FLORA, VEGETATION AND WETLAND ASSESSMENT

VARIOUS ALLOTMENTS, MIDVALE AND STRATTON

Project Number EP14-043

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Executive Summary

Lots 1, 3-4, 8-10, 41-42, 50, 100, 102, 125, 301, 303-305, 427, 12568 and 13313 Farrall Road, Lots 51 and 349-356 Orchard Avenue and Lots 2,3,6,11,12 and 357 Morrison Road, in the localities of Midvale and Stratton (herein referred to as 'the site') are proposed for future urban development. The site is located within the City of Swan and is predominantly owned by Peet Stratton Pty Ltd (the 'proponent'), with some lots in the southern portion of the site owned by other parties. As part of the urban development process, a Local Structure Plan (LSP) is currently being prepared for the site.

Emerge Associates (Emerge) has been engaged by Peet Stratton Pty Ltd to deliver environmental consultancy services in support of the LSP process. The purpose of this assessment is to provide sufficient environmental information on the flora, vegetation and wetlands values within the site to support this process.

The scope of this assessment is to undertake a spring flora, vegetation and wetland assessment in accordance with the Environmental Protection Authorities (EPA's) Guidance Statement No. 51 – *Terrestrial Flora and Vegetation Surveys for Environmental Impact Assessment in Western Australia* (EPA 2004). The intensity of sampling and standard of assessment was to a 'Level 2' standard and conducted in the main flowering period; should additional survey in other seasons be conducted the survey would meet the full requirements of a Level 2 assessment.

Two botanists from Emerge visited the site on the 7 and 8 October 2014 and undertook a 'detailed' flora, vegetation and wetland assessment. The site was traversed on foot and a detailed survey of the vegetation was undertaken at 23 survey locations using non-permanent sampling 10 m x 10 m quadrats or relevés, selected to adequately sample each plant community observed. In addition to sampling plots, points of interest and photo points were recorded opportunistically to show particular site conditions.

86 native flora species were recorded within the site, as well as 72 weed species. No Threatened Flora species were found to occur within the site; however one Priority 3 Flora species, *Isopogon drummondii*, was found to occur scattered on the eastern edge of the site, represented by six individuals. Four of these individuals are located within or directly adjacent to an area of 'Good' condition vegetation, the additional two individuals occur in 'Degraded' areas. No other Threatened or Priority Flora species are considered likely to occur within the site.

Nine remnant plant communities, areas of revegetated vegetation and 'Parkland Cleared' paddocks or other cleared areas were identified and described within the site. These communities are shown on **Figure 4** and described as follows:

BaBm – Sparse to open woodland of *Banksia attenuata*, *Banksia menziesii* and *Eucalyptus todtiana* over open shrubland to shrubland of *Adenanthos cygnorum* and *Allocasuarina humilis* over low sparse shrubland to shrubland of *Conostephium pendulum, Stirlingia latifolia* and *Hibbertia* spp. over forb and sedgeland of *Lyginia* spp., *Dasypogon bromeliifolius*, *Conostylis aculeata* and *Podotheca gnaphalioides* and forb/grassland of pasture weeds.
Mp – Woodland to low open forest of *Melaleuca preissiana*, with emergent *Corymbia calophylla* over sparse shrubland of *Astartea scoparia*, *Marianthus* sp., *Xanthorrhoea preissii* and *Acacia pulchella* over sedgeland to closed sedgeland of *Dielsia stenostachya* and Cyperaceae sp. and open forbland of *Corynotheca micrantha* subsp. *micrantha*, *Drosera* spp. and *Burchardia congesta*. Understorey layers largely absent in degraded areas and replaced by a closed grass/forbland of pasture weeds.

CcEr – Open woodland of *Corymbia calophylla* and *Eucalyptus rudis* over patches of tall shrubland of *Taxandria linearifolia* and **Acacia longifolia* over sparse low shrubland of *Astartea scoparia* and *Hypocalymma angustifolium* over sparse sedgeland of *Hypolaena exsulca* and *Dielsia stenostachya* over closed forb/grassland of pasture weeds.
Cc – Woodland of *Corymbia calophylla* over shrubland *Jacksonia* spp., *Adenanthos cygnorum* and **Leptospermum laevigatum* (or shrub layer absent) over closed forb/grassland of pasture weeds.
Mr – Shrubland to closed shrubland of *Melaleuca rhaphiophylla* over forb/grassland of pasture weeds.
CcM – Woodland of *Corymbia calophylla* with occasional *Melaleuca preissiana* trees over shrubland of *Melaleuca rhaphiophylla* over closed forb/grassland of pasture weeds.
ErMr – Sparse woodland to woodland of *Eucalyptus rudis* over sparse shrubland to shrubland of *Melaleuca rhaphiophylla* over closed forb/grassland of pasture weeds.
Er – Sparse woodland to open forest of *Eucalyptus rudis* over closed forb/grassland of pasture weeds.
Vj – Thicket of *Viminaria juncea* over sedgeland of *Dielsia stenostachya* and grassland of pasture weeds.
R – Revegetated area adjacent to man-made sump contained planted native and exotic species.
Parkland Cleared – Sparse native and planted exotic trees over closed forb/grassland of pasture weeds.

Plant communities **Mp**, **ErMr**, **Er**, **CcEr**, **Mr**, **Vj** and **CcM** were determined to most likely represent Floristic Community Type (FCT) 11 – Wet woodlands and shrublands, which is not listed as a Threatened or Priority Ecological Community. All of these plant communities were in 'Degraded' condition. Statistically, plant community **Cc** showed low similarity (5%) to a large grouping of FCTs. Based on the native species remaining, this community may have once represented FCT 3c - *Corymbia calophylla – Xanthorrhoea preissii* woodlands and shrublands, which is a state and federally listed TEC. However, *C. calophylla, Acacia saligna and Jacksonia sternbergiana* are the only remaining representative species of this FCT within the site and the community was in 'Degraded' condition, thus plant community **Cc** is not considered to represent this FCT. Plant community **BaBm** showed highest similarity to FCT 21c - Low lying *Banksia attenuata* woodlands and shrublands, with comparatively lower similarity to FCT 23a and FCT 20c. FCT 21c is a Priority 3 Ecological Community.

Vegetation across the site ranged from 'Completely Degraded' to 'Excellent' condition. Areas of 'Parkland Cleared' vegetation are in a 'Completely Degraded' condition and comprised 70.5 ha of the total 89 ha site (79%). The nine mapped plant communities were largely in 'Degraded' condition (16.6 ha) however an area on the eastern edge of the site contained small areas of vegetation in 'Good' and 'Excellent' which occupy the remaining 1.9 ha (2%). Much of the site has been historically cleared and subject to extensive weed invasion.

Based on the field assessment of the section of Multiple Use Wetland (MUW) Unique Feature Identifier (UFI) No. 15136 located within the site, it is considered that its current management category is correct. Over the vast majority of its area, the wetland retains its original soils and landform, but the wetland vegetation has been severely compromised, limiting the potential for rehabilitation over the entirety of the area. The section of MUW UFI No. 15136 that is mapped as Bush Forever Site No. 309 however contained plant community **Mp** in 'Excellent' condition. If this small portion of the wider MUW was assessed separately to the remainder of the wetland, the resulting management category would be Conservation Category Wetland (CCW) due to the dominance of vegetation in 'Good' or better

condition and the low percentages remaining of palusplain wetlands of the Swan River consanguineous suite that are mapped as CCWs.

Resource Enhancement Wetland (REW) UFI No. 12624 contained 'Degraded' plant community **Mp**. Whilst the edges were primarily in 'Completely Degraded' condition, the majority of the wetland area contained vegetation with a relatively intact overstorey layer of *Melaleuca preissiana* with scattered emergent *Corymbia calophylla* trees. Within this wetland, plant community **Mp** contained little to no native understorey species, with the understorey dominated by pasture weeds, including Declared Pest species **Zantedeschia aethiopica* in moderate densities. The edge of a man-made lake with permanent open water exists on the northern periphery of REW UFI No. 12624 and extends to the north. The DPaW evaluation indicated that REW is the appropriate management category for UFI No. 12624 due to a higher number of intermediate values than high or low values.

Given the survey findings, Emerge recommends that within the context of a planning and development framework, consideration is given to:

- Retention of BF 309 containing plant community **Mp** in 'Excellent' condition.
- Retention of the area of plant community **BaBm** in 'Good' condition, which contains four of the six recorded individuals of Priority 3 Flora *Isopogon drummondii*.
- Weed control within areas of retained vegetation to limit further spread of weed species.

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1 Introduction

1.1 Project Background

Lots 1, 3-4, 8-10, 41-42, 50, 100, 102, 125, 301, 303-305, 427, 12568 and 13313 Farrall Road, Lots 51 and 349-356 Orchard Avenue and Lots 2,3,6,11,12 and 357 Morrison Road, in the localities of Midvale and Stratton (herein referred to as 'the site' and shown on **Figure 1**) are proposed for future urban development. The site is located within the City of Swan, approximately 19 kilometres north east of the Perth Central Business District (CBD) and is predominantly owned by Peet Stratton Pty Ltd (the 'proponent'), with some lots in the southern portion of the site owned by other parties. As part of the urban development process, a Local Structure Plan (LSP) is currently being prepared for the site.

The site is approximately 89 hectares (ha) in size and is bound by Roe Highway to the west, Toodyay Road to the north, a freight railway line to the east and urban lots to the east and south. The location of the site is shown in **Figure 1**. The site is zoned "Urban" under the Metropolitan Region Scheme (MRS) and "Residential Development" under the City of Swan's Local Planning Scheme No. 17 (LPS No. 17).

1.2 Purpose and Scope of Assessment

Emerge Associates (Emerge) has been engaged by the proponent to deliver environmental consultancy services in support of the preparation of a LSP. The purpose of this assessment is to provide sufficient environmental information on the flora, vegetation and wetlands values within the site to support this process.

The scope of this assessment is to undertake a spring flora, vegetation and wetland assessment in accordance with the Environmental Protection Authorities (EPA's) Guidance Statement No. 51 – *Terrestrial Flora and Vegetation Surveys for Environmental Impact Assessment in Western Australia* (EPA 2004). The intensity of sampling and standard of assessment was to a 'Level 2' standard and conducted in the main flowering period; should additional survey in other seasons be conducted the survey would meet the full requirements of a Level 2 assessment. As part of this scope of works, the following tasks have been undertaken:

- Desktop review of relevant information pertaining to the site and surrounds, including database searches for threatened flora species and communities.
- A 'detailed' spring flora, vegetation and wetland survey in accordance with EPA Guidance Statement No. 51.
- A list of flora species recorded as part of the field survey.
- Determination and mapping of plant communities and vegetation condition across the site.
- Assessment of the wetland values across the site based on the flora and vegetation survey.
- Documentation of the desktop assessment and field methods and results into a report.

2 Desktop Assessment

2.1 Climate

The climate of the site (which applies to the wider Perth metropolitan region) is described as Mediterranean, with hot, dry summers and moderately wet, mild winters.

The majority of rainfall within the region occurs between May and October each year, and on average is between 600 to 1000 mm per year. However, in the last 40 years there has been a marked decrease in rainfall (between 10 to 15 % decrease), with a noticeable shift to a drier climate across the south-west of Western Australia.

The closest weather station to the site which records rainfall and temperature is at the Perth Airport, located approximately 9 km south-west of the site. Average monthly rainfall and minimum and maximum temperatures (1944 - 2014) are summarised in **Table 1**.

Table 1: Temperature and rainfall averages for the Perth Airport weather station (1944 – 2014) (BoM 2014)

STATISTICS	J	F	M	A	M	J	J	A	S	O	N	D
Mean Maximum Temperature	31.7	31.9	29.7	25.6	21.8	18.9	17.9	18.5	20.1	22.6	25.9	29.0
Mean Minimum Temperature	17.0	17.5	15.9	13.0	10.4	9.0	8.0	8.0	8.9	10.2	12.7	14.9
Mean Rainfall (mm)	9.6	14.2	16.2	40.6	99.8	159.1	156.5	117.9	73.7	44.1	26.6	11.3

2.2 Geomorphology, Soils and Topography

The site occurs on the Swan Coastal Plain, which is the geomorphic unit that characterises the Perth region and surrounds (Seddon 2004). It is approximately 20-30 km wide and consists of two sedimentary belts of different origin. On the eastern side of the Swan Coastal Plain, the Pinjarra Plain has been formed from the deposition of alluvial material washed down from the Scarp, whilst the three dune systems (Quindalup, Spearwood and Bassendean) that form the western part of the Swan Coastal Plain are of Aeolian origin (Seddon 2004). The coastal plain itself is low lying, often swampy with sandhills and therefore the soils predominantly consist of recent sands or swampy deposits.

Based on mapping by Churchward and McArthur (1980), the majority of the site is located within the Pinjarra Plain, which is described as an alluvial plain of Pleistocene to Holocene age, originating from the river systems flowing down from the plateau (Government of WA 2000b). The soils of the Pinjarra Plain consist of ‘clays with silts, sands and peat, also areas of ironstone at depth or surface associated with red/brown silts and limestones associated with clays and orange sands’ (Government of WA 2000b).

