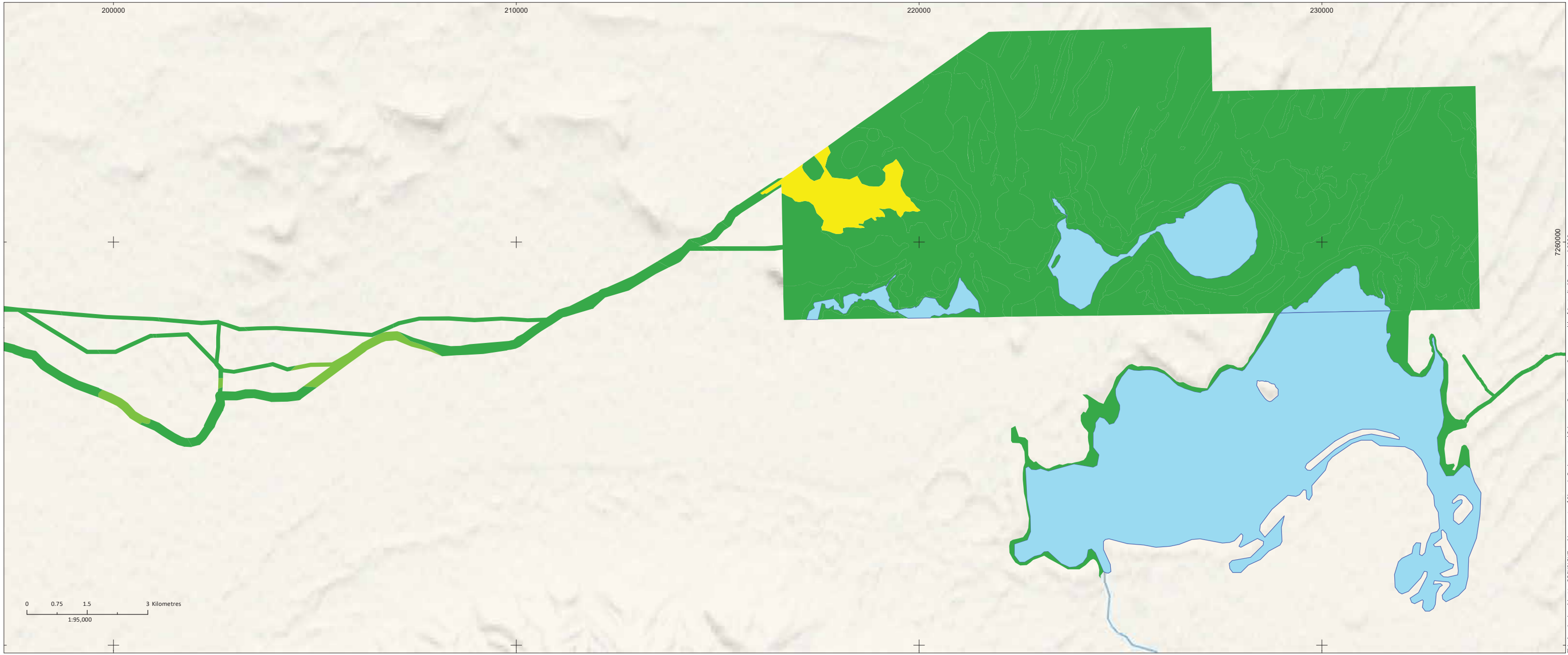
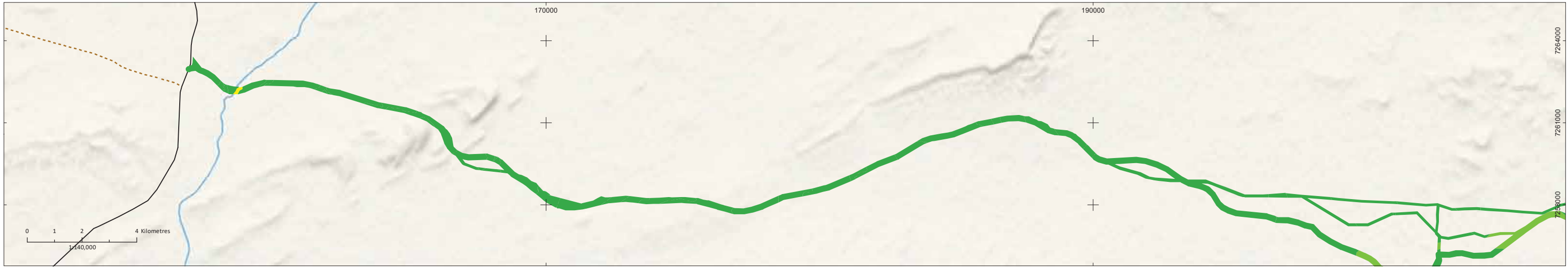
Vegetation condition in the study area was recorded as excellent to good with 67% of the area recorded as excellent (Figure 5-5). There was no evident disturbance in most areas. Animal tracks from domestic stock and feral animals were observed occasionally.

Vegetation where condition was recorded as very good (0.6% including patches within Woodland 2 and Grassland 1) had weed infestation, evidence of light grazing and occasional vehicle tracks. Vegetation in good condition (1.7% patches within Woodland 2 and Woodland 3) had large weed infestations with multiple weed species, greater soil disturbance from domestic stock, a greater level of grazing and the presence of vehicle tracks.

The condition of areas occupied by the lakes was not assessed.

### 5.2.2.3 Threatened and Priority Ecological Communities

None of the vegetation defined for the study area resembles any of the listed TECs or PECs.



**Figure 5–5a**  
**Vegetation condition**  
**in the study area**



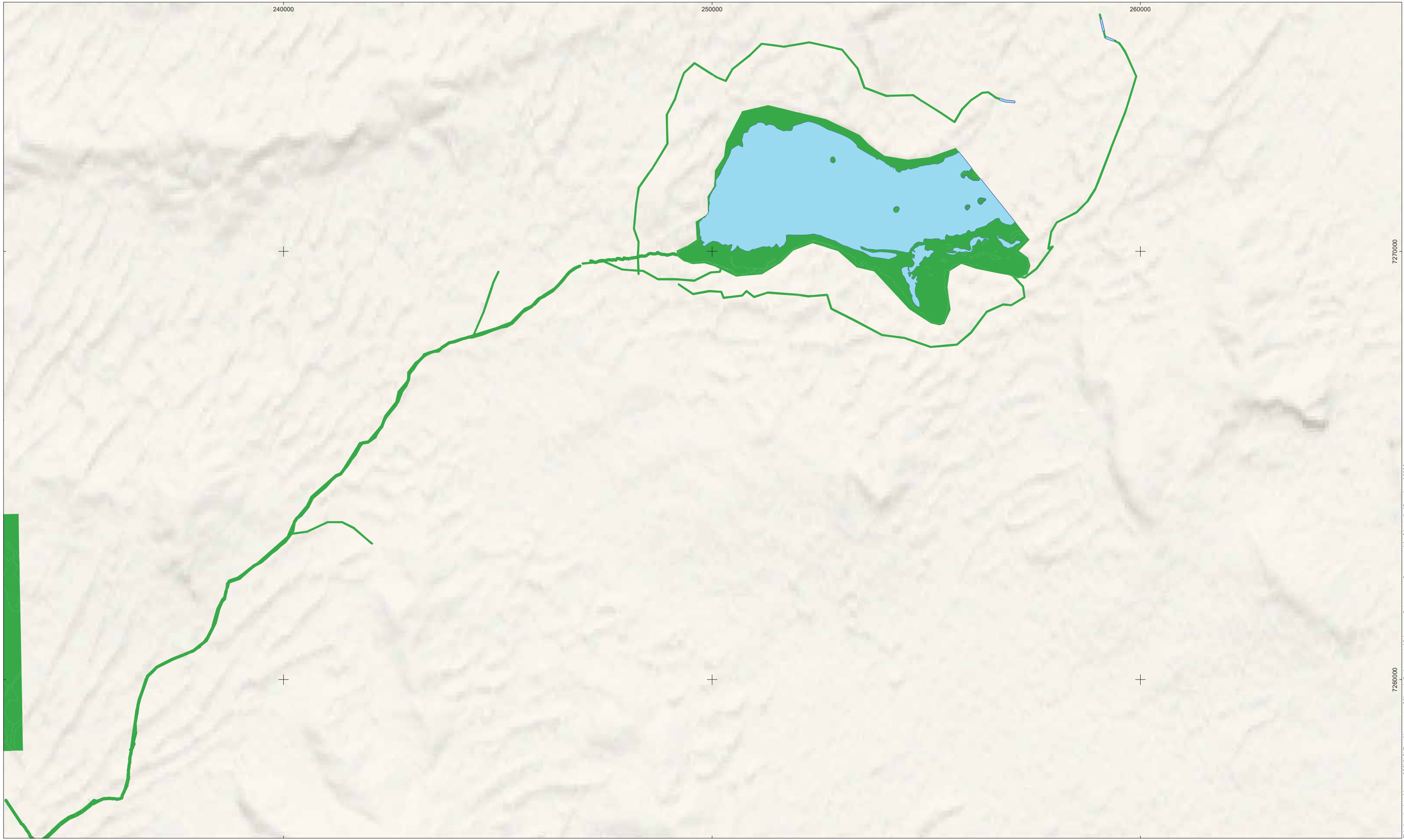
Client: Kalium Lakes Ltd  
 Project: Beyondie Potash Project  
 Author: KW  
 Date: 01-Mar-17  
 Coordinate System: GDA 1994 MGA Zone 51  
 Projection: Transverse Mercator  
 Datum: GDA 1994

- Vegetation condition
- Excellent
  - Very Good
  - Good
  - Lake

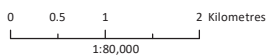


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**Figure 5–5b**  
**Vegetation condition**  
**in the study area**



Client: Kalium Lakes Ltd  
 Project: Beyondie Potash Project

Author: KW  
 Date: 01-Mar-17

Coordinate System: GDA 1994 MGA Zone 51  
 Projection: Transverse Mercator  
 Datum: GDA 1994

**Vegetation condition**

- Excellent
- Lake



### 5.2.2.1 Local and regional significance of vegetation

The paucity of regional information and lack of discussion of conservation significance of vegetation in the flora surveys reviewed for this assessment (EnviroWorks 2010a, b; Shepherd *et al.* 2002) precludes detailed assessment of the regional conservation significance of the vegetation types defined for the current survey. Notably, with the exception of the *Tecticornia* shrublands associated with the lake playas and immediate surrounds, each of the remaining vegetation types defined for the study area align with one or more broad vegetation associations mapped by Shepherd *et al.* (2002) (Table 5-11).

The *Tecticornia* shrublands of the lake playa and beaches are considered locally significant as they represent habitat for the Priority 1 species *Tecticornia globulifera*, *Tecticornia* sp. Christmas Creek, *Tecticornia* sp. Sunshine Lake and *Tecticornia* sp. Little Sandy Desert.

Table 5-11 Comparison of vegetation types from the study area with the regional vegetation types mapped by Shepherd *et al.* (2002)

Shepherd <i>et al.</i> (2002) vegetation association	Vegetation types identified in the study area
18—Low woodland; mulga ( <i>Acacia aneura</i> )	<p><b>Grassland 4</b>—Isolated mixed shrubs over emergent <i>Triodia basedowii</i> hummock grassland.</p> <p><b>Grassland 7</b>— Sparse mid <i>Acacia</i> spp. and <i>Eremophila galeata</i> shrubland over isolated low mixed shrubs over open low <i>Triodia basedowii</i> hummock grassland</p> <p><b>Shrubland 3</b>—Low isolated trees to open woodland of <i>Acacia</i> spp. or occasionally <i>Eucalyptus gamophylla</i> mallee over <i>Eremophila forrestii</i>, <i>Eremophila</i> spp. and <i>Senna</i> spp. shrubland over <i>Triodia basedowii</i> hummock grassland</p> <p><b>Shrubland 9</b>—Isolated low trees to low open <i>Corymbia chippendalei</i> and <i>Eucalyptus gamophylla</i> woodland over low mixed shrubland over isolated low grasses to low open <i>Triodia schinzii</i> and <i>Aristida</i> spp. tussock grassland</p> <p><b>Woodland 1</b>—Low <i>Acacia</i> spp. (Mulga) woodland over <i>Eremophila</i> and <i>Senna</i> spp. low to mid shrubland over isolated low grasses to open low mixed tussock grassland and isolated low mixed forbs</p> <p><b>Woodland 3</b>—Mid <i>Eucalyptus camaldulensis</i> woodland over low open <i>Acacia aneura</i> and <i>A. pteraneura</i> forest over sparse mid <i>Acacia</i> spp. shrubland over low open <i>*Bidens bipinnata</i> and <i>*Malvastrum americanum</i> forbland and isolated low mixed tussock grasses</p> <p><b>Woodland 6</b>—Low <i>Acacia</i> spp. (Mulga) and <i>A. subcontorta</i> woodland over sparse to open mid <i>Acacia</i> spp. and <i>Eremophila</i> spp. shrubland over sparse to open low <i>Triodia basedowii</i> hummock grassland</p>
29—Sparse low woodland; mulga, discontinuous in scattered groups	<p><b>Grassland 1</b>— Isolated mixed trees and shrubs over closed low <i>Eragrostis</i> spp., <i>Eriachne flaccida</i> and <i>Enteropogon ramosus</i> tussock grassland</p> <p><b>Grassland 2</b>—Isolated trees and shrubs over mid <i>Triodia basedowii</i> and <i>T. schinzii</i> hummock/tussock grassland</p> <p><b>Grassland 3</b>—Isolated trees and shrubs over low open <i>Triodia basedowii</i> hummock grassland</p> <p><b>Grassland 4</b>—Isolated mixed shrubs over emergent <i>Triodia basedowii</i> hummock grassland</p> <p><b>Grassland 5</b>—Isolated mixed shrubs to open shrubland over <i>Triodia schinzii</i>, <i>Aristida holathera</i> and <i>Eragrostis</i> spp. tussock grassland</p>

Shepherd <i>et al.</i> (2002) vegetation association	Vegetation types identified in the study area
	<p><b>Shrubland 1</b>—Low <i>Tecticornia indica</i> subsp. <i>bidens</i> shrubland over low mixed tussock grassland, mixed <i>Cyperus</i> spp. sedgeland and isolated low mixed forbs</p> <p><b>Shrubland 3</b>—Low isolated trees to open woodland of <i>Acacia</i> spp. or occasionally <i>Eucalyptus gamophylla</i> mallee over <i>Eremophila forrestii</i>, <i>Eremophila</i> spp. and <i>Senna</i> spp. shrubland over low <i>Triodia basedowii</i> hummock grassland</p> <p><b>Shrubland 4</b>—<i>Melaleuca interioris</i> shrubland over isolated low mixed shrubs over isolated mixed grasses to sparse low mixed grassland and isolated low mixed forbs</p> <p><b>Shrubland 6</b>—Sparse tall to tall <i>Acacia burkittii</i> shrubland over sparse mid <i>Acacia tetragonophylla</i> and <i>Senna artemisioides</i> subsp. <i>petiolaris</i> shrubland over isolated low <i>Eragrostis</i> spp. and <i>Enneapogon caerulescens</i> tussock grasses and isolated low mixed forbs</p> <p><b>Shrubland 8</b>—Isolated low <i>Acacia</i> spp. trees over <i>Eremophila</i> spp. shrubland over low <i>Eriachne pulchella</i>, <i>Tripogon loliiformis</i> and <i>Perotis rara</i> tussock grasses and isolated low mixed forbs</p> <p><b>Shrubland 9</b>—Isolated low trees to low open <i>Corymbia chippendalei</i> and <i>Eucalyptus gamophylla</i> woodland over low mixed shrubland over isolated low grasses to low open <i>Triodia schinzii</i> and <i>Aristida</i> spp. tussock grassland</p> <p><b>Shrubland 13</b>—Isolated tall <i>Acacia aneura</i> and <i>A. tetragonophylla</i> shrubs over low <i>Eremophila margarethae</i> and <i>E. galeata</i> shrubland over low <i>Eriachne pulchella</i> and <i>Tripogon loliiformis</i> tussock grassland and isolated low mixed forbs</p> <p><b>Woodland 1</b>—Low <i>Acacia</i> spp. (Mulga) woodland over <i>Eremophila</i> and <i>Senna</i> spp. low to mid shrubland over isolated low grasses to open low mixed tussock grassland and isolated low mixed forbs</p> <p><b>Woodland 2</b>—Low <i>Acacia</i> spp. (Mulga) woodland occasionally with <i>Corymbia hamersleyana</i> trees over <i>Eremophila</i> spp., frequently <i>E. galeata</i> and <i>Senna</i> spp. over low mixed tussock grassland and low <i>*Bidens bipinnata</i> forbland</p> <p><b>Woodland 4</b>— Low <i>Acacia</i> spp. (Mulga) woodland over low to mid <i>Eremophila</i> spp. shrubland over low <i>Triodia basedowii</i> hummock grassland</p> <p><b>Woodland 6</b>—Low <i>Acacia</i> spp. (Mulga) woodland over low to mid <i>Eremophila</i> spp. shrubland over low <i>Triodia basedowii</i> hummock grassland</p> <p><b>Woodland 8</b>—Low <i>Acacia pruinocarpa</i> woodland over isolated tall <i>Acacia aptaneura</i> shrubs over open mid <i>Eremophila forrestii</i> subsp. <i>forrestii</i>, <i>E. margarethae</i> and <i>Senna artemisioides</i> subsp. <i>x sturtii</i> shrubland over low <i>Triodia basedowii</i> hummock grassland and isolated low mixed forbs</p>
39—Shrublands; mulga scrub	<p><b>Grassland 7</b>— Sparse mid <i>Acacia</i> spp. and <i>Eremophila galeata</i> shrubland over isolated low mixed shrubs over open low <i>Triodia basedowii</i> hummock grassland</p> <p><b>Woodland 2</b>—Low <i>Acacia</i> spp. (Mulga) woodland occasionally with <i>Corymbia hamersleyana</i> trees over <i>Eremophila</i> spp., frequently <i>E. galeata</i> and <i>Senna</i> spp. over low mixed tussock grassland and low <i>*Bidens bipinnata</i> forbland</p>
111—Hummock grasslands, shrub steppe; Eucalyptus	<p><b>Grassland 4</b>—Isolated mixed shrubs over emergent <i>Triodia basedowii</i> hummock grassland</p>

Shepherd <i>et al.</i> (2002) vegetation association	Vegetation types identified in the study area
gamophylla over hard spinifex	<p><b>Shrubland 5</b>—Tall open <i>Acacia balsamea</i>, <i>A. ligulata</i> and <i>A. tetragonophylla</i> shrubland over open mid <i>Senna artemisioides</i> subsp. <i>petiolaris</i> shrubland over open <i>Triodia basedowii</i> and <i>Eragrostis eriopoda</i> hummock tussock grassland</p> <p><b>Shrubland 15</b>—Open tall <i>Acacia rhodophloia</i> and <i>A. kempeana</i> shrubland over isolated low <i>Eucalyptus</i> sp. Little Sandy Desert mallee over isolated mixed shrubs over low <i>Triodia basedowii</i> hummock grassland</p> <p><b>Shrubland 16</b>—Isolated tall <i>Acacia kempeana</i> shrubs over open mid <i>Acacia doreta</i>, <i>Eremophila galeata</i> and <i>E. margarethae</i> shrubland over sparse low <i>Seringia elliptica</i> and <i>Halgania glabra</i> shrubland over sparse mid <i>Triodia basedowii</i> and <i>T. schinzii</i> hummock/tussock grassland.</p> <p><b>Woodland 1</b>—Low <i>Acacia</i> spp. (Mulga) woodland over <i>Eremophila</i> and <i>Senna</i> spp. low to mid shrubland over isolated low grasses to open low mixed tussock grassland and isolated low mixed forbs</p> <p><b>Woodland 6</b>—Low <i>Acacia</i> spp. (Mulga) woodland over low to mid <i>Eremophila</i> spp. shrubland over low <i>Triodia basedowii</i> hummock grassland</p>
125— Small islands within bare areas; salt lakes	<p><b>Grassland 2</b>—Isolated trees and shrubs over mid <i>Triodia basedowii</i> and <i>T. schinzii</i> hummock/tussock grassland</p> <p><b>Grassland 3</b>—Isolated trees and shrubs over low open <i>Triodia basedowii</i> hummock grassland</p> <p><b>Shrubland 10</b>—Isolated mid <i>Eucalyptus</i> spp. mallee and isolated mid to tall mixed shrubs over open low to low <i>Aluta maisonneuvei</i> subsp. <i>maisonneuvei</i> shrubland over sparse to open low <i>Triodia basedowii</i> hummock grassland</p> <p><b>Shrubland 11</b>—Isolated tall <i>Callitris columellaris</i> shrubs over isolated low mixed shrubs and forbs</p> <p><b>Shrubland 14</b>—Isolated low <i>Eucalyptus</i> spp. mallee over mid open <i>Acacia ligulata</i> shrubland over low <i>Triodia basedowii</i> hummock grassland</p>
134—Mosaic: Hummock grasslands, open low tree steppe; desert bloodwood and feathertop spinifex (on) sandhills / Hummock grasslands, shrub steppe; mixed shrubs over spinifex between sandhills	<p><b>Grassland 2</b>—Isolated trees and shrubs over mid <i>Triodia basedowii</i> and <i>T. schinzii</i> hummock/tussock grassland</p> <p><b>Grassland 3</b>—Isolated trees and shrubs over low open <i>Triodia basedowii</i> hummock grassland</p> <p><b>Grassland 4</b>—Isolated mixed shrubs over emergent <i>Triodia basedowii</i> hummock grassland</p> <p><b>Grassland 5</b>—Isolated mixed shrubs to open shrubland over <i>Triodia schinzii</i>, <i>Aristida holathera</i> and <i>Eragrostis</i> spp. tussock grassland</p> <p><b>Grassland 6</b>— Isolated low <i>Casuarina pauper</i> trees over sparse low <i>Tecticornia</i> spp. chenopod shrubland over open low <i>Eragrostis</i> spp. tussock grassland</p> <p><b>Grassland 8</b>— Sparse mid <i>Acacia ligulata</i>, <i>Grevillea</i> spp. and <i>Senna artemisioides</i> subsp. <i>helmsii</i> shrubland over open mid <i>Triodia basedowii</i> hummock grassland</p> <p><b>Shrubland 1</b>—Low <i>Tecticornia indica</i> subsp. <i>bidens</i> shrubland over low mixed tussock grassland, mixed <i>Cyperus</i> spp. sedgeland and isolated low mixed forbs</p> <p><b>Shrubland 2</b>—A mid <i>Acacia ligulata</i> shrubland over isolated low <i>Aluta maisonneuvei</i> subsp. <i>maisonneuvei</i>, <i>Eremophila forrestii</i> and <i>Seringia elliptica</i> shrubs over a mid <i>Triodia basedowii</i>, <i>T. schinzii</i> and <i>Eragrostis</i></p>



Shepherd <i>et al.</i> (2002) vegetation association	Vegetation types identified in the study area
	<p><i>eriopoda</i> hummock/tussock grassland over isolated clumps of low <i>Euphorbia boophthona</i> and <i>Goodenia triodiophila</i> forbs</p> <p><b>Shrubland 3</b>—Low isolated trees to open woodland of <i>Acacia</i> spp. or occasionally <i>Eucalyptus gamophylla</i> mallee over <i>Eremophila forrestii</i>, <i>Eremophila</i> spp. and <i>Senna</i> spp. shrubland over low <i>Triodia basedowii</i> hummock grassland</p> <p><b>Shrubland 4</b>—<i>Melaleuca interioris</i> shrubland over isolated low mixed shrubs over isolated mixed grasses to sparse low mixed grassland and isolated low mixed forbs</p> <p><b>Shrubland 6</b>—Sparse tall to tall <i>Acacia burkittii</i> shrubland over sparse mid <i>Acacia tetragonophylla</i> and <i>Senna artemisioides</i> subsp. <i>petiolaris</i> shrubland over isolated low <i>Eragrostis</i> spp. and <i>Enneapogon caerulescens</i> tussock grasses and isolated low mixed forbs</p> <p><b>Shrubland 7</b>—Low to mid <i>Aluta maisonneuvei</i> subsp. <i>maisonneuvei</i> shrubland over low open <i>Triodia schinzii</i> tussock grassland</p> <p><b>Shrubland 9</b>—Isolated low trees to low open <i>Corymbia chippendalei</i> and <i>Eucalyptus gamophylla</i> woodland over low mixed shrubland over isolated low grasses to low open <i>Triodia schinzii</i> and <i>Aristida</i> spp. tussock grassland</p> <p><b>Samphire Shrublands</b>—Mosaic of <i>Tecticornia</i> species</p> <p><b>Shrubland 10</b>—Isolated mid <i>Eucalyptus</i> spp. mallee and isolated mid to tall mixed shrubs over open low to low <i>Aluta maisonneuvei</i> subsp. <i>maisonneuvei</i> shrubland over sparse to open low <i>Triodia basedowii</i> hummock grassland</p> <p><b>Shrubland 11</b>— Isolated tall <i>Callitris columellaris</i> shrubs over isolated low mixed shrubs and forbs</p> <p><b>Shrubland 12</b>— Mid <i>Corynotheca pungens</i> shrubland over isolated low <i>Eragrostis pegracillis</i> and <i>E. dielsii</i> tussock grasses and isolated low <i>Marsilea 80irsute</i> and <i>Bergia pedicellaris</i> forbs</p> <p><b>Shrubland 14</b>— Isolated low <i>Eucalyptus</i> spp. mallee over mid open <i>Acacia ligulata</i> shrubland over low <i>Triodia basedowii</i> hummock grassland</p> <p><b>Woodland 1</b>—Low <i>Acacia</i> spp. (Mulga) woodland over <i>Eremophila</i> and <i>Senna</i> spp. low to mid shrubland over isolated low grasses to open low mixed tussock grassland and isolated low mixed forbs</p> <p><b>Woodland 5</b>—Low <i>Acacia mulganeura</i>, <i>A. incurvaneura</i> and <i>Grevillea berryana</i> woodland over open low <i>Eremophila margarethae</i> shrubland over open low <i>Triodia melvillei</i> tussock grassland</p> <p><b>Woodland 6</b>— Low <i>Acacia</i> spp. (Mulga) and <i>A. subcontorta</i> woodland over sparse to open mid <i>Acacia</i> spp. and <i>Eremophila</i> spp. shrubland over sparse to open low <i>Triodia basedowii</i> hummock grassland</p> <p><b>Woodland 7</b>— Low <i>Acacia aneura</i> and <i>A. macraneura</i> woodland over open mid <i>Eremophila forrestii</i> subsp. <i>forrestii</i> and <i>Senna artemisioides</i> subsp. <i>helmsii</i> shrubland over mid <i>Triodia basedowii</i> hummock grassland</p>
178—Hummock grasslands, grass steppe; hard spinifex <i>Triodia basedowii</i>	<b>Grassland 3</b> —Isolated trees and shrubs over low open <i>Triodia basedowii</i> hummock grassland

### 5.3 SURVEY LIMITATIONS

Comprehensive flora and vegetation surveys generally require multiple surveys, at different times of year and over a period of a number of years to enable observation of all species present. Some flora species, such as annuals, are only available for collection at certain times of the year when they are flowering. Furthermore, climatic and stochastic events such as fire may affect the presence of certain plant species or the timing of flowering. Species with low abundance in an area are more difficult to locate.