Department of Agriculture soil landscape mapping (DoA 2002) however, shows an area in the eastern portion of the site as comprising Forrestfield soils of the Ridge Hill Shelf landform which is described as the ‘lateritised foothills of the Darling Scarp dominated by gravelly and sandy soils’ by Churchward and McArthur (1980). Both sets of landform and soil mapping over the site are shown in **Figure 2**.

The site specific Geotechnical and Preliminary Acid Sulphate Soils report conducted by Douglas Partners in 2014 identifies the western portion of the site as broadly comprising pebbly silt of the Guildford Formation and the eastern area of the site was identified as sand from the Yoganup Formation. The Yoganup Formation was originally named by Low (1970) as the Ridge Hill dune system, indicating that the DoA (2002) mapping is more accurate and the eastern area of the site likely comprises the Ridge Hill Shelf landform unit.

The site is generally flat, and available contour information indicates that the site ranges from its lowest elevation of approximately 15 metres Australian Height Datum (m AHD) in west to its highest elevation of 17 m AHD in the east. Elevation increases at the railway line interface in the east and north of the site, ranging from 22 m AHD to 24 m AHD.

2.3 Regional Vegetation

The site lies within the Swan Coastal Plain Interim Biogeographic Regionalisation for Australia (IBRA) region (Thackway and Cresswell 1995). The Swan Coastal Plain IBRA region is broadly compatible with the Swan Coastal Plain (Drummond Botanical Subdistrict) Phyto-geographical Subregion as described by Beard (1990). This region is characterised by *Banksia* low woodlands on leached sands, woodlands of tuart (*Eucalyptus gomphocephala*), jarrah (*Eucalyptus marginata*) and marri (*Corymbia calophylla*) on less leached soils and *Melaleuca* swamps.

At a finer scale, vegetation complex mapping undertaken by Heddle *et al.* (1980) for the Swan Coastal Plain indicates that the site occurs within the Guildford Complex. Vegetation in this complex mainly consists of a mixture of open forest to tall open forest of *Corymbia calophylla - Eucalyptus wandoo - Eucalyptus marginata* and woodland of *Eucalyptus wandoo* (with rare occurrences of *Eucalyptus lane-poolei*). Minor components include *Eucalyptus rudis - Melaleuca rhaphiophylla* (Heddle *et al.* 1980).

As described in **Section 2.2**, whilst mapped by Heddle *et al.* (1980) as comprising the Guildford Complex, a small portion of the site to the east is likely to be more representative of the Forrestfield complex (which based on the Heddle *et al.* (1980) mapping begins approximately 150 m to the east of the eastern site boundary). Vegetation of this complex is described as ranging from open forest of *Corymbia calophylla - Eucalyptus wandoo, Eucalyptus marginata* to open forest of *Eucalyptus marginata - Corymbia calophylla, Allocasuarina fraseriana - Banksia* spp with fringing woodland of *Eucalyptus rudis* in the gullies that dissect this landform (Heddle *et al.*1980).

Prior to European settlement and the extensive land clearing that followed, the Guildford Complex covered 92,281 ha of the Swan Coastal Plain. Today 5,413 ha or 5.9% of this complex remains. Less than 1% of this complexes original extent is currently under some form of formal or informal protection (PBP 2013). The Forrestfield Complex once covered 21,211 ha on the Swan Coastal Plain. Today 2,534 ha (12%) remains, with 3.4% under some form of formal or informal protection (PBP 2013).

Many studies have indicated that the loss of biodiversity caused by habitat fragmentation is significantly greater once a habitat type falls below 30% of its original extent (Miles 2001). However this is a purely biodiversity orientated objective, and on the Swan Coastal Plain portion of the Perth Metropolitan Region, which is considered a ‘constrained area’, the EPA has applied a biodiversity protection objective of retaining 10% of each vegetation complex (EPA 2006). Based on this, the extent of the Guildford Complex remaining falls below the 10% constrained area objective whilst the extent of the Forrestfield Complex is slightly above this objective.

2.4 Threatened and Priority Species

Species of flora acquire 'Threatened' ('Declared Rare') or 'Priority' conservation status where populations are restricted geographically or threatened by local processes. The Department of Parks and Wildlife (DPaW) enforces the *Wildlife Conservation Act 1950* (WC Act) to conserve Threatened Flora and protect all populations. Priority flora species are potentially rare or threatened and are classified in order of threat. Threatened and Priority Flora category definitions are listed in **Table 2**.

Species of flora may also be listed pursuant to Schedule 1 of the *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act). These are defined as Threatened Flora species under the EPBC Act and are listed as 'Critically Endangered', 'Endangered' or 'Vulnerable'. Any action likely to have a significant impact on a species listed under the EPBC Act requires approval from the Commonwealth Minister for Environment.

A search was conducted of DPaW's databases for Threatened and Priority Flora within a 5 km radius of the site (Ref. No. 03-1014FL) and the EPBC Act list of Matters of National Environmental Significance (MNES) that occur within the wider local area and the results are listed in **Table 3**. Twenty one Threatened and 23 Priority Flora were identified as potentially occurring within the wider local area, including Threatened species *Calectasia cyanea* and *Darwinia foetida* which are listed as "Critically Endangered" pursuant to the EPBC Act.

Table 2: Definition of Threatened and Priority Flora Species (Smith 2010).

CONSERVATION CODE	CATEGORY
T	**Threatened Flora – Extant Taxa** Taxa which have been adequately searched for and are deemed to be in the wild either rare, in danger of extinction, or otherwise in need of special protection, and have been gazetted as such.
X	**Threatened Flora – Presumed Extinct Taxa** Taxa which have not been collected, or otherwise verified, over the past 50 years despite thorough searching, or of which all known wild populations have been destroyed more recently, and have been gazetted as such.
P1	**Priority One – Poorly Known Taxa** Taxa which are known from one or a few (generally <5) populations which are under threat, either due to small population size, or being on lands under immediate threat e.g. road verges, urban areas, farmland, active mineral leases etc., or the plants are under threat, e.g. from disease, grazing by feral animals etc. May include taxa with threatened populations on protected lands. Such taxa are under consideration for declaration as 'rare flora', but are in urgent need of further survey.
P2	**Priority Two – Poorly Known Taxa** Taxa which are known from one or a few (generally <5) populations, at least some of which are not believed to be under immediate threat (i.e. not currently endangered). Such taxa are under consideration for declaration as 'rare flora', but urgently need further survey.
P3	**Priority Three – Poorly Known Taxa** Taxa which are known from several populations, and the taxa are not believed to be under immediate threat (i.e. not currently endangered), either due to the number of known populations (generally >5), or known populations being large, and either widespread or protected. Such taxa are under consideration for declaration as 'rare flora' but needs further survey.
P4	**Priority Four – Rare Taxa** Taxa which are considered to have been adequately surveyed and which, whilst being rare (in Australia), are not currently threatened by any identifiable factors. These taxa require monitoring every 5-10 years.

Table 3: Significant flora species known to occur within the general area (DPaW Ref. No. 03-1014FL).

SPECIES	SIGNIFICANCE		LIFE STRATEGY	SUBSTRATE	FLOWERING PERIOD
	STATE	EPBC ACT			
Acacia aphylla	T	VU	P	Sand, loam, clay loam. Granite outcrops, hills.	Aug-Oct
Andersonia gracilis	T	EN	P	White/grey sand, sandy clay, gravelly loam. Winter-wet areas, near swamps.	Sep-Nov
Anigozanthos viridis subsp. *terraspectans*	T	VU	P	Grey sand, clay loam. Winter-wet depressions.	Aug-Sep
Anthocercis gracilis	T	VU	P	Sandy or loamy soils. Granite outcrops.	Sep-Oct
Caladenia huegelii	T	EN	Pg	Grey or brown sand, clay loam.	Sep-Oct
Calectasia cyanea	T	CE	P	White, grey or yellow sand, gravel.	Jun-Oct
Calytrix breviseta subsp. breviseta	T	EN	P	Sandy clay. Swampy flats.	Oct-Nov
Conospermum undulatum	T	VU	P	Grey or yellow-orange clayey sand.	May-Oct
Darwinia foetida	T	CE	P	Grey (black/white) sandy soils, sometimes with peat and clay. Often winter wet areas.	Sep-Nov
Diplolaena andrewsii	T	-	P	Loam, clay. Granite outcrops & hillsides.	Jul-Oct
Diuris micrantha	T	VU	Pg	Brown loamy clay. Winter-wet swamps, in shallow water.	Sep-Oct
Diuris purdiei	T	EN	Pg	Grey-black sand, moist. Winter-wet swamps.	Sep-Oct
Drakaea elastica	T	EN	Pg	White or grey sand. Low-lying situations adjoining winter-wet swamps.	Oct-Nov
Drakaea micrantha	T	VU	Pg	White-grey sand.	Sep-Oct
Eucalyptus x balanites	T	EN	P	Sandy soils with lateritic gravel.	Oct-Dec or Jan-Feb
Grevillea curviloba subsp. *incurva*	T	EN	P	Sand, sandy loam. Winter-wet heath.	Aug-Sep
Lepidosperma rostratum	T	EN	P	Peaty sand, clay.	Jun-Jul or Sep-Nov
Synaphea sp. Pinjarra Plain (A.S. George 17182)	T	-	P	Grey sandy loam or clay, grey-brown clayey sand, brown clayey loam, laterite. Flats, seasonally wet areas.	Sep-Nov
Thelymitra dedmaniarum	T	EN	Pg	Granite.	Nov-Dec or Jan
Thelymitra stellata	T	EN	Pg	Sand, gravel, lateritic loam.	Oct-Nov
Trithuria occidentalis	T	EN	A	Inundated soils. Depressions and claypans.	Sep-Nov

SPECIES	SIGNIFICANCE		LIFE STRATEGY	SUBSTRATE	FLOWERING PERIOD
	STATE	EPBC ACT			
Acacia oncinophylla subsp. oncinophylla	P3	-	P	Granitic soils.	Aug-Oct
Acacia ridleyana	P3	-	P	Grey or yellow/brown sand, gravelly clay, granitic loam.	Aug-Dec
Centrolepis caespitosa	P4	EN	A	White sand, clay. Salt flats, wet areas.	Oct-Dec
Cyathochaeta teretifolia	P3	-	P	Grey sand, sandy clay. Swamps, creek edges.	Sep-Jan
Eryngium sp. subdecumbens (G.J. Keighery 5390)	P3	-	A or P	Clay soils. Seasonal wetlands, claypans.	Sep-Nov
Darwinia pimelioides	P4	-	P	Loam, sandy loam. Granite outcrops.	Sep-Oct
Halgania corymbosa	P3	-	P	Gravelly soils, soils over granite.	Aug-Nov
Isopogon drummondii	P3	-	P	White, grey or yellow sand, often over laterite.	Feb-Jun
Lasiopetalum bracteatum	P4	-	P	Sandy clay, clay, lateritic gravel. Along drainage lines, creeks, gullies, granite outcrops.	Aug-Nov
Meionectes tenuifolia	P3	-	Aq	Inundated clay or sandy soils. Granite flats, wetlands.	Oct-Nov
Millotia tenuifolia var. laevis	P2	-	A	Granite or laterite soils.	Sep-Oct
Persoonia sulcata	P4	-	P	Lateritic or granitic soils.	Sep-Nov
Phyllangium palustre	P2	-	A	Clay. Winter-wet claypans, low-lying seasonal wetlands.	Oct-Nov
Picris wagenitzii	P1	-	A/P	-	Nov-Dec
Pithocarpa corymbulosa	P3	-	P	Gravelly or sandy loam. Amongst granite outcrops.	Jan-Apr
Senecio leucoglossus	P4	-	A	Gravelly lateritic or granitic soils. Granite outcrops, slopes.	Aug-Dec
Stylidium longitubum	P3	-	A	Sandy clay, clay. Seasonal wetlands.	Oct-Dec
Tetratheca pilifera	P3	-	P	Gravelly soils.	Aug-Oct
Thelymitra magnifica	P1	-	Pg	Stony ridges.	Oct – early Nov
Thelymitra variegata	P3	-	Pg	Sandy clay, sand, laterite.	Jun-Sep
Thysanotus anceps	P3	-	P	White or grey sand, lateritic gravel, laterite.	Oct-Dec
Thysanotus glaucus	P4	-	P	White, grey or yellow sand, sandy gravel.	Oct-Dec or Jan-Mar
Thysanotus isantherus	P4	-	P	Granite.	Nov-Dec

Note: P=Perennial, Aq=Aquatic annual, Pg=Perennial Geophyte, A=Annual, Ap=Aquatic perennial.

2.5 Threatened Ecological Communities and Priority Ecological Communities

In Western Australia, Threatened Ecological Communities (TECs) are determined by the Western Australian Threatened Ecological Communities Scientific Advisory Committee (WATECSAC) and endorsed by the Minister for the Environment. The WATECSAC is an independent group comprised of representatives from organisations including tertiary institutions, the WA Museum and DPaW. Communities are assigned to one of the categories outlined in **Table 4** relating to their status of threat. While they are not afforded direct statutory protection at a state level (unlike Threatened flora under the WC Act) their significance is acknowledged through other state environmental approval processes such as Environmental Impact Assessment pursuant to Part IV of the *Environmental Protection Act 1986* (EP Act) and Part V of the EP Act and associated clearing regulations.