The limitations of the current flora and vegetation survey have been considered in accordance with the potential survey limitations listed in Guidance Statement 51 (EPA 2004) (Table 5-12) which was current at the time of the field surveys.

Table 5-12 Survey limitations from EPA Guidance Statement 51 (EPA 2004)

Limitations	Limitation for this survey?	Comments
Sources of information and availability of contextual information	Yes	There is a paucity of comparative data in this area regarding flora and vegetation.
Scope — i.e. what life forms were collected	Yes	The surveys were restricted to flowering plants; fungi and non-vascular plants (e.g. alga, mosses and liverworts) were not systematically searched for.
Proportion of flora collected and identified	Yes	A large number of plant taxa were recorded and identified and the numbers of species, family and genera compare favourably with that recorded previously in the area.  Approximately 6% of taxa recorded could not be identified to species level including a number (11) of <i>Tecticornia</i> species, despite submission to the state herbarium, as plants were sterile at the time of the surveys.
Completeness — was the study area fully surveyed	No	Following the first phase autumn field survey of the northern section it was noted that further quadrat surveys and relevés were required to define vegetation units along the proposed haul road and immediately surrounding the lakes. These surveys were conducted during the second phase spring survey completing a comprehensive survey.  Survey of the southern section was limited to three transects in the riparian vegetation which were surveyed during both phases.  Survey of Lake Sunshine was limited to a single phase.
Mapping reliability	Yes	The currency of aerial imagery available for mapping is dated and does not identify recent fire scars.  Difficulty in defining boundaries within the samphire shrubland vegetation types from aerial imagery precluded mapping of each of the vegetation types defined and these vegetation types were subsequently mapped as a single mosaic.  Due to complex and often mosaic floristic composition of the vegetation, grouping of quadrats within the dendrogram did not precisely concur with field observations as to the vegetation types

Limitations	Limitation for this survey?	Comments
		present in the study area.
Timing, weather, season, cycle	No	<p>For the northern and southern areas substantial rainfall events prior to the first phase autumn survey ensured that a high number of annual and short-lived plant species were present and that the majority of plant species were flowering and or fruiting facilitating identification. Site revisits in the second phase spring survey facilitated the identification of numerous taxa to species level that previously were identified only to genus level.</p> <p>The survey of Lake Sunshine was limited to a single phase with the survey conducted in spring following a dry period and the number of annual species present was subsequently limited.</p>
Disturbances which affected the results of the survey – fire, flood, human intervention	No	No disturbances occurring during the period of the field survey are considered to have impacted the results.
Intensity - in retrospect, was the intensity adequate	No	The survey intensity was appropriate for the areas that were surveyed.
Resources	No	The survey was sufficiently resourced.
Access problems	No	The use of a helicopter facilitated access to undertake survey work in all areas.
Competency/experience of survey team	No	The field and laboratory teams and report authors have extensive experience, including taxonomic experience, in survey of flora and vegetation in WA.; some taxonomic groups (i.e. <i>Tecticornia</i> ) were outsourced to experts at the WA Herbarium.

## 6 DISCUSSION

In assessing development proposals, the EPA's broad objective for flora and vegetation surveys is to protect flora and vegetation so that biological diversity and ecological integrity are maintained (EPA 2016a). Considerations for flora and vegetation in EIA include the significance of the flora and vegetation (see section 2), current state of knowledge of the flora and vegetation present, the potential impacts to flora and vegetation, the scale at which the impacts are considered and application of the mitigation hierarchy to avoid or minimise impacts.

The aim of this assessment was to identify the flora species and vegetation communities present within the study area, with emphasis on significant flora and vegetation, to inform an EIA for the Project in relation to the environmental factor flora and vegetation.

The study area is situated in a poorly surveyed area where the eastern Gascoyne and south-western Little Sandy Desert bioregions intercept and where limited contextual information, particularly for conservation significant species, exists (van Leeuwen 2002). This was evident in the poor return from the desktop review.

The paucity of regional context and the limitation of a single phase survey at Lake Sunshine, and limited survey effort for the southern section (restricted to three transects in the riparian vegetation) must be considered when interpreting the results of this survey. Further, weather conditions leading up to Lake Sunshine were suboptimal, with below average rainfall, and this may have impacted survey results/completeness for this section as conditions were not optimal for recording annual species.

### 6.1 FLORA

The number of plant taxa recorded from the study area compares favourably with other studies conducted in the region (Table 6-1). Although the study area represented only 3.2% of that of the regional survey by Van Leeuwen (2002), 93% of the number of species were recorded in the study area at Beyondie Lakes, Ten Mile Lake and Lake Sunshine. The number of recorded species was also considerably larger than that reported by Enviroworks (2010a, b). The survey also recorded large range extensions for several species. These records could be considered locally significant as they represent the range limit for these species.

**Table 6-1 Comparison of floristic data from the current survey with previous flora surveys conducted within close proximity of the study area**

Survey	Area	No. quadrats/relevés	No. of vegetation types	No. of identified species	No. of families	No. of genera	No. of weeds
EnviroWorks (2010a)	- <sup>1</sup>	191	7	67	25	41	0
EnviroWorks (2010b)	- <sup>1</sup>	- <sup>1</sup>	6	79	26	48	1
Van Leeuwen (2002)	9,119 km <sup>2</sup>	53	18	522	67	206	3
This survey	295.9 km <sup>2</sup>	111	53	487	57	181	9

<sup>1</sup> Information not supplied in document.



The survey recorded four conservation significant species all of which are State listed Priority 1 species:

- *Tecticornia globulifera*
- *Tecticornia* sp. Christmas Creek
- *Tecticornia* sp. Little Sandy Desert
- *Tecticornia* sp. Sunshine Lake.

Two unidentified taxa collected in the survey, *Tecticornia* sp. nov. 1 (aff. pruinosa/ laevigata) and *Tecticornia* sp. nov. 2 (aff. pruinosa/undulata), potentially represent undescribed taxa. These may be considered locally significant as they exhibit anomalous features. Further specimens are required to provide sufficient taxonomic characters for definitive identification.

At the family level, the Fabaceae were the most commonly collected group in the study area based on the number of species (Table 6-2). The Fabaceae were also the most commonly recorded family in all other surveys conducted in the region (Table 6-2). Overall, the ten most common plant families based on the number of species collected, represented almost three quarters of the number of species collected in the survey of the study area, which was over 5% higher than for the other regional surveys considered (Table 6-2).

**Table 6-2 Species numbers of the most dominant plant families recorded in the study area in comparison with other regional studies**

Family	This study	EnviroWorks (2010b)	EnviroWorks (2010a)	Van Leeuwen (2002)
Chenopodiaceae	71	3	2	34
Poaceae	60	9	7	52
Fabaceae	73	15	15	86
Malvaceae	36	3	2	25
Scrophulariaceae	16	6	4	21
Goodeniaceae	21	2	0	35
Amaranthaceae	21	3	3	22
Asteraceae	29	2	1	46
Myrtaceae	16	8	8	29
Lamiaceae	12	2	2	14
<b>Total number of species</b>	<b>355</b>	<b>53</b>	<b>44</b>	<b>364</b>
<b>% species of all species recorded</b>	<b>72.9</b>	<b>67.1</b>	<b>65.7</b>	<b>65.9</b>

Overall, results replicated the findings of van Leeuwen (2002), thereby underlining the poor floristic knowledge of the region, that apparently supports a high plant diversity with some conservation significant species.

## 6.2 VEGETATION

The majority of the vegetation types defined for the study area are representative of the broad vegetation types mapped by Shepherd *et al.* (2002). Each of the vegetation types, with the exception

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of Samphire shrubland, are classed as Least Concern as in excess 90% of pre-European extent remain (Government of Western Australia 2015). Consequently, the majority of the vegetation in the study area represents widespread communities and is well represented at a regional level. The paucity of information for the region precludes more detailed assessment of the regional significance of the vegetation.

The samphire shrublands in the study area may be considered locally significant as they represent habitat for conservation significant species.

Based on the results of the current survey, *Tecticornia* shrublands on the lake playa and beaches may hold the highest conservation value of the vegetation types defined, as they represent habitat for conservation significant species and the potentially previously undescribed species. The Western Australian *Tecticornia* include many undescribed species and many species that are currently listed as conservation significant (DPaW 2015a). Regionally, new species of *Tecticornia* have been described from the Little Sandy Desert fairly recently (Shepherd & Van Leeuwen 2007).

Effects of hydrological changes on *Tecticornia* are poorly studied. A physiological greenhouse study on three *Tecticornia* from the Fortescue Marsh in the Pilbara region found varying levels of survival to drought conditions (Marchesini *et al.* 2014). This confirms the notion that different species of halophytes exhibit differences in salinity tolerance, water use and ability to survive periods of inundation (Shepherd & van Leeuwen 2011). The diverse mosaic of *Tecticornia* in the study area therefore requires specific consideration in relation to potential hydrological changes in the future.

In summary, the study area features a comparatively diverse flora in a floristically poorly known region as evidenced by a number of range extensions. The *Tecticornia* shrublands on the lake playa and beaches appear to hold the highest conservation value of the vegetation types defined as they represent habitat for conservation significant species and the potentially undescribed species.

Should development impact on the riparian areas of any of the lakes then future survey work should focus on identifying the distribution of Priority *Tecticornia* spp. likely to inhabit the area and identification of taxa not definitively identified to species level from the current surveys, particularly the potentially undescribed species, to limit impacts to significant flora. Further surveys are recommended for the riparian vegetation of the southern section, if development is likely to impact these areas, as the current survey is limited to three transects and it is highly likely that further populations of Priority Flora are present in this area. The survey of Lake Sunshine was restricted to a single phase in sub-optimal survey conditions and as such further survey effort may be warranted in areas to be impacted by the development.

## 7 REFERENCES

- ALA. 2015. *Atlas of Living Australia*. Available at: <http://www.ala.org.au/> (accessed 6 August 2015).
- Anonymous. 2013. *Birriliburu - Central Western Australia, declared an Indigenous Protected Area in April 2013*. Factsheet. Available at: <http://www.environment.gov.au/indigenous/ipa/pubs/fs-birriliburu.pdf> (accessed 16 April 2015).
- Australian Weeds Committee. 2012. *Weeds of National Significance 2012*. Department of Agriculture, Fisheries and Forestry, Canberra, ACT.
- AWC. 2007. *The Australian Weeds Strategy. A national strategy for weed management in Australia*. Natural Resource Management Ministerial Council, Australian Weeds Committee, Canberra, ACT. Available at: <http://www.environment.gov.au/biodiversity/invasive/weeds/publications/strategies/pubs/weed-strategy.pdf> (accessed 20 November 2015).
- Belbin, L. 2003. *PATN. A revised user's guide*. . Blatant Fabrications Pty Ltd, Bonnet Hill, Tas.
- BoM. 2016. *Climate statistics for Australian locations*. Commonwealth of Australia, Bureau of Meteorology. Available at: <http://www.bom.gov.au/climate/data/>
- Cowan, M. & Kendrick, P. 2001. Little Sandy Desert 2 (LSD2—Trainor subregion). *In: May, J. E. & McKenzie, N. L. (eds) A biodiversity audit of Western Australia's 53 biogeographical subregions in 2002*. Department of Conservation and Land Management, Perth, WA, pp. 413–422.
- DAFWA. 2014. *Soil-landscape systems of Western Australia*. Department of Agriculture and Food Western Australia, South Perth, WA. Dataset provided by DAFWA, April 2015.
- Department of the Environment. 2015. *Protected matters search tool*. Australian Government Department of Sustainability, Environment, Water, Population and Communities, Canberra, ACT. Available at: <http://www.environment.gov.au/epbc/pmst/index.html>
- Department of the Environment and Energy. 2016. *Maps: Australia's bioregions (IBRA)*. Department of the Environment and Energy, Canberra, ACT. Available at: <http://www.environment.gov.au/topics/land/national-reserve-system/science-maps-and-data/australias-bioregions-ibra>
- Desmond, A., Kendrick, P. & Chant, A. 2001. Gascoyne 3 (GAS3—Augustus subregion). *In: May, J. E. & McKenzie, N. L. (eds) A biodiversity audit of Western Australia's 53 biogeographical subregions in 2002*. Department of Conservation and Land Mangement, pp. 240–251.
- DEWHA. 2008a. *Rangelands 2008 - taking the pulse. Gascoyne bioregion*. Department of Environment, Water, Heritage and the Arts, Parkes, ACT. Available at: <http://www.environment.gov.au/system/files/resources/a8015c25-4aa2-4833-ad9c-e98d09e2ab52/files/bioregion-gascoyne.pdf> (accessed 16 April 2015).
- DEWHA. 2008b. *Rangelands 2008 - taking the pulse. Little Sandy Desert bioregion*. Department of Environment, Water, Heritage and the Arts, Parkes, ACT. Available at: <http://www.environment.gov.au/land/publications/acris/pubs/bioregion-little-sandy-desert.pdf> (accessed 25 July 2013).
- DPaW. 2015a. *Florabase*. Department of Parks and Wildlife. Available at: <http://florabase.dpaw.wa.gov.au/>
- DPaW. 2015b. *NatureMap*. Department of Parks and Wildlife, Perth, WA. Available at: <http://naturemap.dec.wa.gov.au/>
- DPaW. 2015c. *Threatened Flora, Fauna and Ecological Communities database searches*. Department of Parks and Wildlife, Kensington, WA. Available at: [http://www.dpaw.wa.gov.au/images/documents/plants-animals/threatened-species/Database\\_Search\\_request\\_information\\_sheet\\_2015.pdf](http://www.dpaw.wa.gov.au/images/documents/plants-animals/threatened-species/Database_Search_request_information_sheet_2015.pdf)
- English, V. & Blyth, J. 1997. *Identifying and conserving threatened ecological communities (TECs) in the South West Botanical Province*. Department of Conservation and Land Management, Wanneroo, WA.
- EnviroWorks. 2010a. *Flora, vegetation and fauna habitat survey, autumn 2010, Beyondie Exploration Area*. EnviroWorks Consulting, East Perth, WA.