'Threatened Communities' are also afforded statutory protection at a Federal level pursuant to the EPBC Act. The EPBC Act provides for the protection of ecological communities, which are listed under section 181 of the Act. They are categorised as either 'Critically Endangered', 'Endangered' or 'Vulnerable'.

Communities may also be listed as a Priority Ecological Community (PEC). This is an ecological community that is under consideration for listing as a state level TEC, but does not yet meet survey criteria or has not been adequately defined, and can be placed on the list of PECs in either Category 1, 2 or 3 (these are described in **Table 5**). Ecological communities that are adequately known and are rare but not threatened, or meet criteria for "Near Threatened", or that have been recently removed from the Threatened list, are placed in Priority 4. These ecological communities require regular monitoring. Conservation dependent ecological communities are placed in Priority 5 (DEC 2009a).

Table 4: Categories of Threatened Ecological Communities (English and Blyth 1997)

CONSERVATION CATEGORY	DESCRIPTION
PD	**Presumably Totally Destroyed** An ecological community that has been adequately searched for but for which no representative occurrences have been located.
CE	**Critically Endangered** An ecological community that has been adequately surveyed and is found to be facing an extremely high risk of total destruction in the immediate future.
E	**Endangered** An ecological community that has been adequately surveyed and is not critically endangered but is facing a very high risk of total destruction in the near future.
V	**Vulnerable** An ecological community that has been adequately surveyed and is not critically endangered or endangered but is facing a high risk of total destruction or significant modification in the medium to long-term future.

Table 5: Categories of Priority Ecological Communities (DEC 2009a)

PRIORITY CATEGORIES	DESCRIPTION
Priority 1	Ecological communities with apparently few, small occurrences, all or most not actively managed for conservation (e.g. within agricultural or pastoral lands, urban areas, active mineral leases) and for which current threats exist. Communities may be included if they are comparatively well-known from one or more localities but do not meet adequacy of survey requirements, and/or are not well defined, and appear to be under immediate threat from known threatening processes across their range.
Priority 2	Communities that are known from few small occurrences, all or most of which are actively managed for conservation (e.g. within national parks, conservation parks, nature reserves, State forest, unallocated Crown land, water reserves, etc.) and not under imminent threat of destruction or degradation. Communities may be included if they are comparatively well known from one or more localities but do not meet adequacy of survey requirements, and/or are not well defined, and appear to be under threat from known threatening processes.
Priority 3	Communities that are known from several to many occurrences, a significant number or area of which are not under threat of habitat destruction or degradation or: (ii) communities known from a few widespread occurrences, which are either large or within significant remaining areas of habitat in which other occurrences may occur, much of it not under imminent threat, or; (iii) communities made up of large, and/or widespread occurrences, that may or not be represented in the reserve system, but are under threat of modification across much of their range from processes such as grazing by domestic and/or feral stock, and inappropriate fire regimes. Communities may be included if they are comparatively well known from several localities but do not meet adequacy of survey requirements and/or are not well defined, and known threatening processes exist that could affect them.
Priority 4	Ecological communities that are adequately known, rare but not threatened or meet criteria for Near Threatened or that have been recently removed from the threatened list. These communities require regular monitoring.
Priority 5	Ecological communities that are not threatened but are subject to a specific conservation program, the cessation of which would result in the community becoming threatened within five years.

A search was conducted of DPaW's TEC and PEC database within a 10 km radius of the site (Ref. No. 08-01014EC) as well as the EPBC Act list of MNES. Five TECs and one PEC were found to occur within a 10 km radius of the site (See **Table 6**).

Of the TECs, SCP3a, SCP3c and SCP 20c are listed as 'Critically Endangered' pursuant to the EP Act and 'Endangered' pursuant to the EPBC Act.

Table 6: TEC's and PEC's known to occur within a 10 km radius of the site (DPaW reference no. 08-01014EC).

COMMUNITY CODE	COMMUNITY NAME	TEC/PEC	LEVEL OF SIGNIFICANCE	
			STATE	EPBC ACT
SCP 3a	*Corymbia calophylla - Kingia australis* woodlands on heavy soils, Swan Coastal Plain	TEC	Critically Endangered	Endangered
SCP 3c	*Corymbia calophylla - Xanthorrhoea preissii* woodlands and shrublands, Swan Coastal Plain	TEC	Critically Endangered	Endangered

COMMUNITY CODE	COMMUNITY NAME	TEC/PEC	LEVEL OF SIGNIFICANCE	
			STATE	EPBC ACT
SCP 20c	Shrublands and woodlands of the eastern side of the Swan Coastal Plain	TEC	Critically Endangered	Endangered
SCP 20a	*Banksia attenuata* woodland over species rich dense shrublands	TEC	Endangered	-
SCP 20b	*Banksia attenuata* and/or *Eucalyptus marginata* woodlands of the eastern side of the Swan Coastal Plain	TEC	Endangered	-
Central Granite Shrublands (Com 5, Markey)	Central Northern Darling Scarp Granite Shrubland Community	PEC	Priority 4	-

2.6 Bush Forever Sites

A small area of remnant vegetation located within the eastern portion of the site is recognised as regionally significant bushland and therefore included within the Bush Forever initiative as Bush Forever Site Number 309 (BF 309) – *Farrall Road Bushland, Stratton*. The attributes contributing to the regional significance of BF 309 include the representation of ecological communities and general criteria for the protection of wetland, streamline and estuarine fringing and coastal vegetation (Government of WA 2000a).

An area of bushland approximately 750 m east of the site is mapped as Bush Forever Site Number 306 (BF 306) – *Talbot Road Bushland, Stratton/Swan View.* The attributes contributing to the regional significance of BF 306 include the representation of ecological communities, diversity, rarity, scientific or evolutionary importance and general criteria for the protection of wetland, streamline and estuarine fringing and coastal vegetation (Government of WA 2000a).

The locations of these Bush Forever sites are shown on **Figure 3.**

2.7 Local and Regionally Significant Flora and Vegetation

Apart from being listed as either Threatened or Priority Flora, plant species may be significant for a number of other reasons. The EPA stated in Guidance Statement No. 51 (EPA 2004) that significant flora may include taxa that have:

- "a keystone role in a particular habitat for threatened species, or supporting large populations representing a significant proportion of the local regional population of a species
- relic status
- anomalous features that indicate a potential new discovery
- being representative of the range of a species (particularly, at the extremes of range, recently discovered range extensions, or isolated outliers of the main range)
- the presence of restricted subspecies, varieties or naturally occurring hybrid
- local endemism/a restricted distribution
- being poorly reserved."

Similarly, plant communities or vegetation may be significant for reasons other than a listing as a TEC or PEC. The EPA (2004) stated that these reasons include:

- "scarcity
- unusual species
- novel combinations of species
- a role as a refuge
- a role as a key habitat for threatened species or large populations representing a significant proportion of the local to regional total population of a species
- being representative of the range of a unit (particularly, a good local and/or regional example
- of a unit in 'prime' habitat, at the extremes of range, recently discovered range extensions, or isolated outliers of the main range)
- a restricted distribution."

Species which meet the above criteria will be identified as part of the field assessment.

2.8 Environmental Sensitive Areas (ESA)

Environmentally Sensitive Areas (ESAs) are prescribed under the *Environmental Protection (Clearing of Native Vegetation) Regulations 2004* and have been identified to protect native vegetation values of areas surrounding significant, threatened or scheduled flora, vegetation communities or ecosystems. Within an ESA none of the exemptions under the *Environmental Protection (Clearing of Native Vegetation) Regulations 2004* apply. However, exemptions under Schedule 6 of the *Environmental Protection Act 1986* still apply, including any clearing in accordance with a subdivision approval under the *Planning and Development Act 2005* (a recognised exemption under the Schedule 6 of the *Environmental Protection Act 1986*).

An ESA is located within the site and has been identified to protect BF 309 (described in detail in **Section 2.6**) located within the site. This ESA is shown on **Figure 3**.

2.9 Hydrology

2.9.1 Groundwater

The Perth Groundwater Atlas mapping does not extend to cover the site, however calculations of the average annual maximum groundwater level (AAMGL) undertaken by MPA Williams and Associates (2005) for the site indicated groundwater ranged from 5 m below the ground level to ponding at the surface, with the majority of the site AAMGL less than 0.25 m below ground level.

2.9.2 Wetlands

Wetlands in Western Australia have been defined locally as: "*areas of seasonally, intermittently or permanently waterlogged soils or inundated land, whether natural or otherwise, fresh and saline, e.g. waterlogged soils, ponds, billabongs, lakes, swamps, tidal flats, estuaries, rivers and their tributaries* (Wetlands Advisory Committee 1977). This definition has been adopted by Semeniuk (1987) and by the V & C Semeniuk Group for the purposes of mapping and classification and is discussed further below in **Section 2.9.2.1**.

Wetlands can further be recognised by the presence of vegetation associated with waterlogging or the presence of hydric soils such as peat, peaty sand or carbonate mud (Hill *et al.* 1996). When determining the

boundary of a wetland, it should encompass all features diagnostic of "wet" lands, therefore within a single wetland, there may be parts or zones that are permanently inundated, seasonally inundated or seasonally waterlogged by water table rise, and all of these zones or parts of wetlands would be viewed as being "wet" lands (Hill *et al.* 1996).

2.9.2.1 Geomorphic Wetland Classification and Dataset

The geomorphic wetland classification system of Semeniuk (1987) is a recognised classification system for the Darling System (which includes the Swan Coastal Plain) and is based on the landform shape and water permanence (hydro-period) of the wetland.

DPaW maintains the *Geomorphic Wetland Swan Coastal Plain Dataset*, which also categorises individual wetlands into specific management categories as described in **Table 7**. The significance of each wetland is based on hydrological, biological and human use features, which are the key components for the determination of management categories. This dynamic dataset is continually updated with site-specific wetland surveys providing new and relevant information. The guidelines for proposing changes to the wetland boundaries and management categories (DEC 2009b) state that relevant information should be obtained in the optimal season for vegetation condition and water levels, which is usually spring (DEC 2009b).

Each classified wetland listed in the *Geomorphic Wetland Swan Coastal Plain Dataset* is given a Unique Feature Identifier (UFI). However in the case of larger wetlands that have undergone a degree of disturbance, a separate management category may be assigned to parts of the wetland in order to reflect the current values.

Table 7: Wetland management categories and management objectives (WAPC 2005).

MANAGEMENT CATEGORY	DESCRIPTION OF WETLAND	MANAGEMENT OBJECTIVES
Conservation (CCW)	Supports high levels of attributes and functions	Preserve wetland attributes and functions through reservation in national parks, crown reserves and state owned land. Protection provided under environmental protection policies.
Resource Enhancement (REW)	Partially modified but still supporting substantial functions and attributes	Restore wetland through maintenance and enhancement of wetland functions and attributes. Protection via crown reserves, state or local government owned land, environmental protection policies and sustainable management on private properties.
Multiple Use (MUW)	Few wetland attributes but still provide important hydrological functions	Use, development and management considered in the context of water, town and environmental planning through land care.

A review of the *Geomorphic Wetlands Swan Coastal Plain* dataset identified portions of two wetland systems that occur within the boundaries of the site (See **Table 7** and **Figure 3**).

A Resource Enhancement Wetland (REW) (Palusplain) UFI No. 12624 occurs on the north eastern edge of the site. REW classification indicates that the wetland supports an average of 66% of the original vegetation intact and substantial wetland attributes (Hill *et al.* 1996). The management priorities for REWs are to restore wetlands through maintenance and enhancement of wetland functions and attributes (Hill *et al.* 1996).

The majority of the site forms part of the large Multiple Use Wetland (MUW) UFI No. 15136. Most MUWs are extensively cleared wetlands. On the Swan Coastal Plain over 82% of the palusplain area has been included in the MUW category. The management objectives for MUWs are to use, develop and manage wetlands in context of water, town and environmental planning (Hill *et al.* 1996).

Table 8: Details of Geomorphic Wetlands Swan Coastal Plain areas present within the site.

UNIQUE FEATURE IDENTIFIER NUMBER	WETLAND TYPE	MANAGEMENT CATEGORY	AREA WITHIN SITE
15136	Palusplain (seasonally waterlogged flat)	Multiple Use	55 ha
12624	Palusplain (seasonally waterlogged flat)	Resource Enhancement	2.8 ha

2.9.2.2 Consanguineous Suites

The term ‘consanguineous suite’ as defined by Semeniuk (1988) has been used to describe the relatedness between wetlands with respect to their proximity, size, shape, type, salinity, hydrology and geological origin. The concept was further developed and the wetlands of the Swan Coastal Plain delineated into consanguineous suites by Hill *et al.* (1996).

Hill *et al.* (1996) indicates that the geomorphic wetlands within the site comprise the Swan River consanguineous suite. The Swan River suite considers of river floodplains traversing the Swan Coastal Plain with incised channel alternatives with braided shallow channels, terraces and large point bar deposits (Hill *et al.* 1996). The wetlands within the site comprise palusplains. Statistics of the distribution of consanguineous suites across the Swan Coastal Plain indicate that Swan River wetlands comprised 10,252 ha as of 2008, of which 6.6% is classified as CCW (DPaW 2013).