- EnviroWorks. 2010b. *Flora, vegetation and fauna habitat survey, Beyondie Exploration Area*. EnviroWorks Consulting, East Perth, WA.
- EPA. 2000. *Position Statement No. 2. Environmental protection of native vegetation in Western Australia. Clearing of native vegetation, with particular reference to the agricultural area*. Environmental Protection Authority, Perth, WA. Position Statement No. 2. Available at: [http://edit.epa.wa.gov.au/EPADocLib/1032\\_PS2.pdf](http://edit.epa.wa.gov.au/EPADocLib/1032_PS2.pdf) (accessed 15 November 2015).
- EPA. 2002. *Position Statement no. 3. Terrestrial biological surveys as an element of biodiversity protection*. Environmental Protection Authority, Perth, WA. Available at: [http://www.epa.wa.gov.au/docs/1033\\_PS3.pdf](http://www.epa.wa.gov.au/docs/1033_PS3.pdf) (accessed 7 September 2012).
- EPA. 2004. *Guidance for the assessment of environmental factors (in accordance with the Environmental Protection Act 1986). Terrestrial flora and vegetation surveys for environmental impact assessment in Western Australia. No. 51*. Environmental Protection Authority, Perth, WA. Available at: [http://www.epa.wa.gov.au/docs/1839\\_gs51.pdf](http://www.epa.wa.gov.au/docs/1839_gs51.pdf) (accessed 2 April 2013).
- EPA. 2006. *Guidance for the assessment of environmental factors (in accordance with the Environmental Protection Act 1986). Level of assessment for proposals affecting natural areas within the System 6 Region and Swan Coastal Plain portion of the System 1 Region. No. 10*. Environmental Protection Authority, Perth, WA.
- EPA. 2016a. *Environmental Factor Guideline. Flora and vegetation*. Environmental Protection Authority, Perth, WA. Available at: [http://www.epa.wa.gov.au/sites/default/files/Policies\\_and\\_Guidance/Guideline-Flora-Vegetation-131216\\_4.pdf](http://www.epa.wa.gov.au/sites/default/files/Policies_and_Guidance/Guideline-Flora-Vegetation-131216_4.pdf) (accessed 20 December 2016).
- EPA. 2016b. *Technical Guidance. Flora and vegetation surveys for Environmental Impact Assessment*. Environmental Protection Authority, Perth, WA. Available at: [http://www.epa.wa.gov.au/sites/default/files/Policies\\_and\\_Guidance/EPA%20Technical%20Guidance%20-%20Flora%20and%20Vegetation%20survey\\_Dec13.pdf](http://www.epa.wa.gov.au/sites/default/files/Policies_and_Guidance/EPA%20Technical%20Guidance%20-%20Flora%20and%20Vegetation%20survey_Dec13.pdf) (accessed 20 December 2016).
- EPA & DPaW. 2015. *Technical guide - flora and vegetation surveys for environmental impact assessment*. Environmental Protection Authority and Department of Parks and Wildlife, Perth, WA. (accessed 7 September 2012).
- Government of Western Australia. 2013. *Biosecurity and Agriculture Management Regulations 2013*. Government of Western Australia, Perth, WA. Available at: [http://www.slp.wa.gov.au/gazette/gazette.nsf/lookup/2013-18/\\$file/gg018.pdf](http://www.slp.wa.gov.au/gazette/gazette.nsf/lookup/2013-18/$file/gg018.pdf)
- Government of Western Australia. 2015. *2015 Statewide Vegetation Statistics incorporating the CAR Reserve Analysis (Full Report). Current as of May 2016*. Department of Parks and Wildlife, Perth, WA. Available at: <https://www2.landgate.wa.gov.au/web/guest/downloader> (accessed 8 August 2016).
- Marchesini, V. A., Yin, C. M., Colmer, T. D. & Veneklaas, E. J. 2014. Drought tolerances of three stem-succulent halophyte species of an inland semiarid salt lake system. *Functional Plant Biology* 41: 1230–1238.
- NVIS. 2003. *National Vegetation Information System — Australian vegetation attribute manual (version 6.0)*. Department to Environment and Heritage, Canberra. Available at: <http://www.environment.gov.au/topics/science-and-research/databases-and-maps/national-vegetation-information-system>
- Shepherd, D. P., Beeston, G. R. & Hopkins, A. J. M. 2002. *Native vegetation in Western Australia. Extent, type and status*. Department of Agriculture, South Perth, WA. Resource Management Technical Report 249.
- Shepherd, K. A. & Van Leeuwen, S. 2007. *Tecticornia bibenda* (Chenopodiaceae: Salicornioideae), a new C4 samphire from the Little Sandy Desert, Western Australia. *Nuytsia* 16: 383-391.
- Shepherd, K. A. & van Leeuwen, S. J. 2011. *Tecticornia globulifera* and *T. medusa* (subfamily Salicornioideae: Chenopodiaceae), two new priority samphires from the Fortescue Marsh in the Pilbara region of Western Australia. *Telopea* 13: 349–358.
- Thackway, R. & Cresswell, I. D. 1995. *An interim biogeographical regionalisation for Australia (IBRA version 4.0)*. Australian Government.



Flora and vegetation survey for the Beyondie Potash Project

Client: Kalium Lakes Potash Pty Ltd

- Trudgen, M. E. 1991. Vegetation Condition Scale. *In: National Trust (WA) (ed.) 1993 Urban Bushland Policy*. National Trust of Australia (WA), Wildflower Society of Western Australia (Inc.) and the Tree Society (Inc.), Perth, WA.
- van Leeuwen, S. 2002. *Biological survey of the south-western Little Sandy Desert*. Department of Conservation and Land Management, Perth, WA. Final report, National Reserve System Project N706.
- Western Australian Government. 2015. Wildlife Conservation Act 1950 - Wildlife Conservation (Rare Flora) Notice 2015. *Western Australian Government Gazette* **166**: 4525–4531.

Appendix 1 Survey site descriptions

Appendix 2 NVIS vegetation community structure classifications

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)	Bryophyte, lichen, seagrass, aquatic
8	>30	tall	N/A	N/A	N/A	N/A
7	10-30	mid	N/A	tall	N/A	N/A
6	<10	low	N/A	mid	N/A	N/A
5	<3	N/A	N/A	low	N/A	N/A
4	>2	N/A	tall	N/A	tall	N/A
3	1-2	N/A	mid	N/A	tall	N/A
2	0.5-1	N/A	low	N/A	mid	tall
1	<0.5	N/A	low	N/A	low	low

Structural Formation Classes

Growth form	Height ranges (m)	Structural formation classes					
Foliage cover % (cover #)		70-100% (5)	30-70% (4)	10-30% (3)	<10% (2)	0-5% (1)	≈0% (N)
tree, palm	<10,10-30,>30	closed forest	open forest	woodland	open woodland	isolated trees	isolated clumps of trees
tree mallee	<3, <10, 10-30	closed mallee forest	open mallee forest	mallee woodland	open mallee woodland	isolated mallee trees	isolated clumps of mallee trees
shrub, cycad, grass-tree, tree-fern	<1,1-2,>2	closed shrubland	shrubland	open shrubland	sparse shrubland	isolated shrubs	isolated clumps of shrubs
mallee shrub	<3, <10, 10-30	closed mallee shrubland	mallee shrubland	open mallee shrubland	sparse mallee shrubland	isolated mallee shrubs	isolated clumps of mallee shrubs
heath shrub	<1,1-2,>2	closed heathland	heathland	open heathland	sparse heathland	isolated heath shrubs	isolated clumps of heath shrubs
chenopod shrub	<1,1-2,>2	closed chenopod shrubland	chenopod shrubland	open chenopod shrubland	sparse chenopod shrubland	isolated chenopod shrubs	isolated clumps of chenopod shrubs

Growth form	Height ranges (m)	Structural formation classes					
samphire shrub	<0.5,>0.5	closed samphire shrubland	samphire shrubland	open samphire shrubland	sparse samphire shrubland	isolated samphire shrubs	isolated clumps of samphire shrubs
hummock grass	<2,>2	closed hummock grassland	hummock grassland	open hummock grassland	sparse hummock grassland	isolated hummock grasses	isolated clumps of hummock grasses
tussock grass	<0.5,>0.5	closed tussock grassland	tussock grassland	open tussock grassland	sparse tussock grassland	isolated tussock grasses	isolated clumps of tussock grasses
other grass	<0.5,>0.5	closed grassland	grassland	open grassland	sparse grassland	isolated grasses	isolated clumps of grasses
sedge	<0.5,>0.5	closed sedgeland	sedgeland	open sedgeland	sparse sedgeland	isolated sedges	isolated clumps of sedges
rush	<0.5,>0.5	closed rushland	rushland	open rushland	sparse rushland	isolated rushes	isolated clumps of rushes
forb	<0.5,>0.5	closed forbland	forbland	open forbland	sparse forbland	isolated forbs	isolated clumps of forbs
fern	<1,1-2,>2	closed fernland	fernland	open fernland	sparse fernland	isolated ferns	isolated clumps of ferns
bryophyte	<0.5	closed bryophyteland	bryophyteland	open bryophyteland	sparse bryophyteland	isolated bryophytes	isolated clumps of bryophytes
lichen	<0.5	closed lichenland	lichenland	open lichenland	sparse lichenland	isolated lichens	isolated clumps of lichens
vine	<10,10-30,>30	closed vineland	vineland	open vineland	sparse vineland	isolated vines	isolated clumps of vines
aquatic	0-0.5,<1	closed aquatic bed	aquatic bed	open aquatic bed	sparse aquatics	isolated aquatics	isolated clumps of aquatics
seagrass	0-0.5,<1	closed seagrass bed	seagrass bed	open seagrass bed	sparse seagrass bed	isolated seagrasses	isolated clumps of seagrasses



## Appendix 3 Flora species identified in the desktop review

Family	Species
Aizoaceae	<i>Gunnioopsis</i> sp. Lake Kerrylyn (N. Gibson et al. NG 7028)
	<i>Trianthema glossostigmum</i>
	<i>Trianthema triquetrum</i>
	<i>Trianthema turgidifolium</i>
Amaranthaceae	* <i>Aerva javanica</i>
	<i>Amaranthus cuspidifolius</i>
	<i>Amaranthus mitchellii</i>
	<i>Amaranthus</i> sp. Little Sandy Desert (SVL 3348)
	<i>Ptilotus aevroides</i>
	<i>Ptilotus albidus</i>
	<i>Ptilotus aphyllus</i>
	<i>Ptilotus astrolasius</i>
	<i>Ptilotus calostachyus</i>
	<i>Ptilotus carinatus</i>
	<i>Ptilotus chrysocomus</i>
	<i>Ptilotus daphne</i>
	<i>Ptilotus exaltatus</i>
	<i>Ptilotus fusiformis</i>
	<i>Ptilotus gaudichaudii</i>
	<i>Ptilotus helipteroides</i>
	<i>Ptilotus macrocephalus</i>
	<i>Ptilotus obovatus</i>
	<i>Ptilotus polystachyus</i>
	<i>Ptilotus rotundifolius</i>
	<i>Ptilotus schwartzii</i>
	<i>Ptilotus schwartzii</i> var. <i>georgei</i>
	<i>Ptilotus</i> sp. Little Sandy Desert (SVL 2884)
<i>Ptilotus stipitatus</i>	
<i>Ptilotus tetrandrus</i>	
<i>Surreya diandra</i>	
Apiaceae	<i>Daucus glochidiatus</i>
Apocynaceae	<i>Cynanchum floribundum</i>
	<i>Marsdenia australis</i>
	<i>Rhyncharrhena linearis</i>
	<i>Sarcostemma viminale</i> subsp. <i>australe</i>
Araliaceae	<i>Trachymene bialata</i>
	<i>Trachymene glaucifolia</i>
	<i>Trachymene oleracea</i>
Asparagaceae	<i>Lomandra leucocephala</i> subsp. <i>robusta</i>
	<i>Thysanotus exiliflorus</i>
	<i>Thysanotus</i> sp. Desert East of Newman (R.P. Hart 964)
Asteraceae	<i>Actinobole uliginosum</i>
	<i>Angianthus cyathifer</i>
	<i>Angianthus milnei</i>

Family	Species
	<i>Angianthus</i> sp. Little Sandy Desert (SVL 2911)
	<i>Angianthus tomentosus</i>
	* <i>Bidens bipinnata</i>
	<i>Brachyscome iberidifolia</i>
	<i>Calocephalus beardii</i> P.S. Short ms
	<i>Calocephalus knappii</i>
	<i>Calotis erinacea</i>
	<i>Calotis hispidula</i>
	<i>Centipeda thespidioides</i>
	<i>Chrysocephalum eremaeum</i>
	<i>Chrysocephalum</i> sp. Little Sandy Desert (SVL 4899)
	<i>Erymophyllum ramosum</i> subsp. <i>ramosum</i>
	Genus nov. sp. nov. Little Sandy Desert (SVL 2645)
	<i>Gnephosis brevifolia</i>
	<i>Ixiochlamys cuneifolia</i>
	<i>Kippistia suaedifolia</i>
	<i>Minuria multiseta</i>
	<i>Minuria</i> sp. Little Sandy Desert 1 (SVL 4919)
	<i>Myriocephalus rudallii</i>
	<i>Olearia incana</i>
	<i>Olearia</i> sp. Little Sandy Desert (SVL 3335)
	<i>Olearia stuartii</i>
	<i>Peripleura arida</i>
	<i>Pluchea dentex</i>
	<i>Pluchea tetranthera</i>
	<i>Podolepis canescens</i>
	<i>Podolepis capillaris</i>
	<i>Podolepis kendallii</i>
	<i>Pterocaulon sphacelatum</i>
	<i>Rhodanthe charsleyae</i>
	<i>Rhodanthe floribunda</i>
	<i>Rhodanthe humboldtiana</i>
	<i>Rhodanthe polakii</i>
	<i>Rhodanthe propinqua</i>
	<i>Rhodanthe sterilecens</i>
	<i>Rhodanthe stricta</i>
	<i>Rhodanthe tietkensis</i>
	<i>Rutidosia helichrysoides</i>
	<i>Schoenia cassiniana</i>
	<i>Senecio gregorii</i>
	<i>Senecio magnificus</i>
	<i>Streptoglossa bubakii</i>
	<i>Streptoglossa cylindriceps</i>
	<i>Streptoglossa decurrens</i>
	<i>Taplinia saxatilis</i>