2.9.3 Significant Wetland Databases and Lists

Wetlands of regional, national, international or cultural significance are often added to wetland lists. The following lists were checked as part of this assessment:

- *Ramsar List of Wetlands of International Importance*
- *A Directory of Important Wetlands in Australia*
- *Environment Protection Policy (EPP) Lakes*
- *Register of the National Estate*

The site is not known to contain any of the above significant wetland features.

2.10 Biodiversity Linkages

Biodiversity linkages are linear landscape elements that allow the movement of fauna, flora and genetic material between areas of remnant habitat. The movement of fauna and the exchange of genetic material between vegetation remnants improve the viability of those remnants by allowing greater access to breeding partners and food sources, refuge from disturbances such as fire and maintenance of the genetic diversity of plant communities and populations. Biological linkages are ideally continuous or near-continuous as the more fractured a linkage is, the less ease flora and fauna have in moving within the corridor (Alan Tingay and Associates 1998).

Regional Biodiversity Linkages have been identified by the State Government in Bush Forever, Perth's Greenways and the System 6 study and supported by the WA Local Government Association (Molloy *et al.* 2007). These identified linkages reflect the on-ground linkages throughout the Perth Metropolitan area. The dataset is employed as a conservation tool aimed to conserve and enhance regional biological linkages.

Biodiversity Linkage No. 126 runs from east to west just to the north of the site and associated with Jane Brook connects with Biodiversity Linkage Nos 35 and 34 to the west and east of the site respectively. Sections of these linkages occurring close to the site are shown on **Figure 3**.

2.11 Previous Flora and Vegetation Assessments

A flora and vegetation assessment was undertaken by Coffey Environments in October and November of 2006 over the majority of the site, excluding the portion to the north of the railway line. This assessment identified 125 flora species occurring within the site, of which 36 (29%) were introduced non-native species. None of the species recorded were listed as Threatened or Priority Flora. The assessment identified nine vegetation types throughout the site, and the site was inferred to contain Floristic Community Types (FCTs) No. 11 – 'Wet Forests and Woodlands' and No. 23a – 'Central *Banksia attenuata* – *B. menziesii* Woodlands'. Neither FCT is listed as a TEC or PEC. The majority of the site was considered to be in 'Completely Degraded' condition with some patches in 'Degraded' condition where weed invasion and partial clearing has occurred. A small patch of 'Good' condition vegetation was recorded in the centre of the site and BF 309 was considered to be in 'Excellent' condition.

3 Field Survey

3.1 Field Survey Methods

Two botanists from Emerge visited the site on the 7 and 8 October 2014 and undertook a 'detailed' flora, vegetation and wetland assessment. The site was traversed on foot and a detailed survey of the vegetation was undertaken at 23 survey locations using non-permanent sampling 10 m x 10 m quadrats or relevés, selected to adequately sample each plant community observed (as shown on **Figure 4**) and provide replication within plant communities where possible. The position of each survey location was recorded with a hand-held GPS unit and all vascular plant species were recorded within the survey area. An estimate of the percentage Foliage Projective Cover (FPC) was made for each species at each survey location. In addition, opportunistic plant taxa that were observed, but not located at a particular survey location, were also recorded through the course of the survey.

Data recorded from each survey location included:

- Site details (site name, site number, observers, date, location).
- Environmental data (slope, aspect, bare-ground, rock outcropping soil type and colour class, litter layer, topographical position, time since last fire event).
- Biological data (vegetation structure and condition, degree of disturbance, species cover percentages).

The condition of the vegetation was assessed to assist in determining the conservation values of the site. The vegetation condition was rated according to Keighery (1994), a vegetation condition scale commonly used in the Perth Metropolitan Region, but which is also appropriate for other urbanised and agricultural areas. The categories are listed and defined in **Table 9**.

In addition to sampling plots, points of interest (POIs) and photograph points were recorded opportunistically to show particular site conditions. These site photograph locations are shown on **Figures 4** and **5** and the photographs taken provided in **Appendix A**.

All plant specimens collected during the field survey were dried, pressed and then named in accordance with requirements of the Western Australian Herbarium. Identification of specimens occurred through comparison with named material and through the use of taxonomic keys.

Table 9: Vegetation condition scale (Keighery 1994).

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

3.1.1 Wetland Assessment

The wetland vegetation of MUW UFI No. 15136 and REW UFI No. 12624 was surveyed as part of the flora and vegetation survey (methods provided in **Section 3.1**). Other wetland characteristics, such as size, shape and boundary have been noted as part of the field assessment.

DPaW have released a draft version of "*A methodology for the evaluation of specific wetland types on the Swan Coastal Plain, Western Australia*" (DPaW 2013). This document aims to update the methodology by which wetlands on the Swan Coastal Plain are assigned management categories based on a two tiered evaluation system, with preliminary and secondary evaluation stages. The preliminary evaluation aims to identify any extraordinary features of conservation significance that would immediately place the wetland within the CCW management category. Examples of these significant features include presence on significant wetland lists, presence of TECs or PECs (Priority 1 and 2), presence of Threatened Flora and over 90% of vegetation in 'Good' or better condition based on the Keighery (1994) scale. If such environmental values are identified the wetland would be categorised as CCW without further evaluation. Should the preliminary evaluation indicate that no such features occur, the secondary evaluation and full site assessment are required and aimed at determining the number of high, intermediate and low level environmental attributes, functions and values and subsequently the appropriate management category.

The completed DPaW evaluations for MUW UFI No. 15136 and REW UFI No. 12624 are presented in **Appendix B.**

3.1.2 Mapping and Data Analysis

Plant communities were determined by performing a hierarchical cluster analysis on the % FPC data recorded for each species at each survey location. The % FPC data was first converted to a Domin

value (Kent and Coker 1994) and then imported into the statistical analysis package Primer-6 (Clarke and Gorley 2006). Classification was undertaken using a group-average hierarchical clustering technique using the Bray-Curtis distance measure. Groups were further defined by using a similarity probability measure, with a significance level of 0.05%. The resultant dendrogram is provided in **Appendix C.**

The identified plant communities and vegetation condition were then mapped on aerial photography (1:8,000) from the survey locations and by interpretation of vegetation patterns on the aerial photography.

Once plant communities were described and mapped, each community was statistically compared to the regional Floristic Community Type (FCT) studies and dataset by Gibson *et al.* (1994). Floristic Community Types (FCTs) were determined statistically using presence/absence species data. Site data was reconciled with the SCP dataset of Gibson *et al*. (1994) by standardising the names of taxa with those used in the earlier study. This was necessary due to changes in nomenclature in the intervening period. Taxa that were only identified to genus level were excluded while some infra-species that have been identified since 1994 were reduced to species level. The combined dataset was then imported into the statistical analysis package Primer-6 (Clarke and Gorley 2006). Classification was undertaken using a group-average hierarchical clustering technique using the Bray-Curtis distance measure (as described above for plant community determination). Due to the lack of clarity of some results of this analysis, additional statistical analysis was undertaken by an independent botanist specialising in statistical analysis, the methodology and results of the analyses performed are provided in **Appendix D**.

The various methodologies of determining FCTs based on the Gibson *et al.* (1994) dataset have a number of limitations which need to be considered. These include;

- Areas of disturbance and reduced condition tend to have reduced numbers of native species and increased numbers of introduced weed species. Both methods outlined above may be skewed by a small number of species where species loss and disturbance has occurred, leading to misleading similarities to FCTs.
- The Gibson *et al.* (1994) survey was focused on the least degraded sites available. Thus, highly degraded sites can be very difficult to place within this data.
- The Gibson *et al.* (1994) dataset comprises a relatively limited number of sites (509) in relation to the degree of variability of vegetation present within the large area on which it is based.
- As noted within Bush Forever (Government of WA 2000), not all geographical or geomorphological variation was sampled. The foothills, Pinjarra Plain, Quindalup Dunes and Dandaragan Plain were either under-sampled or not sampled at all. As a result a number of the defined FCTs were based on as few as two survey locations.
- A number of supplementary surveys were conducted from 1994-1998 in order to update the dataset. These surveys comprised an additional 613 quadrats and when analysed against the Gibson *et al.* (1994) dataset, resulted in a further 23 FCTs being identified (Government of WA 2000). These additional FCTs are listed in Bush Forever (Government of WA 2000) and inferred to occur within the descriptions of Bush Forever sites but were never formally described or published. Nor has the data been made available in order to include within analyses of FCTs.
- The Gibson *et al.* (1994) dataset records presence or absence of flora species, but does not account for changes in species dominance, which is highly variable on the Swan Coastal Plain.
- With the exception of plant community **BaBm**, vegetation within the site was largely surveyed using relevés (vegetation sampled within a radius of approximately 10 m from a central point), as

opposed to the quadrats (vegetation surveyed within a defined 10 x 10 m square) used within the Gibson *et al.* (1994) survey. These methods sample different areas of land, thus are not strictly comparable. Within degraded areas however it is unlikely that surveying quadrats would yield widely different results, thus on the basis that approximately three times the area of land is surveyed within a relevé, sampling relevés may identify more species within degraded areas and yield more comparable results to the Gibson *et al.* (1994) dataset (which was focused on the least degraded locations possible).

3.2 Field Results

3.2.1 General Site Conditions

The majority of the site has been subject to significant clearing, grazing and weed invasion historically however some patches of remnant vegetation remain. The portion of the site to the west of Farrall Road contained areas of standing water at the time of the survey. This portion of the site contains many tracks and considerable domestic rubbish dumping was noted in some locations along the tracks, as shown in **Plate 1**. The portion of the site to the east of Farrall Road (excluding BF 309) contained sandy soils and was notably drier at the time of the survey.

Plate 1: Rubbish dumping noted within the portion of the site to the west of Farrall Road.

3.2.2 Flora

A total of 86 native and 72 weed species were recorded within the site in 2014, representing 54 families and 124 genera. The dominant families containing native taxa were Myrtaceae (18 native taxa and four introduced taxa), Fabaceae (13 native taxa and ten introduced taxa) and Proteaceae (ten

native taxa). The genera containing the highest number of species were *Melaleuca* (five native and two introduced taxa), *Eucalyptus* (four native taxa and one introduced taxon), *Jacksonia* (four native taxa), *Acacia* (2 native taxa and two introduced taxa) and *Banksia* (four native taxa).

For a complete species list and individual survey data refer to **Appendix E, Appendix F** and **Appendix G** respectively.

3.2.3 Introduced Flora

A total of 72 non-native weed species were identified to occur within the site.

3.2.3.1 Declared Pests

Two weed species, **Asparagus asparagoides* (Bridal Creeper) and **Zantedeschia aethiopica* (Arum Lily) were recorded that are listed as 'Declared Pests' pursuant to the *Biosecurity and Agriculture Management Act 2007* (BAM Act). Declared Pest status means weed species are highly invasive and aggressive. Species may be a Declared Pest over the whole of the state, or by particular local government areas.

Under the BAM Act, all Declared Pests are placed in one of three categories, namely C1 (exclusion), C2 (eradication) or C3 (management). These categories are described further in **Table 10**.

Declared Pest species **A. asparagoides* was recorded at three locations localised though the centre of the site. **Z. aethiopica* was recorded at seven locations scattered throughout the site, including within REW UFI No. 12624. Both Declared Pest species are categorised as a C3 species.

Table 10: Categories of Declared Pest species under the BAM Act (DAFWA 2013).

CATEGORY	DESCRIPTION
C1 (Exclusion)	Not established in Western Australia and control measures are to be taken, including border checks, in order to prevent them entering and establishing in the State.
C2 (Eradication)	Present in Western Australia in low enough numbers or in sufficiently limited areas that their eradication is still a possibility.
C3 (Management)	Established in Western Australia but it is feasible, or desirable, to manage them in order to limit their damage. Control measures can prevent a C3 pest from increasing in population size or density or moving from an area in which it is established into an area which currently is free of that pest.

Under the BAM Act, a person must not; "*a) keep, breed or cultivate the declared pest; b) keep, breed or cultivate an animal, plant or other thing that is infected or infested with the declared pest; c) release into the environment the declared pest, or an animal, plant or other thing that is infected or infested with the declared pest; or d) intentionally infect or infest, or expose to infection or infestation, a plant, animal or other thing with a declared pest*" (Part 2.3.23).

Observed locations within the site of these Declared Pests are shown on **Figures 4** and **5**, but this may not represent their entire distributions throughout the site.

In addition, **Moraea flaccida* and **Echium plantagineum* were recorded within the site and are listed as a Declared Pest on the Western Australian Organism List, however the Declared Pest status of these species does not cover the entirety of the state and neither are listed as Declared Pests within the City of Swan in which the site is located.

3.2.4 Priority and Threatened Flora

No Threatened Flora species were recorded as occurring within the site; however six individuals of Priority 3 species *Isopogon drummondii* were recorded scattered in the eastern portion of the site. The locations of *I. drummondii* are provided in **Table 11** and shown on **Figures 4** and **5**.

Table 11: Locations of Priority 3 Flora species Isopogon drummondii within the site.