Family	Species
	<i>Tietkensia corrickiae</i>
	<i>Vittadinia eremaea</i>
	<i>Waitzia acuminata</i> var. <i>acuminata</i>
	<i>Xerochrysum</i> sp. Beyondie (SVL 1831)
Boraginaceae	<i>Halgania cyanea</i> var. Allambi Stn (B.W. Strong 676)
	<i>Halgania glabra</i>
	<i>Halgania gustafsenii</i>
	<i>Halgania solanacea</i> var. Mt Doreen (G.M. Chippendale 4206)
	<i>Heliotropium chrysocarpum</i>
	<i>Heliotropium curassavicum</i>
	<i>Trichodesma zeylanicum</i> var. <i>zeylanicum</i>
Brassicaceae	<i>Lepidium echinatum</i>
	<i>Lepidium muelleri-ferdinandii</i>
	<i>Lepidium oxytrichum</i>
	<i>Lepidium pedicellosum</i>
	<i>Lepidium phlebopetalum</i>
	<i>Menkea sphaerocarpa</i>
	<i>Menkea villosula</i>
	<i>Stenopetalum anfractum</i>
	<i>Stenopetalum decipiens</i>
	<i>Stenopetalum lineare</i> var. <i>lineare</i>
	<i>Stenopetalum pedicellare</i>
	<i>Stenopetalum</i> sp. Little Sandy Desert (SVL 4964)
	<i>Stenopetalum velutinum</i>
Campanulaceae	<i>Lobelia heterophylla</i>
	<i>Wahlenbergia tumidifructa</i>
Capparaceae	<i>Capparis lasiantha</i>
	<i>Capparis spinosa</i>
	<i>Cassytha filiformis</i>
Caryophyllaceae	<i>Polycarpaea holtzei</i>
	<i>Polycarpaea involucreta</i>
Casuarinaceae	<i>Allocasuarina decaisneana</i>
	<i>Casuarina pauper</i>
Celastraceae	<i>Macgregoria racemigera</i>
	<i>Maytenus</i> sp. Mt Windell (SVL 846)
	<i>Stackhousia clementii</i>
	<i>Stackhousia intermedia</i>
	<i>Stackhousia megaloptera</i>
	<i>Stackhousia</i> sp. Lake Mackay (P.K. Latz 12870)
	<i>Stackhousia</i> sp. Little Sandy Desert (SVL 4426)
	<i>Stackhousia</i> sp. swollen gynophore (W.R. Barker 2041)
Centrolepidaceae	<i>Centrolepis eremica</i>
Chenopodiaceae	<i>Atriplex spongiosa</i>
	<i>Atriplex vesicaria</i>
	<i>Dissocarpus paradoxus</i>

Family	Species
	<i>Dysphania kalpari</i>
	<i>Dysphania melanocarpa</i>
	<i>Dysphania rhadinostachya</i>
	<i>Dysphania saxatilis</i>
	<i>Dysphania sphaerosperma</i>
	<i>Enchylaena tomentosa</i>
	<i>Maireana amoena</i>
	<i>Maireana carnosia</i>
	<i>Maireana georgei</i>
	<i>Maireana luehmannii</i>
	<i>Maireana melanocoma</i>
	<i>Maireana planifolia</i>
	<i>Maireana platycarpa</i>
	<i>Maireana prosthecochaeta</i>
	<i>Maireana</i> sp. Little Sandy Desert (SVL 2985)
	<i>Maireana thesioides</i>
	<i>Maireana tomentosa</i>
	<i>Maireana triptera</i>
	<i>Maireana villosa</i>
	<i>Rhagodia eremaea</i>
	<i>Rhagodia</i> sp. Little Sandy Desert (SVL 2984)
	<i>Salsola australis</i>
	<i>Sclerolaena alata</i>
	<i>Sclerolaena clelandii</i>
	<i>Sclerolaena cornishiana</i>
	<i>Sclerolaena cuneata</i>
	<i>Sclerolaena eriacantha</i>
	<i>Sclerolaena fimbriolata</i>
	<i>Sclerolaena</i> sp. Little Sandy Desert (SVL 2945)
	<i>Tecticornia bibenda</i>
	<i>Tecticornia calyptata</i>
	<i>Tecticornia disarticulata</i>
	<i>Tecticornia halocnemoides</i>
	<i>Tecticornia indica</i>
	<i>Tecticornia indica</i> subsp. <i>bidens</i>
	<i>Tecticornia indica</i> subsp. <i>leiostachya</i>
	<i>Tecticornia laevigata</i>
	<i>Tecticornia mellaria</i>
	<i>Tecticornia pterygosperma</i> subsp. <i>denticulata</i>
	<i>Tecticornia pterygosperma</i> subsp. <i>pterygosperma</i>
	<i>Tecticornia</i> sp. Christmas Creek (K.A. Shepherd & T. Colmer et al. KS 1063)
	<i>Tecticornia</i> sp. Little Sandy Desert (K.A. Shepherd & C. Wilkins KS 830)
	<i>Tecticornia</i> sp. Little Sandy Desert (SVL 4973)
	<i>Tecticornia</i> sp. Sunshine Lake (K.A. Shepherd et al. KS 867)
Cleomaceae	<i>Cleome oxalidea</i>



Family	Species
Colchicaceae	<i>Wurmbea deserticola</i>
Convolvulaceae	<i>Bonamia pannosa</i>
	<i>Duperreya commixta</i>
	<i>Evolvulus alsinoides</i>
Cucurbitaceae	<i>Mukia maderaspatana</i>
Cyperaceae	<i>Bulbostylis barbata</i>
	<i>Cyperus bulbosus</i>
	<i>Cyperus centralis</i>
	<i>Cyperus rigidellus</i>
	<i>Cyperus</i> sp. Little Sandy Desert (SVL 4470)
	<i>Cyperus squarrosus</i>
	<i>Eleocharis</i> sp. Little Sandy Desert (SVL 3055)
	<i>Fimbristylis dichotoma</i>
	<i>Fimbristylis</i> / <i>rara</i>
	<i>Fimbristylis sieberiana</i>
Droseraceae	<i>Drosera burmanni</i>
	<i>Drosera finlaysoniana</i>
	<i>Drosera indica</i>
Elaeocarpaceae	<i>Tetradlea chapmanii</i>
Elatinaceae	<i>Bergia trimera</i>
Euphorbiaceae	<i>Adriana tomentosa</i> var. <i>hookeri</i>
	<i>Euphorbia alsiniflora</i>
	<i>Euphorbia australis</i>
	<i>Euphorbia boophthona</i>
	<i>Euphorbia coghlanii</i>
	<i>Euphorbia sarcostemmoides</i>
	<i>Euphorbia stevenii</i>
	<i>Euphorbia tannensis</i> subsp. <i>eremophila</i>
	<i>Monotaxis luteiflora</i>
Fabaceae	<i>Acacia abrupta</i>
	<i>Acacia adoxa</i> var. <i>adoxo</i>
	<i>Acacia adsurgens</i>
	<i>Acacia</i> aff. <i>validinervia</i> (SVL 3234)
	<i>Acacia ancistrocarpa</i>
	<i>Acacia aneura</i>
	<i>Acacia aneura</i> var. (SVL 2545)
	<i>Acacia aptaneura</i>
	<i>Acacia ayersiana</i>
	<i>Acacia caesaneura</i>
	<i>Acacia balsamea</i>
	<i>Acacia bivenosa</i>
	<i>Acacia burkittii</i>
	<i>Acacia citrinoviridis</i>
	<i>Acacia coriacea</i> subsp. <i>pendens</i>
	<i>Acacia craspedocarpa</i>

Family	Species
	<i>Acacia cuthbertsonii</i>
	<i>Acacia daviesioides</i>
	<i>Acacia dictyophleba</i>
	<i>Acacia eriopoda</i>
	<i>Acacia grasbyi</i>
	<i>Acacia hilliana</i>
	<i>Acacia inaequilatera</i>
	<i>Acacia incurvaneura</i>
	<i>Acacia jamesiana</i>
	<i>Acacia kempeana</i>
	<i>Acacia ligulata</i>
	<i>Acacia maitlandii</i>
	<i>Acacia marramamba</i>
	<i>Acacia melleodora</i>
	<i>Acacia minyura</i>
	<i>Acacia nyssophylla</i>
	<i>Acacia oswaldii</i>
	<i>Acacia pachyacra</i>
	<i>Acacia paraneura</i>
	<i>Acacia prainii</i>
	<i>Acacia pruinocarpa</i>
	<i>Acacia pyrifolia</i> var. <i>pyrifolia</i>
	<i>Acacia quadrimarginea</i>
	<i>Acacia ramulosa</i> var. <i>linophylla</i>
	<i>Acacia ramulosa</i> var. <i>ramulosa</i>
	<i>Acacia rhodophloia</i>
	<i>Acacia sericophylla</i>
	<i>Acacia sibirica</i>
	<i>Acacia</i> sp. Little Sandy Desert (SVL 2397)
	<i>Acacia spondylophylla</i>
	<i>Acacia synchronicia</i>
	<i>Acacia tetragonophylla</i>
	<i>Acacia validinervia</i>
	<i>Acacia wanyu</i>
	<i>Acacia xiphophylla</i>
	<i>Crotalaria cunninghamii</i>
	<i>Cullen pustulatum</i>
	<i>Daviesia arthropoda</i>
	<i>Daviesia eremaea</i>
	<i>Daviesia grahamii</i>
	<i>Gastrolobium grandiflorum</i>
	<i>Gompholobium polyzygum</i>
	<i>Gompholobium simplicifolium</i>
	<i>Indigofera georgei</i>
	<i>Indigofera monophylla</i>

Family	Species
	<i>Isotropis atropurpurea</i>
	<i>Isotropis forrestii</i>
	<i>Jacksonia aculeata</i>
	<i>Kennedia prorepens</i>
	<i>Leptosema chambersii</i>
	<i>Lotus cruentus</i>
	<i>Mirbelia viminalis</i>
	<i>Muelleranthus stipularis</i>
	<i>Muelleranthus trifoliolatus</i>
	<i>Petalostylis cassioides</i>
	<i>Phyllota luehmannii</i>
	<i>Senna artemisioides</i> subsp. <i>helmsii</i>
	<i>Senna artemisioides</i> subsp. <i>oligophylla</i>
	<i>Senna artemisioides</i> subsp. <i>petiolaris</i>
	<i>Senna artemisioides</i> subsp. <i>x artemisioides</i>
	<i>Senna artemisioides</i> subsp. <i>x sturtii</i>
	<i>Senna curvistyla</i>
	<i>Senna glaucifolia</i>
	<i>Senna glutinosa</i> subsp. <i>chatelainiana</i>
	<i>Senna glutinosa</i> subsp. <i>glutinosa</i>
	<i>Senna glutinosa</i> subsp. <i>pruinosa</i>
	<i>Senna glutinosa</i> subsp. <i>x luerssenii</i>
	<i>Senna notabilis</i>
	<i>Senna pleurocarpa</i> var. <i>angustifolia</i>
	<i>Senna pleurocarpa</i> var. <i>pleurocarpa</i>
	<i>Senna</i> sp. Meekatharra (E. Bailey 1-26)
	<i>Swainsona formosa</i>
	<i>Swainsona kingii</i>
	<i>Swainsona microphylla</i>
	<i>Swainsona</i> sp. Little Sandy Desert (SVL 5017)
	<i>Templetonia egena</i>
	<i>Tephrosia</i> sp. deserts (J.R. Maconochie 1403)
	<i>Tephrosia</i> sp. Little Sandy Desert (SVL 3195)
	<i>Trigonella suavissima</i>
Frankeniaceae	<i>Frankenia cinerea</i>
	<i>Frankenia desertorum</i>
	<i>Frankenia fecunda</i>
	<i>Frankenia glomerata</i>
	<i>Frankenia interioris</i>
	<i>Frankenia laxiflora</i>
	<i>Frankenia punctata</i>
Gentianaceae	<i>Schenkia australis</i>
Goodeniaceae	<i>Brunonia australis</i>
	<i>Dampiera atriplicina</i>
	<i>Dampiera candicans</i>

Family	Species
	<i>Dampiera cinerea</i>
	<i>Dampiera dentata</i>
	<i>Dampiera ramosa</i>
	<i>Dampiera roycei</i>
	<i>Goodenia azurea</i>
	<i>Goodenia gypsicola</i>
	<i>Goodenia lamprosperma</i>
	<i>Goodenia microptera</i>
	<i>Goodenia modesta</i>
	<i>Goodenia muelleriana</i>
	<i>Goodenia pascua</i>
	<i>Goodenia ?pinifolia</i>
	<i>Goodenia prostrata</i>
	<i>Goodenia schwerinensis</i>
	<i>Goodenia</i> sp. Beyondie (L.W. Sage & S. van Leeuwen LWS 2518)
	<i>Goodenia</i> sp. Little Sandy Desert (SVL 2926)
	<i>Goodenia stobbsiana</i>
	<i>Goodenia triodiophila</i>
	<i>Goodenia wilunensis</i>
	<i>Goodenia xanthosperma</i>
	<i>Lechenaultia striata</i>
	<i>Scaevola amblyanthera</i> var. <i>centralis</i>
	<i>Scaevola basedowii</i>
	<i>Scaevola browniana</i> subsp. <i>browniana</i>
	<i>Scaevola collaris</i>
	<i>Scaevola parvifolia</i> subsp. <i>pilbarae</i>
	<i>Scaevola sericophylla</i>
	<i>Scaevola spinescens</i>
	<i>Velleia connata</i>
	<i>Velleia glabrata</i>
	<i>Velleia panduriformis</i>
Gyrostemonaceae	<i>Codonocarpus cotinifolius</i>
	<i>Gyrostemon ramulosus</i>
Haloragaceae	<i>Gonocarpus eremophilus</i>
	<i>Gonocarpus pycnostachyus</i>
	<i>Haloragis gossei</i>
	<i>Haloragis gossei</i> var. <i>gossei</i>
	<i>Haloragis odontocarpa</i> forma <i>pterocarpa</i>
	<i>Haloragis odontocarpa</i> forma <i>rugosa</i>
Hemerocallidaceae	<i>Corynotheca micrantha</i> var. <i>divaricata</i>
Hypericaceae	<i>Hypericum gramineum</i>
Juncaginaceae	<i>Triglochin nana</i>
Lamiaceae	<i>Clerodendrum tomentosum</i> var. <i>lanceolatum</i>
	<i>Dicrastylis cordifolia</i>
	<i>Dicrastylis doranii</i>