EASTING	NORTHING	NUMBER OF INDIVIDUALS
408612	6473074	1
408731	6472610	1
408721	6472607	1
408710	6472595	1
408713	6472594	1
408707	6472773	1

3.2.5 Plant Communities

Nine remnant plant communities, areas of revegetation and 'Parkland Cleared' paddocks or other cleared areas were identified and described within the site. They are shown on **Figure 4** and described as follows:

BaBm – Sparse to open woodland of *Banksia attenuata*, *Banksia menziesii* and *Eucalyptus todtiana* over open shrubland to shrubland of *Adenanthos cygnorum* and *Allocasuarina humilis* over low sparse shrubland to shrubland of *Conostephium pendulum, Stirlingia latifolia* and *Hibbertia* spp. over forb and sedgeland of *Lyginia* spp., *Dasypogon bromeliifolius*, *Conostylis aculeata*, *Podotheca gnaphalioides* and forb/grassland of pasture weeds (**Plate 2**).
Mp – Woodland to low open forest of *Melaleuca preissiana*, with emergent *Corymbia calophylla* over sparse shrubland of *Astartea scoparia*, *Marianthus* sp., *Xanthorrhoea preissii* and *Acacia pulchella* over sedgeland to closed sedgeland of *Dielsia stenostachya* and Cyperaceae sp. and open forbland of *Corynotheca micrantha* subsp. *micrantha*, *Drosera* spp. and *Burchardia congesta*. Understorey layers largely absent in degraded areas and replaced by a closed grass/forbland of pasture weeds (**Plate 3**).
CcEr – Open woodland of *Corymbia calophylla* and *Eucalyptus rudis* over patches of tall shrubland of *Taxandria linearifolia* and **Acacia longifolia* over sparse low shrubland of *Astartea scoparia* and *Hypocalymma angustifolium* over sparse sedgeland of *Hypolaena exsulca* and *Dielsia stenostachya* over closed forb/grassland of pasture weeds (**Plate 4**).
Cc – Woodland of *Corymbia calophylla* over shrubland *Jacksonia* spp., *Adenanthos cygnorum* and **Leptospermum laevigatum* (or shrub layer absent) over closed forb/grassland of pasture weeds (**Plate 5**).
Mr – Shrubland to closed shrubland of *Melaleuca rhaphiophylla* over forb/grassland of pasture weeds (**Plate 6**).
CcM – Woodland of *Corymbia calophylla* with occasional *Melaleuca preissiana* trees over shrubland of *Melaleuca rhaphiophylla* over closed forb/grassland of pasture weeds (**Plate 7**).
ErMr – Sparse woodland to woodland of *Eucalyptus rudis* over sparse shrubland to shrubland of *Melaleuca rhaphiophylla* over closed forb/grassland of pasture weeds (**Plate 8**).

Er – Sparse woodland to open forest of *Eucalyptus rudis* over closed forb/grassland of pasture weeds (**Plate 9**).
Vj – Thicket of *Viminaria juncea* over sedgeland of *Dielsia stenostachya* and grassland of pasture weeds (**Plate 10**).
R – Revegetated area adjacent to man-made sump containing planted native and exotic species (**Plate 11**).
Parkland Cleared – Sparse native and planted exotic trees over closed forb/grassland of pasture weeds (**Plate 12**).

*Plate 2: Plant Community **BaBm** in 'Good' condition. Taken facing east at survey location Q1.*

*Plate 3: Plant community **Mp** in 'Excellent' condition. Taken facing south at survey location R4.*

*Plate 4: Plant community **CcEr** in 'Degraded' condition. Taken facing south at survey location R15.*

*Plate 5: Plant community **Cc** in 'Degraded' condition. Taken facing east at survey location R1.*

*Plate 6: Plant community **Mr** in 'Degraded' condition. Taken facing west at survey location R17.*

*Plate 7: Plant community **CcM** in 'Degraded' condition. Taken facing north at survey location R9.*

*Plate 8: Plant community **ErMr** in 'Degraded' condition. Taken facing west at survey location 11.*

*Plate 9: Plant community **Er** in 'Degraded' condition. Taken facing north at survey location 20.*

*Plate 10: Plant community **Vj** in 'Degraded' condition. Taken facing south at survey location R17.*

Plate 11: Revegetated area bordering man-made lake at the northern periphery of REW UFI No. 12624. Taken facing east at survey location R5.

Plate 12: Parkland Cleared vegetation in 'Completely Degraded' condition. Taken facing south at photo point 10.

3.2.6 Analysis of Floristic Community Types

Based on the statistical comparison between the plant communities described above and the Gibson *et al.* (1994) Swan Coastal Plain floristic survey dataset and a comparison of species occurrences, the FCTs present within the site are considered most likely to be FCT 11: Wet forests and woodlands and FCT 21c: Low lying *Banksia attenuata* woodlands and shrublands.

Plant community **Cc** showed a low similarity (5%) to a grouping containing many FCTs (including FCT 3a, 3c, 4, 5, 10b, 22, 24, 26a, 26b, 28, 29 and 30). Based on the native species remaining, plant community **Cc** may have once represented FCT 3c – *Eucalyptus calophylla* (now named *Corymbia calophylla*) – *Xanthorrhoea preissii* woodlands and shrublands, however *C. calophylla, Acacia saligna and Jacksonia sternbergiana* are the only remaining representative species of this FCT and thus plant community **Cc** is not considered to represent this FCT.

The majority of plant communities (**Mp, ErMr, Er, CcEr, Mr, Vj and CcM)** are likely to represent FCT 11 and plant community **BaBm** is considered most likely to represent FCT 21c showing 38% similarity to Gibson *et al.* (1994) FCT 21c sites DEJONG-C and HYMUS03, with lower similarities to FCT 23a (36%)and FCT 20c (33%) also noted. The results of the analysis and additional statistical analysis are provided in **Appendix D**.

FCT 11 is considered to be 'well reserved' and 'low risk' (Gibson *et al.* 1994). FCT 21c is considered to be 'well reserved' but 'susceptible' (Gibson *et al.* 1994) and is listed as a PEC.

3.2.7 Vegetation Condition

Vegetation across the site ranged from 'Completely Degraded' to 'Excellent' condition. Areas of 'Parkland Cleared' were 'Completely Degraded' and comprise 70.5 ha of the total 89 ha site (79%). The mapped plant communities ranged from 'Degraded' to 'Excellent' condition and occupied the remaining 18.5 ha (21%).

One area of 'Excellent' condition vegetation was located in the south eastern portion of the site within BF 309. Directly east of this BF site, an area of plant community **BaBm** was in 'Good' condition, due to a relatively intact vegetation structure. The remaining area of plant community **BaBm** along the eastern edge of the site was in 'Degraded' condition. Scattered patches of marginally intact vegetation were located throughout the site and were also in 'Degraded' condition. Vegetation condition across the site is shown on **Figure 5**.

3.2.8 Wetlands

3.2.8.1 REW UFI No. 12624

REW UFI No. 12624 contained plant community **Mp** in 'Degraded' condition surrounded by Parkland Cleared vegetation consisting of pasture weeds. The canopy was dominated by *Melaleuca preissiana* and was relatively intact, with some tall woody weeds such as **Schinus terebinthifolius* and **Ficus carica.* Only scattered native understorey species remained within the wetland area, with the understorey dominated by invasive grass and forb species, including Declared Pest species **Z. aethiopica*, which was recorded at both survey locations within the wetland. A representative photograph of the vegetation present within REW UFI No. 12624 is depicted in **Plate 13**. It is considered likely that REW UFI No. 12624 would have once contained similar vegetation to that found within BF 309.

A man-made constructed lake occurs on the northern periphery of REW UFI No. 12624 (shown on **Plate 14**), this lake extends further to the northwest of the site, where there are an additional two constructed lakes outside of the site boundary. Examination of historical aerial photography available through Landgate (2014) indicates that these lakes were excavated between 1985 and 1995, at which point there was no native vegetation within the area. Planted vegetation surrounding the water bodies however is visible from 2000; the field survey indicated that this planted vegetation includes a variety of native and exotic flora species.

The DPaW evaluation methodology resulted in a total of four high scores, eight intermediate scores and 5 low scores for REW UFI No. 12624, indicating that Resource Enhancement (or Rehabilitation Potential as proposed within DPaW (2013)) is the most applicable management category.

*Plate 13: Vegetation within REW UFI No. 12624. Plant community **Mp** in 'Degraded' condition with invasion by a number of weed species, including *Schinus terebinthifolius (centre), *Zantedeschia aethiopica (right) and grass weeds throughout.*

Plate 14: Constructed lake and area of revegetation within the northern extent of REW UFI No 12624. Contained native and exotic flora species.

3.2.8.2 MUW UFI No. 15136

MUW UFI No. 15136 covers the majority of the site and extends further to the west, north and east of the site. Over the wetlands entire area (335 ha), the condition is variable, containing pockets of relatively intact vegetation especially to the north of the site along the Jane Brook waterway. Within the site the vegetation is similarly variable, the majority comprising 'Degraded' or 'Completely Degraded' vegetation dominated by scattered *Eucalyptus rudis* trees and *Melaleuca rhaphiophylla* shrubs. One small area of plant community **Mp** within the wetland was in 'Excellent' condition. This area is also mapped as Bush Forever Site No. 309 – Farrall Road Bushland, Stratton and is shown in **Plate 3**.

The soils within MUW UFI No. 15136 consisted of orange to brown silt with dark organic matter and some areas with pebbles during the field survey, thus it is considered likely that the soils are the original wetland soils. Some localised changes to the landform were noted, with some excavation and dumping of soil and vegetation; however the wetland's original landform largely is intact, which is subject to seasonal inundation as shown in **Plates 15** and **16**.

Plate 15: Silty soils on tracks, areas of open water pooling and Parkland Cleared vegetation within MUW UFI No. 15136.

Plate 16: Cleared and seasonally inundated grasslands within MUW UFI No. 15136.

The DPaW evaluation methodology for the portion of MUW UFI No. 15136 within the site resulted in a total of five high scores, six intermediate scores and eight low scores for the portion of MUW UFI No. 15136 within the site, indicating that Multiple Use is the most appropriate management category.

If the management category of the area plant community **Mp** in 'Excellent' condition within MUW UFI No. 15136 was assessed separate from the rest of MUW UFI No. 15136, it is likely that the appropriate management category would be CCW due to the domination of vegetation in Good or better condition.

4 Discussion

The site has been described and mapped by Heddle *et al.* (1980) as being part of the Guildford Complex, which is transitional between the Bassendean Dune System and the Pinjarra Plain. Vegetation in this complex mainly consists of a mixture of woodland of *Eucalyptus marginata-Allocasuarina fraseriana-Banksia* spp. to low woodland of *Melaleuca* spp. and sedgelands on moister sites (Heddle *et al.* 1980). Department of Agriculture soil landscape mapping (DoA 2002) however shows some of the eastern portion of the site as comprising Forrestfield soils. Vegetation of the Forrestfield Complex is described as ranging from open forest of *Corymbia calophylla - Eucalyptus wandoo, Eucalyptus marginata* to open forest of *Eucalyptus marginata - Corymbia calophylla, Allocasuarina fraseriana - Banksia* spp with fringing woodland of *Eucalyptus rudis* in the gullies that dissect this landform (Heddle *et al.*1980).

86 native flora species were recorded within the site, compared to 72 weed species. No Threatened Flora species were found to occur within the site; however one Priority 3 Flora species, *Isopogon drummondii*, was found to occur on the eastern edge of the site, represented by six individuals. Four of these individuals are located within an area of 'Good' condition vegetation, the additional two individuals occur in 'Degraded' areas. Due to their life history, the perennial geophyte species *Thelymitra variegata* (P3) and the annual daisy species *Picris wagenitzii* (P1) would not have been in flower when the survey was conducted and thus would not have been readily detected during the field survey. *Thelymitra variegata* is largely found in sandy soils with *Banksia* and jarrah woodlands (Hoffman and Brown 1998) between Perth and Albany. The closest collection to the site was taken in 1903, located along the Helena River approximately 3 km to the south of the site (FloraBase 2014). No other collections have been made close to the site. The only part of the site meeting the habitat preferences of *T. variegata* is the eastern portion containing sandy soils and plant community **BaBm**. This area has been significantly degraded historically through clearing, grazing and weed invasion and is largely in 'Degraded' condition, excepting a small pocket in 'Good' condition adjacent to BF 309. Given the level of historical disturbance it is not deemed to be likely that *T. variegata* occurs within the site. *Picris wagenitzii* (P1) was described in 1994 from a small number of specimens collected between 1826-1899 (Holzapfel 1994). No specimens of this species are located within the Western Australian Herbarium collection (FloraBase 2014). Holzapfel (1994) noted the limited available data on the species due to the age of the specimens, but suggests that the species may be limited to the Darling Range based on available information. As such, the species is highly unlikely to occur within the site as it is located west of the Darling Range on the Swan Coastal Plain landform. Thus, no other Threatened or Priority Flora species are considered likely to occur within the site and not have been recorded during the field survey.