Family	Species
	<i>Dicrastylis exsuccosa</i>
	<i>Dicrastylis georgei</i>
	<i>Dicrastylis kumarinensis</i>
	<i>Dicrastylis</i> sp. Little Sandy Desert (SVL 2937)
	<i>Hemigenia tysonii</i>
	<i>Lachnostachys verbascifolia</i>
	<i>Microcorys macredieana</i>
	<i>Newcastelia cephalantha</i>
	<i>Newcastelia cladotricha</i>
	<i>Newcastelia spodiotricha</i>
	<i>Pityrodia loricata</i>
	<i>Prostanthera albiflora</i>
	<i>Prostanthera wilkieana</i>
	<i>Quoya loxocarpa</i>
Lauraceae	<i>Cassytha</i> sp. Little Sandy Desert (SVL 3233)
Loranthaceae	<i>Amyema bifurcata</i>
	<i>Amyema fitzgeraldii</i>
	<i>Amyema gibberula</i> var. <i>gibberula</i>
	<i>Amyema hilliana</i>
	<i>Amyema miquelii</i>
	<i>Amyema sanguinea</i> var. <i>pulchra</i>
	<i>Lysiana casuarinae</i>
	<i>Lysiana exocarpi</i>
Malvaceae	<i>Abutilon leucopetalum</i>
	<i>Abutilon</i> sp. Dioicum (A.A. Mitchell PRP 1618)
	<i>Abutilon</i> sp. Little Sandy Desert (SVL 2630)
	<i>Alyogyne pinoniana</i>
	<i>Androcalva luteiflora</i>
	<i>Brachychiton gregorii</i>
	<i>Corchorus obtectus</i>
	<i>Corchorus sidoides</i>
	<i>Corchorus</i> sp. Little Sandy Desert (SVL 2383)
	<i>Corchorus tectus</i> ms
	<i>Hannafordia bissillii</i> subsp. <i>bissillii</i>
	<i>Hibiscus arenicola</i>
	<i>Hibiscus burtonii</i>
	<i>Hibiscus coatesii</i>
	<i>Hibiscus gardneri</i> ms
	<i>Hibiscus leptocladus</i>
	<i>Hibiscus</i> sp. Carnarvon (S. van Leeuwen 5110)
	<i>Hibiscus</i> sp. Little Sandy Desert (SVL 2489)
	<i>Hibiscus sturtii</i> var. <i>truncatus</i>
	<i>Keraudrenia</i> sp. Little Sandy Desert (SVL 2376)
	<i>Keraudrenia velutina</i> subsp. <i>elliptica</i>
	<i>Lawrencia densiflora</i>

Family	Species
	<i>Lawrenzia glomerata</i>
	<i>Lawrenzia helmsii</i>
	* <i>Malvastrum americanum</i>
	<i>Sida arenicola</i>
	<i>Sida cardiophylla</i>
	<i>Sida echinocarpa</i>
	<i>Sida</i> sp. (SVL 3227)
	<i>Sida</i> sp. Articulation below (A.A. Mitchell PRP 1605)
	<i>Sida</i> sp. Excedentifolia (J.L. Egan 1925)
	<i>Sida</i> sp. Golden calyces glabrous (H.N. Foote 32)
	<i>Sida</i> sp. Golden calyces pubescent (G.J. Leach 1966)
	<i>Sida</i> sp. Little Sandy Desert (SVL 2489)
	<i>Sida</i> sp. Pilbara (A.A. Mitchell PRP 1543)
	<i>Sida</i> sp. Rabbit Flat (B.J. Carter 626)
	<i>Sida</i> sp. Sand dunes (A.A. Mitchell PRP1208)
	<i>Sida</i> sp. Verrucose glands (F.H. Mollemans 2423)
Marsileaceae	<i>Marsilea hirsuta</i>
Meliaceae	<i>Owenia acidula</i>
Moraceae	<i>Ficus brachypoda</i>
Myrtaceae	<i>Aluta maisonneuvei</i>
	<i>Calothamnus aridus</i>
	<i>Calytrix carinata</i>
	<i>Calytrix praecipua</i>
	<i>Corymbia ?aspera</i>
	<i>Corymbia chippendalei</i>
	<i>Corymbia deserticola</i>
	<i>Corymbia hamersleyana</i>
	<i>Corymbia terminalis</i>
	<i>Eucalyptus camaldulensis</i> var. <i>obtusata</i>
	<i>Eucalyptus eremicola</i> subsp. <i>peeneri</i>
	<i>Eucalyptus gamophylla</i>
	<i>Eucalyptus kingsmillii</i> subsp. <i>kingsmillii</i>
	<i>Eucalyptus lucasii</i>
	<i>Eucalyptus mannensis</i> subsp. <i>mannensis</i>
	<i>Eucalyptus oldfieldii</i>
	<i>Eucalyptus odontocarpa</i>
	<i>Eucalyptus oldfieldii</i>
	<i>Eucalyptus pachyphylla</i>
	<i>Eucalyptus rameliana</i>
	<i>Eucalyptus repullulans</i>
	<i>Eucalyptus semota</i>
	<i>Eucalyptus socialis</i>
	<i>Eucalyptus</i> sp. Little Sandy Desert (D. Nicolle & M. French DN 4304)
	<i>Eucalyptus trivalva</i>
	<i>Eucalyptus victrix</i>

Family	Species
	<i>Lamarchea sulcata</i>
	<i>Melaleuca eleuterostachya</i>
	<i>Melaleuca glomerata</i>
	<i>Melaleuca lasiandra</i>
	<i>Melaleuca linophylla</i>
	<i>Melaleuca uncinata</i>
	<i>Melaleuca xerophila</i>
	<i>Micromyrtus flaviflora</i>
	<i>Micromyrtus mucronulata</i>
	<i>Thryptomene wittweri</i>
Nyctaginaceae	<i>Boerhavia coccinea</i>
Oleaceae	<i>Jasminum calcareum</i>
Ophioglossaceae	<i>Ophioglossum lusitanicum</i>
Orobanchaceae	<i>Buchnera linearis</i>
Phrymaceae	<i>Mimulus gracilis</i>
	<i>Mimulus repens</i>
	<i>Peplidium</i> sp. C Evol. Fl. Fauna Arid Aust. (N.T. Burbidge & A. Kanis 8158)
	<i>Peplidium</i> sp. E Evol. Fl. Fauna Arid Aust. (A.S. Weston 12768)
	<i>Peplidium</i> sp. Little Sandy Desert (SVL 4986)
Phyllanthaceae	<i>Phyllanthus erwinii</i>
Pittosporaceae	<i>Pittosporum angustifolium</i>
Plantaginaceae	<i>Stemodia linophylla</i>
Plumbaginaceae	<i>Muellerolimon salicorniaceum</i>
Poaceae	<i>Amphipogon caricinus</i>
	<i>Aristida contorta</i>
	<i>Aristida holathera</i>
	<i>Aristida jerichoensis</i> var. <i>subspinulifera</i>
	<i>Aristida</i> sp. Little Sandy Desert (SVL 3047)
	<i>Brachyachne prostrata</i>
	<i>Chrysopogon fallax</i>
	<i>Cymbopogon ambiguus</i>
	<i>Cymbopogon bombycinus</i>
	<i>Cymbopogon obtectus</i>
	<i>Dichanthium sericeum</i> subsp. <i>humilius</i>
	<i>Digitaria brownii</i>
	<i>Enneapogon avenaceus</i>
	<i>Enneapogon caerulescens</i>
	<i>Enneapogon polyphyllus</i>
	<i>Eragrostis cumingii</i>
	<i>Eragrostis desertorum</i>
	<i>Eragrostis dielsii</i>
	<i>Eragrostis eriopoda</i>
	<i>Eragrostis olida</i>
	<i>Eragrostis pergracilis</i>
	<i>Eragrostis setifolia</i>

Family	Species
	<i>Eragrostis</i> sp. Little Sandy Desert (SVL 2491)
	<i>Eragrostis xerophila</i>
	<i>Eriachne aristidea</i>
	<i>Eriachne mucronata</i>
	<i>Eriachne ovata</i>
	<i>Eriachne pulchella</i> subsp. <i>pulchella</i>
	<i>Eriachne</i> sp. Woolly culms (P.K. Latz 10065)
	<i>Eulalia aurea</i>
	<i>Iseilema eremaeum</i>
	<i>Iseilema membranaceum</i>
	<i>Paractaenum novae-hollandiae</i> subsp. <i>novae-hollandiae</i>
	<i>Paraneurachne muelleri</i>
	<i>Paspalidium clementii</i>
	<i>Paspalidium rarum</i>
	<i>Setaria dielsii</i>
	* <i>Setaria verticillata</i>
	<i>Sporobolus australasicus</i>
	<i>Themeda triandra</i>
	<i>Tragus australianus</i>
	<i>Triodia angusta</i>
	<i>Triodia basedowii</i>
	<i>Triodia brizoides</i>
	<i>Triodia lanigera</i>
	<i>Triodia longiceps</i>
	<i>Triodia melvillei</i>
	<i>Triodia pungens</i>
	<i>Triodia schinzii</i>
	<i>Triodia</i> sp. Little Sandy Desert (aff. <i>lanigera</i> ) (SVL 4935)
	<i>Triodia wiseana</i>
	<i>Tripogon loliiformis</i>
	<i>Triraphis mollis</i>
	<i>Xerochloa laniflora</i>
Polygalaceae	<i>Comesperma pallidum</i>
	<i>Comesperma viscidulum</i>
	<i>Polygala isingii</i>
Portulacaceae	<i>Calandrinia eremaea</i>
	<i>Calandrinia polyandra</i>
	<i>Calandrinia ptychosperma</i>
	<i>Portulaca filifolia</i>
	<i>Portulaca oleracea</i>
	<i>Portulaca pilosa</i>
Pottiaceae	<i>Tortula atrovirens</i>
Primulaceae	<i>Samolus</i> sp. Fortescue Marsh (A. Markey & R. Coppen FM 9702)
	<i>Samolus</i> sp. Little Sandy Desert (SVL 2912)
Proteaceae	<i>Grevillea deflexa</i>



Family	Species
	<i>Grevillea eriostachya</i>
	<i>Grevillea eriostachya x spinosa</i>
	<i>Grevillea juncifolia</i>
	<i>Grevillea nematophylla</i>
	<i>Grevillea pterosperma</i>
	<i>Grevillea spinosa</i>
	<i>Grevillea stenobotrya</i>
	<i>Grevillea striata</i>
	<i>Grevillea wickhamii</i> subsp. <i>aprica</i>
	<i>Hakea divaricata</i>
	<i>Hakea leucoptera</i> subsp. <i>sericipes</i>
	<i>Hakea lorea</i>
	<i>Hakea preissii</i>
	<i>Hakea rhombales</i>
Pteridaceae	<i>Cheilanthes brownii</i>
	<i>Cheilanthes lasiophylla</i>
	<i>Cheilanthes sieberi</i> subsp. <i>pseudovellea</i>
	<i>Cheilanthes sieberi</i> subsp. <i>sieberi</i>
Rubiaceae	<i>Oldenlandia crouchiana</i>
	<i>Pomax</i> sp. desert (A.S. George 11968)
	<i>Psydrax attenuata</i> ms
	<i>Psydrax latifolia</i> ms
	<i>Psydrax suaveolens</i> ms
	<i>Synaptantha tillaeacea</i>
	<i>Synaptantha tillaeacea</i> var. <i>hispidula</i>
<i>Synaptantha tillaeacea</i> var. <i>tillaeacea</i>	
Ruppiaceae	<i>Ruppia maritima</i>
Santalaceae	<i>Anthobolus leptomerioides</i>
	<i>Exocarpos sparteus</i>
	<i>Santalum lanceolatum</i>
Sapindaceae	<i>Diplopeltis stuartii</i> var. <i>stuartii</i>
	<i>Dodonaea coriacea</i>
	<i>Dodonaea microzyga</i> var. <i>acrolobata</i>
	<i>Dodonaea pachyneura</i>
	<i>Dodonaea petiolaris</i>
	<i>Dodonaea viscosa</i> subsp. <i>angustissima</i>
	<i>Dodonaea viscosa</i> subsp. <i>spatulata</i>
Scrophulariaceae	<i>Eremophila anomala</i>
	<i>Eremophila appressa</i>
	<i>Eremophila arachnoides</i> subsp. <i>arachnoides</i>
	<i>Eremophila citrina</i> ms
	<i>Eremophila clarkei</i>
	<i>Eremophila eriocalyx</i>
	<i>Eremophila exillifolia</i>
<i>Eremophila falcata</i>	