Nine plant communities and areas of revegetation and 'Parkland Cleared' vegetation were described as occurring within the site. Two plant communities (**BaBm** and **Cc**) are relatively dryland, whereas the remaining seven plant communities occur in the wetter portions of the site and predominately contain wetland flora species. 'Parkland Cleared' vegetation comprises the majority of the site (79%) and consists of scattered remnant *Eucalyptus rudis* and *Corymbia calophylla* trees and planted exotic tree species over weeds with isolated native shrubs and forbs over a closed grass/forbland of pasture weeds.

Plant communities **Mp**, **ErMr**, **Er**, **CcEr**, **Mr**, **Vj** and **CcM** were determined or inferred to most likely represent FCT 11 – Wet woodlands and shrublands, which is not listed as a TEC or PEC. All of these plant communities were in 'Degraded' condition. Statistically, plant community **Cc** showed low

similarity to a large grouping of FCTs. Based on the native species remaining, this community may have once represented FCT 3c - *Corymbia calophylla – Xanthorrhoea preissii* woodlands and shrublands, which is a state and federally listed TEC However, *C. calophylla, Acacia saligna* and *Jacksonia sternbergiana* are the only remaining representative species of this FCT within the site and the community was in 'Degraded' condition, thus plant community **Cc** is not considered to represent this FCT. Plant community **BaBm** showed highest similarity to FCT 21c - Low lying *Banksia attenuata* woodlands and shrublands, with comparatively lower similarity to FCT 23a and FCT 20c. FCT's 21c (and FCT 23a) are predominantly located on the Bassendean Dune system (Gibson *et al.* 1994), and there are no known locations of this FCT on the Guildford or Forrestfield units that occupy the site. Given this, the statistical determination of this FCT may have been skewed by the high degree of historical disturbance within the area through clearing, grazing and weed invasion, leading to changes in species composition. Whilst the quadrat data used for the analysis was collected from the small patch of this community in 'Good' condition and given that data was collected in the peak flowering period, additional survey is unlikely to provide a more conclusive determination of the FCT present within the site.

On the basis of soils, plant community **BaBm** is more likely to have once represented FCT 20c as is present 700 m to the east of the site within the Talbot Road Bushland. This FCT predominately occurs on Forrestfield soils within the Talbot Road Bushland, with a very small corner on the Guildford complex (CALM 2000). The population within the Talbot Road Bushland is one of two occurrences of FCT 20c. The other is located within the Bushmead Rifle Range in Helena Valley (CALM 2000). This FCT is a state and federally listed TEC. Based on species composition however, plant community **BaBm** is considered unlikely to represent this FCT as there are a number of common species recorded within plant community **BaBm** that have not previously been recorded within FCT 20c, including *Eucalyptus todtiana*, *Calytrix flavescens, Dampiera linearis, Anigozanthos humilis* and *Macrozamia riedlei* (Gibson *et al.* 1994). Given the differences in current species composition between the site and sites comprising FCT 20c, it is not considered likely that plant community resembles the FCT to any high degree and FCT 21c is the most likely FCT with regard to species composition, however only the small area in 'Good' condition could be considered to represent this FCT to any high degree.

Vegetation across the site ranged from 'Completely Degraded' to 'Excellent' condition. Areas of 'Parkland Cleared' vegetation are in a 'Completely Degraded' condition and comprise 70.5 ha of the total 89 ha site (79%). The nine mapped plant communities were largely in 'Degraded' condition (16.6 ha) however an area on the eastern edge of the site contained small areas of vegetation in 'Good' and 'Excellent' which occupy the remaining 1.9 ha (2%). Much of the site has been historically cleared or otherwise disturbed and has since been subject to extensive weed invasion.

Based on the field assessment of the section of MUW UFI No. 15136 located within the site, it is considered that its current management category is correct. Over the vast majority of its area, the wetland retains its original soils and landform, but the wetland vegetation has been severely compromised, limiting the potential for rehabilitation over the entirety of the area. The section of MUW UFI No. 15136 that is mapped as BF 309 (comprising 1.6 ha), however, contains intact vegetation in 'Excellent' condition. If this small portion of the wider wetland was assessed separately to the remainder of the wetland, the resulting management category would be CCW due to the dominance of vegetation in 'Good' or better condition within this small area and the low percentages remaining of palusplain wetlands of the Swan River consanguineous suite that are mapped as CCWs.

REW UFI No. 12624 contained 'Degraded' plant community **Mp**. Whilst the edges were primarily in 'Completely Degraded' condition, the majority of the wetland area contained vegetation with a relatively intact overstorey layer of *Melaleuca preissiana* with scattered emergent *Corymbia calophylla* trees. Within this wetland, plant community **Mp** contained little to no native understorey species, with the understorey dominated by pasture weeds, including Declared Pest species **Zantedeschia aethiopica* in moderate densities. The edge of a man-made lake with permanent open water exists on the northern periphery of REW UFI No. 12624 and extends to the north. This lake is surrounded by an area of revegetation (plant community **R**) of native and exotic species. The DPaW evaluation indicated that REW is the appropriate management category for UFI No. 12624 due to a higher number of intermediate values than high or low values.

5 Conclusions and Recommendations

158 flora species (including 72 introduced weed species) were recorded within the site within nine plant communities plus areas of revegetation and “Parkland Cleared’ vegetation. The vegetation within the site has been significantly degraded and only two small areas comprising less than 2% of the area of the site were in ‘Good’ or better condition.

No Threatened Flora species were found to occur within the site; however one Priority 3 Flora species, *Isopogon drummondii*, was found to occur on the eastern edge of the site within plant community **BaBm**. Four of the individuals are located or directly adjacent to the area of plant community **BaBm**, whereas the other two individuals are located in ‘Degraded’ vegetation.

Despite having not previously been identified on the Pinjarra Plain or Ridge Hill Shelf landforms, plant community **BaBm** showed the highest level of similarity in species composition to FCT 21c – Low lying *Banksia attenuata* woodlands or shrublands which is a Priority 3 Ecological Community.

Given the above findings, Emerge recommends that within the context of a planning and development framework, consideration is given to:

- Retention of BF 309 containing plant community **Mp** in ‘Excellent’ condition.
- Retention of the area of plant community **BaBm** in ‘Good’ condition, which contains four of the six recorded individuals of Priority 3 Flora *Isopogon drummondii*.
- Weed control within areas of retained vegetation to limit further spread of weed species.

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FIGURES

Figure 1: Site Locality and Plan.

Figure 2: Landform and Soil Mapping.

Figure 3: Environmental Values.

Figure 4: Plant Communities.

Figure 5: Vegetation Condition.

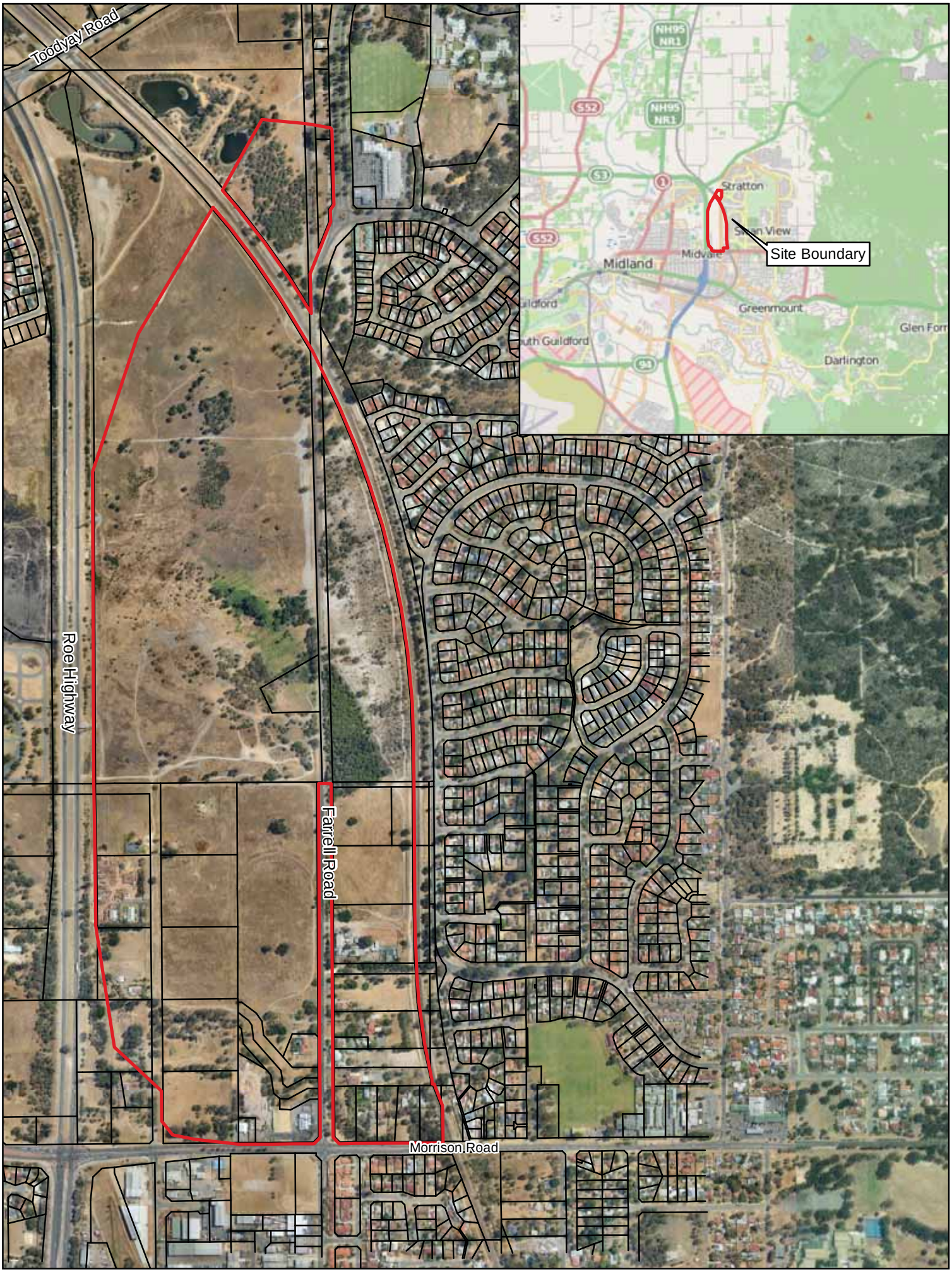

Figure 1:	**Site Locality and Plan**	**Plan Number: EP14-043(08)--F08A**	
Project:	Spring Flora, Vegetation and Wetland Assessment Various Allotments Midvale and Stratton	Drawn: GRO	Date: 07/01/15
Client:	Peet Stratton Pty Ltd	Approved: CKK	Date: 22/01/2015
		Checked: SKP	Scale: 1:9,000@A4

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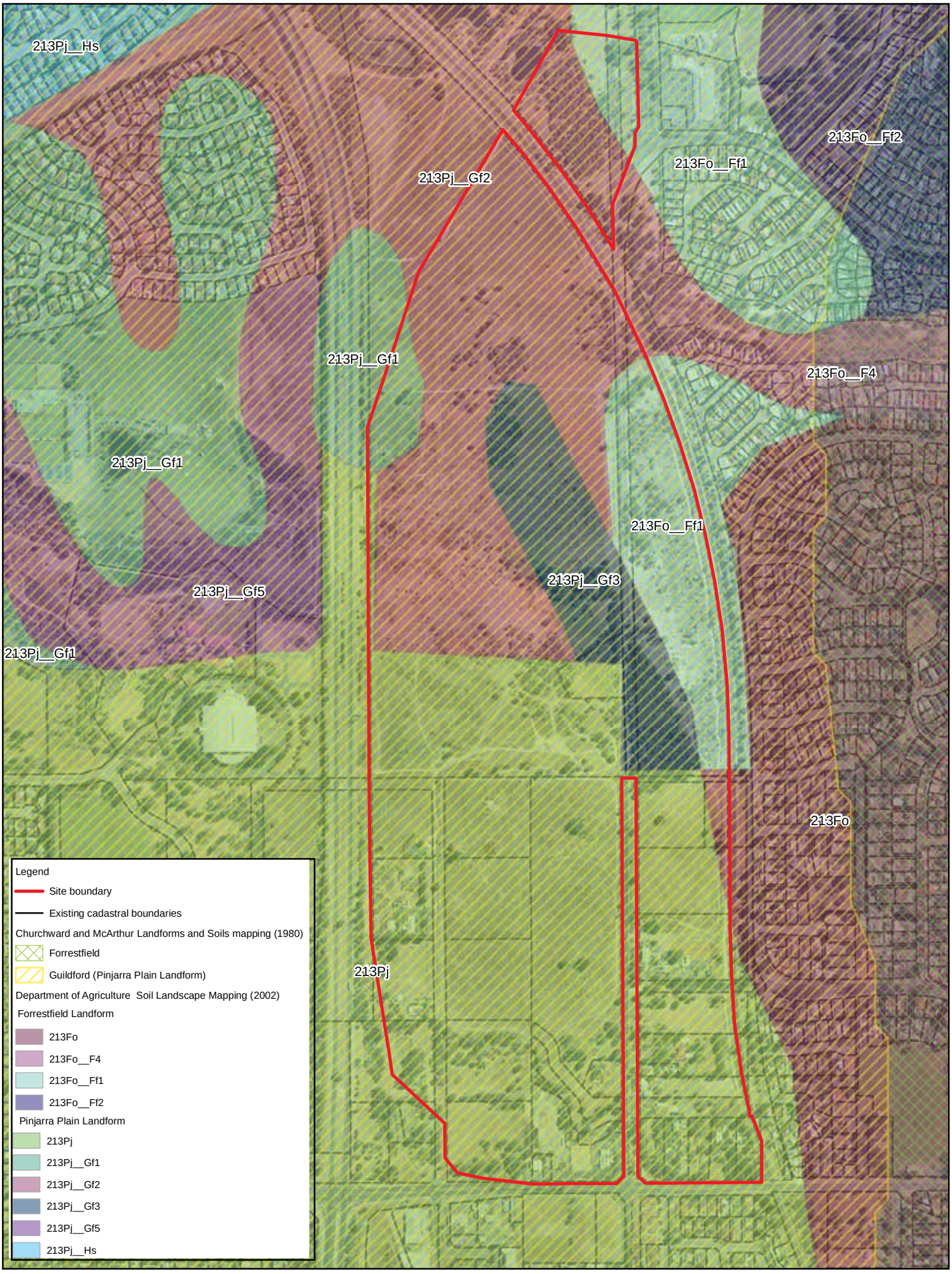