Family	Species
	<i>Eremophila fasciata</i>
	<i>Eremophila forrestii</i>
	<i>Eremophila galeata</i>
	<i>Eremophila glabra</i> subsp. Inland Salt Lakes (B. & B. Backhouse SR 191)
	<i>Eremophila glabra</i> subsp. <i>tomentosa</i>
	<i>Eremophila lanceolata</i> ms
	<i>Eremophila latrobei</i> subsp. <i>filiformis</i> ms
	<i>Eremophila latrobei</i> subsp. <i>glabra</i> ms
	<i>Eremophila latrobei</i> subsp. <i>latrobei</i> ms
	<i>Eremophila lanata</i>
	<i>Eremophila longifolia</i>
	<i>Eremophila maculata</i>
	<i>Eremophila maculata</i> subsp. <i>brevifolia</i>
	<i>Eremophila margarethae</i>
	<i>Eremophila oppositifolia</i> subsp. <i>angustifolia</i>
	<i>Eremophila petrophila</i> subsp. <i>petrophila</i> ms
	<i>Eremophila phyllopoda</i> subsp. <i>phyllopoda</i> ms
	<i>Eremophila platythamnus</i>
	<i>Eremophila punctata</i>
	<i>Eremophila rigida</i>
	<i>Eremophila</i> sp. Carnarvon Range (D.J. Edinger Nats 24)
	<i>Eremophila</i> sp. Katjarra South (N. Gibson et al. NG 7149)
	<i>Eremophila</i> sp. Little Sandy Desert (SVL 2615)
	<i>Eremophila</i> sp. Mt. Methwin (B. Backhouse et al. BEMJ 74)
	<i>Eremophila</i> sp. Ostrina (M. Officer 164)
	<i>Eremophila tietkensis</i>
Solanaceae	<i>Duboisia hopwoodii</i>
	<i>Nicotiana benthamiana</i>
	<i>Nicotiana rosulata</i> subsp. <i>rosulata</i>
	<i>Nicotiana simulans</i>
	<i>Solanum centrale</i>
	<i>Solanum cleistogamum</i>
	<i>Solanum gabrielae</i>
	<i>Solanum horridum</i>
	<i>Solanum lasiophyllum</i>
	<i>Solanum orbiculatum</i> subsp. <i>macrophyllum</i>
	<i>Solanum phlomoides</i>
	<i>Solanum sturtianum</i>
Stylidiaceae	<i>Levenhookia chippendalei</i>
	<i>Stylidium desertorum</i>
	<i>Stylidium humphreysii</i>
	<i>Stylidium inaequipetalum</i>
Surianaceae	<i>Stylobasium spathulatum</i>
Thymelaceae	<i>Pimelea ammocharis</i>
	<i>Pimelea trichostachya</i>

Family	Species
Typhaceae	<i>Typha domingensis</i>
Violaceae	<i>Hybanthus aurantiacus</i>
Xanthorrhoeaceae	<i>Xanthorrhoea thorntonii</i>
Zygophyllaceae	<i>Tribulus astrocarpus</i>
	<i>Tribulus occidentalis</i>
	<i>Tribulus platypterus</i>
	<i>Tribulus suberosus</i>
	<i>Zygophyllum aurantiacum</i>
	<i>Zygophyllum aurantiacum</i> subsp. <i>aurantiacum</i>
	<i>Zygophyllum compressum</i>
	<i>Zygophyllum iodocarpum</i>
	<i>Zygophyllum simile</i>
<i>Zygophyllum tesquorum</i>	

## Appendix 4 Species recorded in the study area

Family	Species
Marsileaceae	<i>Marsilea drummondii</i>
	<i>Marsilea hirsuta</i>
Pteridaceae	<i>Cheilanthes sieberi</i> subsp. <i>sieberi</i>
Cupressaceae	<i>Callitris columellaris</i>
Juncaginaceae	<i>Triglochin nana</i>
Xanthorrhoeaceae	<i>Xanthorrhoea thorntonii</i>
Hemerocallidaceae	<i>Corynotheca micrantha</i> var. <i>divaricata</i>
	<i>Corynotheca pungens</i>
Cyperaceae	<i>Bulbostylis barbata</i>
	<i>Bulbostylis turbinata</i>
	<i>Cyperus bulbosus</i>
	<i>Cyperus iria</i>
	<i>Cyperus rigidellus</i>
	<i>Cyperus squarrosus</i>
	<i>Eleocharis pallens</i>
	<i>Fimbristylis dichotoma</i>
	<i>Fimbristylis simulans</i>
	Poaceae
<i>Amphipogon sericeus</i>	
<i>Aristida contorta</i>	
<i>Aristida holathera</i>	
<i>Aristida inaequiglumis</i>	
<i>Aristida nitidula</i>	
<i>Bothriochloa ewartiana</i>	
* <i>Cenchrus ciliaris</i>	
* <i>Chloris virgata</i>	
<i>Chrysopogon fallax</i>	
<i>Cymbopogon ambiguus</i>	
<i>Cymbopogon obtectus</i>	
<i>Cynodon convergens</i>	
<i>Dactyloctenium radulans</i>	
<i>Digitaria brownii</i>	
* <i>Digitaria ciliaris</i>	
<i>Digitaria ctenantha</i>	
<i>Enneapogon caeruleus</i>	
<i>Enneapogon polyphyllus</i>	



	<i>Enneapogon robustissimus</i>
	<i>Enteropogon ramosus</i>
	<i>Eragrostis cumingii</i>
	<i>Eragrostis desertorum</i>
	<i>Eragrostis dielsii</i>
	<i>Eragrostis eriopoda</i>
	<i>Eragrostis falcata</i>
	<i>Eragrostis kennedyae</i>
	<i>Eragrostis leptocarpa</i>
	<i>Eragrostis pergracilis</i>
	<i>Eragrostis xerophila</i>
	<i>Eriachne aristidea</i>
	<i>Eriachne flaccida</i>
	<i>Eriachne helmsii</i>
	<i>Eriachne mucronata</i>
	<i>Eriachne pulchella</i>
	<i>Iseilema membranaceum</i>
	<i>Iseilema vaginiflorum</i>
	<i>Monachather paradoxus</i>
	<i>Neurachne minor</i>
	<i>Paractaenum refractum</i>
	<i>Paraneurachne muelleri</i>
	<i>Paspalidium constrictum</i>
	<i>Paspalidium rarum</i>
	<i>Paspalidium reflexum</i>
	<i>Perotis rara</i>
	Poaceae sp.
	* <i>Setaria verticillata</i>
	<i>Themeda triandra</i>
	<i>Thyridolepis mitchelliana</i>
	<i>Thyridolepis xerophila</i>
	<i>Tragus australianus</i>
	<i>Triodia basedowii</i>
	<i>Triodia longiceps</i>
	<i>Triodia melvillei</i>
	<i>Triodia pungens</i>
	<i>Triodia schinzii</i>
	<i>Triodia</i> sp.

	<i>Tripogon loliiformis</i>
	<i>Triraphis mollis</i>
	<i>Yakirra australiensis</i>
Proteaceae	<i>Grevillea berryana</i>
	<i>Grevillea eriostachya</i>
	<i>Grevillea juncifolia</i> subsp. <i>juncifolia</i>
	<i>Grevillea</i> sp.
	<i>Grevillea stenobotrya</i>
	<i>Grevillea striata</i>
	<i>Hakea lorea</i>
	<i>Hakea rhombales</i>
Haloragaceae	<i>Glischrocaryon angustifolium</i>
	<i>Haloragis gossei</i>
	<i>Haloragis</i> sp.
	<i>Haloragis trigonocarpa</i>
Zygophyllaceae	<i>Tribulus astrocarpus</i>
	<i>Tribulus macrocarpus</i>
	<i>Tribulus occidentalis</i>
	<i>Tribulus platypterus</i>
	<i>Tribulus suberosus</i>
	<i>Zygophyllum aurantiacum</i>
	<i>Zygophyllum compressum</i>
	<i>Zygophyllum eremaeum</i>
Fabaceae	<i>Acacia abrupta</i>
	<i>Acacia adsurgens</i>
	<i>Acacia ampliceps</i>
	<i>Acacia aneura</i>
	<i>Acacia aptaneura</i>
	<i>Acacia ayersiana</i>
	<i>Acacia balsamea</i>
	<i>Acacia brachystachya</i>
	<i>Acacia burkittii</i>
	<i>Acacia caesaneura</i>
	<i>Acacia citrinoviridis</i>
	<i>Acacia coriacea</i>
	<i>Acacia daviesioides</i>
	<i>Acacia dictyophleba</i>
	<i>Acacia doreta</i>

	<i>Acacia fuscaneura</i>
	<i>Acacia hamersleyensis</i>
	<i>Acacia incurvaneura</i>
	<i>Acacia kempeana</i>
	<i>Acacia ligulata</i>
	<i>Acacia macraneura</i>
	<i>Acacia maitlandii</i>
	<i>Acacia marramamba</i>
	<i>Acacia minyura</i>
	<i>Acacia mulganeura</i>
	<i>Acacia nyssophylla</i>
	<i>Acacia pachyacra</i>
	<i>Acacia paraneura</i>
	<i>Acacia prainii</i>
	<i>Acacia pruinocarpa</i>
	<i>Acacia pteraneura</i>
	<i>Acacia pyrifolia</i>
	<i>Acacia ramulosa</i>
	<i>Acacia ramulosa</i> var. <i>linophylla</i>
	<i>Acacia rhodophloia</i>
	<i>Acacia sibirica</i>
	<i>Acacia</i> sp.
	<i>Acacia steedmanii</i> subsp. <i>borealis</i>
	<i>Acacia subcontorta</i>
	<i>Acacia synchronicia</i>
	<i>Acacia tenuissima</i>
	<i>Acacia tetragonophylla</i>
	<i>Acacia thoma</i>
	<i>Crotalaria cunninghamii</i>
	<i>Daviesia eremaea</i>
	<i>Glycine canescens</i>
	<i>Indigofera colutea</i>
	<i>Indigofera georgei</i>
	<i>Indigofera linnaei</i>
	<i>Indigofera monophylla</i>
	<i>Kennedia prorepens</i>
	<i>Leptosema chambersii</i>
	<i>Muelleranthus trifoliolatus</i>

	<i>Petalostylis cassioides</i>
	<i>Phyllota luehmannii</i>
	<i>Senna artemisioides</i> subsp. <i>filifolia</i>
	<i>Senna artemisioides</i> subsp. <i>helmsii</i>
	<i>Senna artemisioides</i> subsp. <i>oligophylla</i>
	<i>Senna artemisioides</i> subsp. <i>petiolaris</i>
	<i>Senna artemisioides</i> subsp. <i>x artemisioides</i>
	<i>Senna artemisioides</i> subsp. <i>x sturtii</i>
	<i>Senna glaucifolia</i>
	<i>Senna glutinosa</i>
	<i>Senna glutinosa</i> subsp. <i>pruinosa</i>
	<i>Senna notabilis</i>
	<i>Senna pleurocarpa</i>
	<i>Senna sericea</i>
	<i>Senna symonii</i>
	<i>Sesbania cannabina</i>
	<i>Swainsona decurrens</i>
	<i>Swainsona laciniata</i>
	<i>Swainsona oroboides</i>
	<i>Templetonia egena</i>
Surianaceae	<i>Stylobasium spathulatum</i>
Polygalaceae	<i>Polygala isingii</i>
Casuarinaceae	<i>Casuarina pauper</i>
Cucurbitaceae	* <i>Citrullus colocynthis</i>
	* <i>Citrullus lanatus</i>
Celastraceae	<i>Maytenus</i> sp. Mt Windell (S. van Leeuwen 846)
	<i>Stackhousia intermedia</i>
	<i>Stackhousia megaloptera</i>
	<i>Stackhousia</i> sp. swollen gynophore (W.R. Barker 2041)
Euphorbiaceae	<i>Euphorbia australis</i>
	<i>Euphorbia boophthona</i>
	<i>Euphorbia drummondii</i>
	<i>Euphorbia tannensis</i>
Phyllanthaceae	<i>Phyllanthus maderaspatensis</i>
Elatinaceae	<i>Bergia pedicellaris</i>
Violaceae	<i>Hybanthus aurantiacus</i>
Myrtaceae	<i>Aluta maisonneuvei</i> subsp. <i>maisonneuvei</i>
	<i>Calytrix carinata</i>



	<i>Corymbia chippendalei</i>
	<i>Corymbia deserticola</i>
	<i>Corymbia hamersleyana</i>
	<i>Corymbia opaca</i>
	<i>Eucalyptus ? victrix</i>
	<i>Eucalyptus camaldulensis</i>
	<i>Eucalyptus gamophylla</i>
	<i>Eucalyptus mannensis</i> subsp. <i>mannensis</i>
	<i>Eucalyptus</i> sp.
	<i>Eucalyptus</i> sp. Little Sandy Desert (D. Nicolle & M. French DN 4304)
	<i>Eucalyptus trivalva</i>
	<i>Melaleuca interioris</i>
	<i>Melaleuca xerophila</i>
	<i>Micromyrtus flaviflora</i>
Sapindaceae	<i>Dodonaea coriacea</i>
	<i>Dodonaea viscosa</i>
Malvaceae	<i>Abutilon cryptopetalum</i>
	<i>Abutilon fraseri</i>
	<i>Abutilon leucopetalum</i>
	<i>Abutilon macrum</i>
	<i>Abutilon otocarpum</i>
	<i>Abutilon oxycarpum</i>
	<i>Alyogyne pinoniana</i>
	<i>Androcalva loxophylla</i>
	<i>Brachychiton gregorii</i>
	<i>Corchorus crozophorifolius</i>
	<i>Hibiscus burtonii</i>
	<i>Hibiscus coatesii</i>
	<i>Hibiscus</i> sp.
	<i>Lawrencía densiflora</i>
	<i>Lawrencía glomerata</i>
	<i>Lawrencía helmsii</i>
	<i>Lawrencía squamata</i>
	* <i>Malvastrum americanum</i>
	<i>Seringia elliptica</i>
	<i>Sida ammophila</i>
	<i>Sida arenicola</i>
	<i>Sida calyxhymania</i>