Figure 2: Soils and Landform Mapping

Project: Spring Flora, Vegetation and Wetland Assessment
Various Allotments Midvale and Stratton

Client: Peet Stratton Pty Ltd

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Plan Number: EP14-043(08)--F09A

Drawn:	GRO	Date:	07/01/15
Approved:	CKK	Date:	22/01/2015
Checked:	SKP	Scale:	1:8,000@A4

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emerge ASSOCIATES
Integrated Science & Design

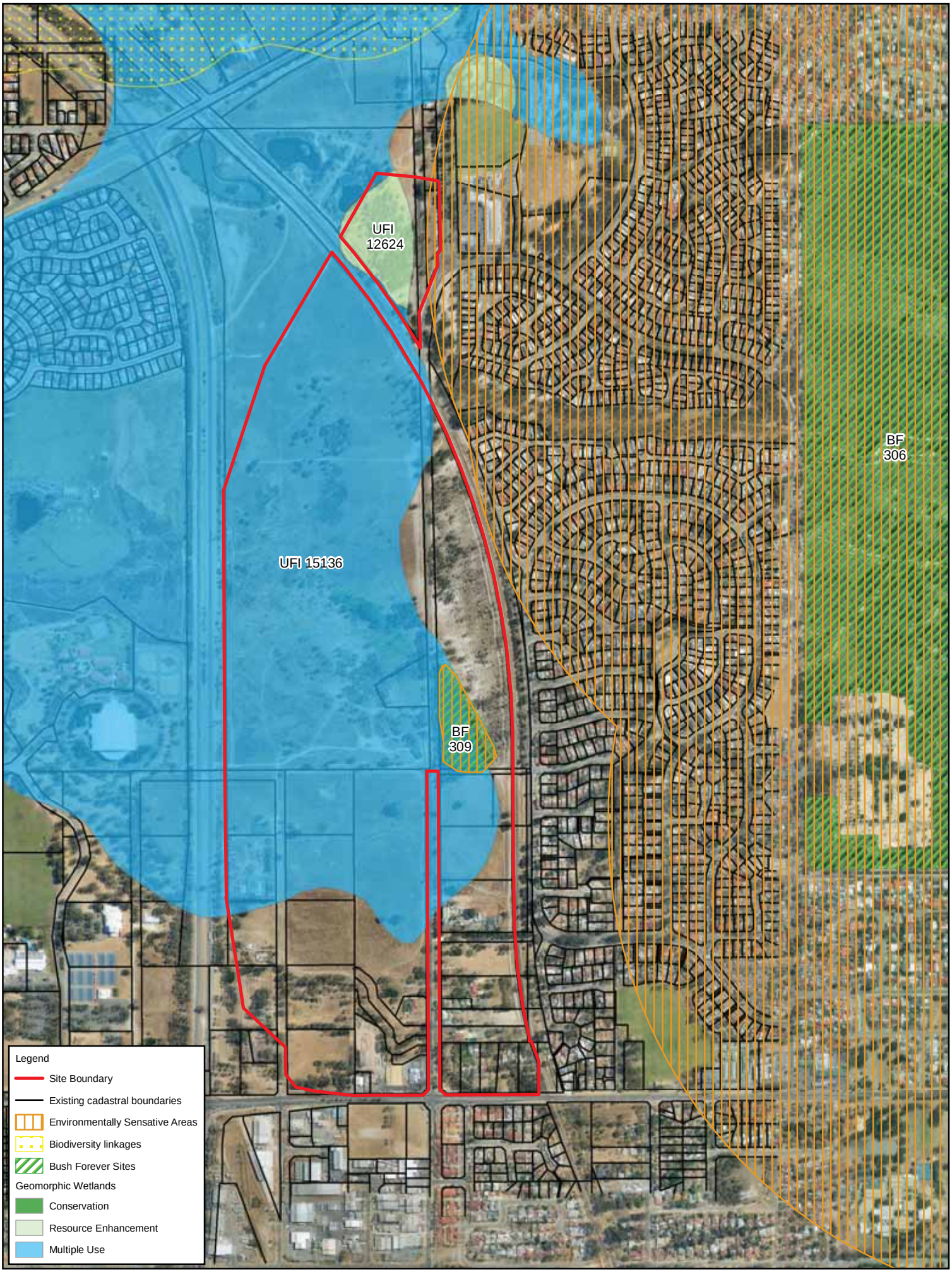

Figure 3: Environmental Features

Project: Spring Flora, Vegetation and Wetland Assessment
Various Allotments Midvale and Stratton

Client: Peet Stratton Pty Ltd

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Plan Number: EP14-043(08)--F10A

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Approved:	CKK	Date:	22/01/2015
Checked:	SKP	Scale:	1:10,000@A4

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Sources: The following datasets were used in the production of this map: Geomorphic Wetlands - DPaW (2014), Bush Forever - DoP (2007), ESAs - DEC (2012)

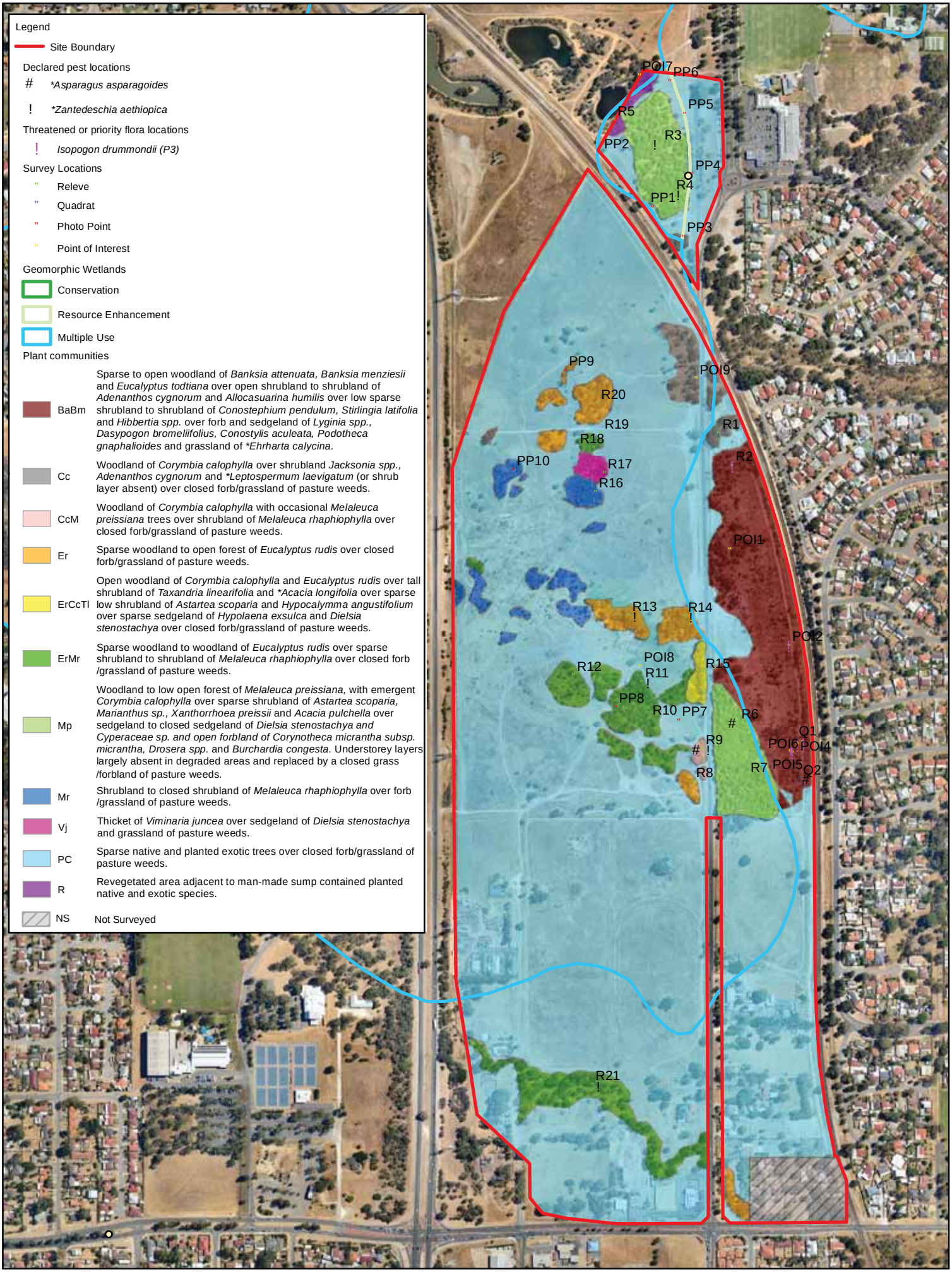

Figure 4:	**Vegetation Communities**	**Plan Number: EP14-043(08)--F11A**	
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Client:	Peet Stratton Pty Ltd	Approved: CKK	Date: 22/01/2015
		Checked: SKP	Scale: 1:8,000@A4
		0 75 150 300 Metres	

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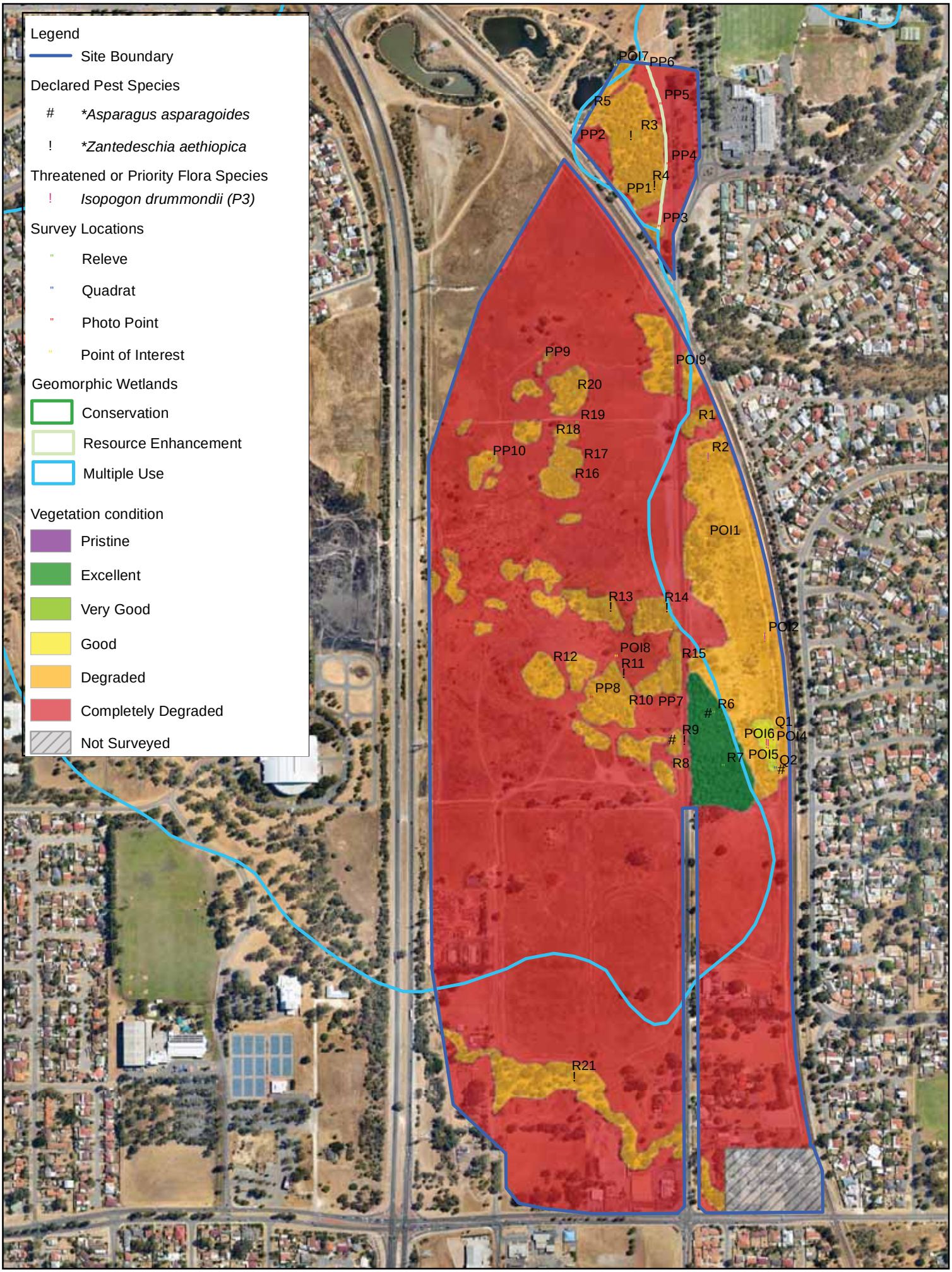

Figure 5:	**Vegetation Condition**	0	**Plan Number: EP14-043(08)--F12A**
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Client:	Peet Stratton Pty Ltd		0 75 150 300 Metres

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APPENDIX A

SITE PHOTOGRAPHS

Site Photographs

Photo Points

Plate 1: Photo Point 1 facing east from western edge of REW UFI No. 12624. Area of 'Completely Degraded' vegetation in foreground and 'Degraded' plant community Mp in background.