	<i>Sida cardiophylla</i>
	<i>Sida echinocarpa</i>
	<i>Sida ectogama</i>
	<i>Sida fibulifera</i>
	<i>Sida intricate</i>
	<i>Sida platycalyx</i>
	<i>Sida</i> sp.
	<i>Sida</i> sp. dark green fruits (S. van Leeuwen 2260)
	<i>Sida</i> sp. Golden calyces glabrous (H.N. Foote 32)
	<i>Sida</i> sp. Golden calyces pubescent (G.J. Leach 1966)
	<i>Sida</i> sp. sand dunes (A.A. Mitchell PRP1208)
	<i>Sida</i> sp. tiny glabrous fruit (A.A. Mitchell PRP1152)
	<i>Sida</i> sp. verrucose glands (F.H. Mollemans 2423)
	<i>Sida trichopoda</i>
Thymelaeaceae	<i>Pimelea ammocharis</i>
	<i>Pimelea microcephala</i> subsp. <i>microcephala</i>
Gyrostemonaceae	<i>Codonocarpus cotinifolius</i>
	<i>Gyrostemon ramulosus</i>
Cleomaceae	<i>Cleome oxalidea</i>
	<i>Cleome viscosa</i>
Brassicaceae	<i>Lepidium oxytrichum</i>
	<i>Lepidium phlebopetalum</i>
	<i>Stenopetalum decipiens</i>
	<i>Stenopetalum lineare</i>
Santalaceae	<i>Anthobolus leptomerioides</i>
	<i>Exocarpos sparteus</i>
	<i>Santalum acuminatum</i>
	<i>Santalum spicatum</i>
Loranthaceae	<i>Amyema hilliana</i>
	<i>Lysiana exocarpi</i>
	<i>Lysiana murrayi</i>
Frankeniaceae	<i>Frankenia cinerea</i>
	<i>Frankenia laxiflora</i>
	<i>Frankenia setosa</i>
Plumbaginaceae	<i>Muellerolimon salicorniaceum</i>
Polygonaceae	<i>Duma florulenta</i>
Caryophyllaceae	<i>Polycarpaea corymbosa</i>
Amaranthaceae	<i>Alternanthera angustifolia</i>

	<i>Alternanthera nana</i>
	<i>Alternanthera nodiflora</i>
	<i>Gomphrena affinis</i>
	<i>Gomphrena kanisii</i>
	<i>Ptilotus aervoides</i>
	<i>Ptilotus albidus</i>
	<i>Ptilotus aphyllus</i>
	<i>Ptilotus carinatus</i>
	<i>Ptilotus gaudichaudii</i>
	<i>Ptilotus helipteroides</i>
	<i>Ptilotus latifolius</i>
	<i>Ptilotus macrocephalus</i>
	<i>Ptilotus nobilis</i>
	<i>Ptilotus obovatus</i>
	<i>Ptilotus polystachyus</i>
	<i>Ptilotus roei</i>
	<i>Ptilotus rotundifolius</i>
	<i>Ptilotus schwartzii</i>
	<i>Ptilotus stipitatus</i>
	<i>Surreya diandra</i>
Chenopodiaceae	<i>Atriplex amnicola</i>
	<i>Atriplex bunburyana</i>
	<i>Atriplex</i> sp.
	<i>Atriplex spongiosa</i>
	<i>Chenopodium gaudichaudianum</i>
	<i>Dysphania kalpari</i>
	<i>Dysphania melanocarpa</i>
	<i>Dysphania plantaginella</i>
	<i>Dysphania rhadinostachya</i>
	<i>Dysphania saxatilis</i>
	<i>Dysphania simulans</i>
	<i>Dysphania sphaerosperma</i>
	<i>Enchylaena tomentosa</i>
	<i>Eremophea spinosa</i>
	<i>Maireana amoena</i>
	<i>Maireana convexa</i>
	<i>Maireana georgei</i>
	<i>Maireana luehmannii</i>

	<i>Maireana melanocoma</i>
	<i>Maireana planifolia</i>
	<i>Maireana pyramidata</i>
	<i>Maireana scleroptera</i>
	<i>Maireana suaedifolia</i>
	<i>Maireana thesioides</i>
	<i>Maireana tomentosa</i>
	<i>Maireana tomentosa</i> subsp. <i>tomentosa</i>
	<i>Maireana trichoptera</i>
	<i>Maireana triptera</i>
	<i>Maireana villosa</i>
	<i>Rhagodia drummondii</i>
	<i>Rhagodia eremaea</i>
	<i>Salsola australis</i>
	<i>Sclerolaena alata</i>
	<i>Sclerolaena cornishiana</i>
	<i>Sclerolaena costata</i>
	<i>Sclerolaena deserticola</i>
	<i>Sclerolaena diacantha</i>
	<i>Sclerolaena eriacantha</i>
	<i>Sclerolaena fimbriolata</i>
	<i>Sclerolaena glabra</i>
	<i>Sclerolaena lanicuspis</i>
	<i>Sclerolaena</i> sp.
	<i>Tecticornia</i> aff. sp. Dennys Crossing (KS 552)
	<i>Tecticornia auriculata</i>
	<i>Tecticornia calyptata</i>
	<i>Tecticornia globulifera</i> (P1)
	<i>Tecticornia indica</i> subsp. <i>bidens</i>
	<i>Tecticornia indica</i> subsp. <i>leiostachya</i>
	<i>Tecticornia laevigata</i>
	<i>Tecticornia peltata</i>
	<i>Tecticornia pergranulata</i> subsp. <i>elongata</i>
	<i>Tecticornia pergranulata</i> subsp. <i>pergranulata</i>
	<i>Tecticornia pruinosa</i>
	<i>Tecticornia pterygosperma</i> subsp. <i>denticulata</i>
	<i>Tecticornia</i> sp.
	<i>Tecticornia</i> sp. (Group 3 Or 5)

	<i>Tecticornia</i> sp. (sterile) ? [group 6]
	<i>Tecticornia</i> sp. (sterile) [group 1]
	<i>Tecticornia</i> sp. (sterile) [group 2]
	<i>Tecticornia</i> sp. (sterile) [group 3]
	<i>Tecticornia</i> sp. (sterile) [group 4]
	<i>Tecticornia</i> sp. (sterile) [group 5]
	<i>Tecticornia</i> sp. Christmas Creek (K.A. Shepherd & T. Colmer et al. KS 1063) (P1)
	<i>Tecticornia</i> sp. Dennys Crossing (K.A. Shepherd & J. English KS 552)
	<i>Tecticornia</i> sp. Little Sandy Desert (K.A. Shepherd & C. Wilkins KS 830) (P1)
	<i>Tecticornia</i> sp. nov. 1 (aff. <i>pruinosa</i> / <i>laevigata</i> )
	<i>Tecticornia</i> sp. nov. 2 (aff. <i>pruinosa</i> / <i>undulata</i> )
	<i>Tecticornia</i> sp. Sunshine Lake (K.A. Shepherd et al. KS 867) (P1)
	<i>Tecticornia</i> sp. Yoothapina Station (A.A. Mitchell 883)
	<i>Tecticornia undulata</i>
	<i>Tecticornia verrucosa</i>
Aizoaceae	<i>Trianthema glossostigma</i>
	<i>Trianthema triquetrum</i>
Nyctaginaceae	<i>Boerhavia coccinea</i>
	<i>Boerhavia repleta</i>
	<i>Boerhavia schomburgkiana</i>
Molluginaceae	<i>Glinus oppositifolius</i>
	<i>Mollugo cerviana</i>
Portulacaceae	<i>Calandrinia polyandra</i>
	<i>Calandrinia ptychosperma</i>
	<i>Calandrinia</i> sp.
	<i>Portulaca filifolia</i>
	<i>Portulaca intraterranea</i>
	<i>Portulaca oleracea</i>
Primulaceae	<i>Samolus repens</i>
Rubiaceae	<i>Pomax</i> sp. desert (A.S. George 11968)
	<i>Psydrax latifolia</i>
	<i>Psydrax rigidula</i>
	<i>Psydrax suaveolens</i>
	<i>Synaptantha tillaeacea</i> var. <i>hispidula</i>
Apocynaceae	<i>Marsdenia australis</i>



	<i>Rhyncharrhena linearis</i>
Boraginaceae	<i>Halgania cyanea</i> var. Allambi Stn (B.W. Strong 676)
	<i>Halgania erecta</i>
	<i>Halgania glabra</i>
	<i>Halgania</i> sp. A Kimberley Flora (H.A. Johnson 5123)
	<i>Heliotropium cunninghamii</i>
	<i>Heliotropium heteranthum</i>
	<i>Heliotropium tanythrix</i>
	<i>Trichodesma zeylanicum</i> var. <i>grandiflorum</i>
Convolvulaceae	<i>Bonamia erecta</i>
	<i>Convolvulus clementii</i>
	<i>Duperreya commixta</i>
	<i>Evolvulus alsinoides</i> var. <i>villosicalyx</i>
	<i>Ipomoea calobra</i>
Solanaceae	<i>Nicotiana occidentalis</i>
	<i>Nicotiana rosulata</i>
	<i>Solanaceae</i> sp.
	<i>Solanum centrale</i>
	<i>Solanum cleistogamum</i>
	<i>Solanum lasiophyllum</i>
	<i>Solanum phlomoides</i>
	<i>Solanum</i> sp.
Oleaceae	<i>Jasminum didymum</i> subsp. <i>lineare</i>
Plantaginaceae	<i>Stemodia viscosa</i>
Scrophulariaceae	<i>Eremophila</i> ? <i>clarkei</i>
	<i>Eremophila cuneifolia</i>
	<i>Eremophila forrestii</i> subsp. <i>forrestii</i>
	<i>Eremophila galeata</i>
	<i>Eremophila glabra</i> subsp. <i>glabra</i>
	<i>Eremophila lachnocalyx</i>
	<i>Eremophila lanceolata</i>
	<i>Eremophila latrobei</i> subsp. <i>filiformis</i>
	<i>Eremophila latrobei</i> subsp. <i>glabra</i>
	<i>Eremophila latrobei</i> subsp. <i>latrobei</i>
	<i>Eremophila longifolia</i>
	<i>Eremophila maculata</i>
	<i>Eremophila margarethae</i>
	<i>Eremophila oppositifolia</i>

	<i>Eremophila</i> sp.
	<i>Eremophila spectabilis</i>
Lamiaceae	<i>Clerodendrum tomentosum</i> var. <i>lanceolatum</i>
	<i>Clerodendrum tomentosum</i> var. <i>tomentosum</i>
	<i>Dicrastylis cordifolia</i>
	<i>Dicrastylis doranii</i>
	<i>Dicrastylis fulva</i>
	<i>Dicrastylis kumarinensis</i>
	<i>Microcorys macredieana</i>
	<i>Newcastelia spodiotricha</i>
	<i>Pityrodia loricata</i>
	<i>Prostanthera wilkieana</i>
	<i>Quoya loxocarpa</i>
	<i>Spartothamnella teucriflora</i>
Phrymaceae	<i>Mimulus gracilis</i>
	<i>Mimulus repens</i>
	<i>Peplidium aithocheilum</i>
	<i>Peplidium maritimum</i>
	<i>Peplidium muelleri</i>
Campanulaceae	<i>Lobelia heterophylla</i>
	<i>Wahlenbergia tumidifruca</i>
Stylidiaceae	<i>Stylidium humphreysii</i>
Goodeniaceae	<i>Brunonia australis</i>
	<i>Dampiera cinerea</i>
	<i>Goodenia gypsicola</i>
	<i>Goodenia heterochila</i>
	<i>Goodenia lamprosperma</i>
	<i>Goodenia mueckeana</i>
	<i>Goodenia muelleriana</i>
	<i>Goodenia pascua</i>
	<i>Goodenia prostrata</i>
	<i>Goodenia quasilibera</i>
	<i>Goodenia ramelii</i>
	<i>Goodenia stellata</i>
	<i>Goodenia triodiophila</i>
	<i>Goodenia wilunensis</i>
	<i>Goodeniaceae</i> sp.
	<i>Scaevola amblyanthera</i>

	<i>Scaevola basedowii</i>
	<i>Scaevola collaris</i>
	<i>Scaevola parvifolia</i> subsp. <i>pilbarae</i>
	<i>Scaevola sericophylla</i>
	<i>Scaevola spinescens</i>
Asteraceae	<i>Angianthus cyathifer</i>
	<i>Angianthus tomentosus</i>
	* <i>Bidens bipinnata</i>
	<i>Brachyscome blackii</i>
	<i>Brachyscome ciliaris</i>
	<i>Calocephalus knappii</i>
	<i>Calotis</i> sp. Carnarvon Range (D.J. Edinger & K.F. Kenneally D 2708 K 12243)
	<i>Centipeda thespidioides</i>
	<i>Cephalopterum drummondii</i>
	<i>Kippistia suaedifolia</i>
	<i>Leiocarpa semicalva</i>
	<i>Minuria multiseta</i>
	<i>Myriocephalus rudallii</i>
	<i>Olearia incana</i>
	<i>Olearia subspicata</i>
	<i>Pluchea dentex</i>
	<i>Pluchea rubelliflora</i>
	<i>Podolepis capillaris</i>
	<i>Podolepis gardneri</i>
	<i>Pterocaulon serrulatum</i>
	<i>Pterocaulon sphacelatum</i>
	<i>Rhodanthe humboldtiana</i>
	<i>Rhodanthe propinqua</i>
	<i>Rutidosis helichrysoides</i>
	<i>Senecio gregorii</i>
	* <i>Sigesbeckia orientalis</i>
	<i>Streptoglossa cylindriceps</i>
	<i>Streptoglossa liatroides</i>
	<i>Vittadinia eremaea</i>
Pittosporaceae	<i>Pittosporum angustifolium</i>
Araliaceae	<i>Trachymene</i> sp.