Plate 2: Photo Point 1 facing south from western edge of REW UFI No. 12624. Area of 'Completely Degraded' vegetation to right, 'Degraded' plant community Mp to left and 'Degraded' plant community Cc in background. Note area of *Watsonia meriana* var. *bulbillifera* to right.

Plate 3: Photo Point 2 facing east from western edge of REW UFI No. 12624. Area of ‘Completely Degraded’ weed dominated vegetation in foreground part of mapped REW, with ‘Degraded’ plant community Mp in background.

Plate 4: Photo Point 3 facing north from southern edge of REW UFI No. 12624. Within patch of ‘Degraded plant community Cc. Area of ‘Parkland Cleared’ vegetation and ‘Degraded plant community Mp in background.

Plate 5: Photo point 3 facing south. Area of 'Degraded' plant community Cc with understorey dominated by weed species.

Plate 6: Photo Point 4 on eastern edge of REW UFI No. 12624 facing west. Shows ‘Degraded’ plant community Mp with weed dominated understorey and some woody weeds in background.

Plate 7: Photo Point 4 on eastern edge of REW UFI No. 12624 facing north showing track running along edge of wetland vegetation.

Plate 8: Photo Point 5 on eastern edge of REW UFI No. 12624 facing west. Shows area of ‘Completely Degraded’ vegetation in foreground and ‘Degraded’ plant community Mp in background.

Plate 9: Photo Point 6 at north-eastern edge of REW UFI No. 12624 facing west showing edge of REW to left and area of revegetation surrounding the man-made lake to the right.

Plate 10: Photo Point 7 facing west showing 'Completely Degraded' vegetation with 'Degraded' plant community ErMr in background.

Plate 11: Photo Point 8 facing east. Rubbish dumping along tracks in area of 'Degraded' plant community ErMr.

Plate 12: Photo Point 9 facing north. 'Degraded' and 'Completely Degraded' vegetation.

Plate 13: Photo Point 10 facing south showing plant community Mr in 'Degraded' condition.

Points of Interest

Plate 14: POI 2 facing north - individual of *Isopogon drummondii* (P3) recorded.

Plate 15: POI 13 facing east - patch of dense Typha orientalis.

APPENDIX B

DPAW WETLAND EVALUATIONS

DPAW EVALUATION OF REW UFI NO. 12624

REW UFI No. 12624

SECONDARY EVALUATION CRITERIA

Attributes/ functions/ values	General criteria	Criteria	Score
		Geomorphology	
1	Representative-ness	≤20% of wetlands of the same type are assigned Conservation on the Swan Coastal Plain by area. (3.8%)	(H)
2		≤20% of wetlands in the same consanguineous suite are assigned Conservation by area. (6.6%)	(H)
3		≤20% of wetlands of the same type in the same consanguineous suite are assigned Conservation by area. (7.7%)	(H)
4		The wetland is outstanding in some geomorphic aspect, for example size, origin, height relative to sea level, depth, age.	H
5	Naturalness	Alteration to the wetland's geomorphology by % area: < 25% altered 25-75% altered > 75% altered.	 H I (L)
6	Scarcity	The wetland exhibits unusual geomorphology or unusual internal geomorphic features compared to other wetlands of the same type in the consanguineous suite.	H
7		The wetland is the best example of its type in its consanguineous suite.	H
		Wetland processes	
8	Representative-ness	The wetland is an important component of the natural hydrological cycle providing natural functions (e.g. flood protection and recharge/discharge). The wetland's vegetation, geomorphology, hydrology or sediments are modified; however, the wetland is still a component of the hydrological cycle providing natural and artificial functions (e.g. flood remediation, recharge/discharge and hydrological storage). The wetland's vegetation, geomorphology, hydrology or sediments are modified to the extent that the wetlands hydrological functions are artificial such as storage, or the wetland has been disconnected from the natural hydrological cycle and no longer provides natural attributes and functions.	H (I) L
9		The wetland supports a representative process (e.g. wetland process typical of the wetland's hydrological setting, sediment accretionary process typical of the wetland's geomorphic setting or hydrochemical process typical of the wetland's geological setting).	H

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Attributes/ functions/ values	General criteria	Criteria	Score
10	Naturalness	The wetland is not subject to altered wetland processes or, is subject to altered wetland processes and the wetland's natural attributes and functions are maintained. The wetland is subject to altered wetland processes and the wetland's natural attributes and functions have been changed; however, they have the potential to be rehabilitated. The wetland is subject to altered wetland processes to the extent that the wetland no longer supports natural attributes and functions.	H (I) L
11	Scarcity	The wetland exhibits unusual processes (e.g. hydrological, sedimentological, chemical, biological) compared to other wetlands of the same type in the consanguineous suite.	H
		Linkages	
12	Representative-ness	The wetland is a hydrological link in a larger or more complex and intact system.	H
13	Naturalness	The wetland is part of a continuous ecological linkage or wildlife corridor, or a regionally significant ecological linkage or wildlife corridor connecting bushland or wetland areas. The wetland is part of a fragmented ecological linkage or wildlife corridor. The wetland is disturbed and isolated, surrounded by either a built or highly disturbed environment with no nearby native vegetation or waterways to support an intact or fragmented ecological linkage or wildlife corridor.	H (I) L
14	Scarcity	The wetland has unusual hydrological, hydrochemical or ecological linkages with adjacent wetland or bushland.	I
		Habitats	
15	Representative-ness	The wetland is isolated from other undisturbed wetlands or bushland and as a result, maintains important ecological or genetic fauna or flora diversity within its consanguineous suite domain.	H
16		The wetland contains evidence of surface water that is vital to maintaining regionally significant populations of native aquatic or terrestrial flora or fauna.	H
17		The wetland provides a nursery for native fauna populations, or maintains fauna populations at a vulnerable stage of their life cycle.	H
18	Naturalness	The wetland supports habitats that are unaltered or the wetland has been altered and its natural habitats are maintained.	H

PRELIMINARY EVALUATION CRITERIA

No.	Criteria	Y/N
1	The wetland is currently recognised as internationally or nationally significant for its natural values. Lists/registers include: The Ramsar Convention on Wetlands State government endorsed candidate sites for the Ramsar Convention on Wetlands Directory of Important Wetlands in Australia National Heritage List Or equivalent.	N
2	The wetland is spatially dominated by vegetation in a good or better condition using the vegetation condition scale outlined in Appendix B and is identified as significant for its natural values under one or more of the following: Conservation Reserves for Western Australia Systems 1, 2, 3, 5 Conservation Reserves for Western Australia, The Darling System – System 6 A Systematic Overview of Environmental Values of the Wetlands, Rivers and Estuaries of the Busselton – Walpole Region The Environmental Significance of Wetlands in the Perth to Bunbury Region Bush Forever, Swan Bioplan or equivalent.	N
3	The wetland supports a breeding, roosting, or refuge site or a critical feeding site for populations of fauna listed by the Australian Government (for example, Environment Protection and Biodiversity Conservation Act 1999, migratory bird agreements such as JAMBA, CAMBA and RoKAMBA) or the State (for example, Threatened and Specially Protected Fauna listed under the Wildlife Conservation Act 1950).	N
4	The wetland is spatially dominated by vegetation in a good or better condition using the vegetation condition scale outlined in Appendix B and supports one or more of the following: An occurrence of a Threatened Ecological Community A confirmed occurrence of a Priority 1 or Priority 2 Ecological Community A confirmed occurrence of a Declared Rare (Threatened) flora species.	N
5	Equal to or greater than 90% of the wetland supports vegetation in a good or better condition using the vegetation condition scale outlined in Appendix B.	N
6	The wetland is spatially dominated by vegetation in a good or better condition using the vegetation condition scale outlined in Appendix B and is known to support internationally, nationally or state-wide scientific values including geoheritage and geoconservation.	N
7	The wetland is spatially dominated by vegetation in a good or better condition using the vegetation condition scale outlined in Appendix B and meets one of	

No.	Criteria	Y/N
	the following: ≤10% of wetlands of the same type are assigned Conservation management category within the Swan Coastal Plain (by area) ≤10% of all wetlands in the same consanguineous suite are assigned Conservation management category (by area) ≤10% of wetlands of the same type in its consanguineous suite are assigned Conservation management category (by area) best representative of its type within its consanguineous suite domain.	N

Note: If a wetland does not satisfy any of the above preliminary evaluation criteria or, does satisfy the preliminary evaluation criteria but is not considered to be commensurate with the values of a Conservation management category wetland then a secondary evaluation including a full site assessment is required. Refer to Step 3 and 4 of the evaluation procedure which indicates the process for conducting a secondary evaluation.

Attributes/ functions/ values	General criteria	Criteria	Score
		The wetland supports habitats that are altered; however, the habitats are still identifiable and have the potential to be rehabilitated. The wetland is altered and as a result is no longer supporting natural habitats which can be rehabilitated.	I L
19	Scarcity	The wetland supports habitats that are unusual compared to other wetlands of the same type on the Swan Coastal Plain.	H
		Flora	
20	Representative-ness	The wetland's current diversity of native flora is similar to what would be expected in an unaltered state. The wetland supports a reduced diversity of native flora due to human induced disturbances. The wetland supports a significantly reduced diversity of native flora species due to human induced disturbances.	H I L
21		The wetland is identified in a vegetation complex (Heddle et al. 1980) which is represented by: ≤30% of the pre-European extent 30-50% of the pre-European extent.	H I
22	Naturalness	Using the vegetation condition scale outlined in Appendix B, the wetland's vegetation condition by area is: ≥ 75% Good, Very Good, Excellent or Pristine 25-75% Good, Very Good, Excellent or Pristine < 25% Good, Very Good, Excellent or Pristine.	H I L
23		The wetland or ≥ 50% of the wetland boundary is surrounded by land dominated by remnant native vegetation. The wetland or 10-50% of the wetland boundary is surrounded by land dominated by remnant native vegetation. The wetland or < 10% of the wetland boundary is surrounded by land dominated by remnant native vegetation.	H I L
24	Scarcity	The wetland supports an occurrence of Declared Rare, Priority 1, Priority 2, Priority 3 or Priority 4 flora, or an occurrence of 3 or more significant flora taxa.	H
25		The wetland is likely to support Declared Rare, Priority 1, Priority 2, Priority 3 or Priority 4 flora; however, the occurrence cannot be located or its habitat has been altered and is no longer in a natural state.	I
26		The wetland supports an occurrence of a Threatened Ecological Community, Priority 1 or Priority 2 ecological community.	H

Attributes/ functions/ values	General criteria	Criteria	Score
27		The wetland supports an occurrence of a Priority 3 or Priority 4 ecological community.	I
		Fauna	
28	Representative-ness	The wetland is an ecological refuge for regionally significant fauna species or fauna assemblages. The wetland has the potential to be an ecological refuge but is disturbed and its attributes and functions require rehabilitation.	H I
29		The wetland supports a permanent or seasonal feeding, breeding, roosting or watering site for regionally significant native fauna. The wetland supports a permanent or seasonal feeding, breeding, roosting or watering site for regional or local fauna but only in association with other surrounding natural areas.	H I
30	Naturalness	The wetland's current diversity of native fauna is similar to what would be expected in an unaltered state, or the wetland supports diverse fauna compared to other wetlands of the same type. The wetland supports a reduced diversity of fauna compared to other wetlands of the same type.	H I
31		The wetland supports limited attributes and functions for fauna populations due to human induced disturbances.	L
32	Scarcity	The wetland is likely to support a breeding, roosting, refuge or feeding site for populations of fauna listed by the Commonwealth (e.g. EPBC Act 1999, JAMBA, CAMBA, RoKAMBA Agreements) or the State (e.g. Threatened or Specially Protected Fauna listed under the Wildlife Conservation Act 1950).	H
33		The wetland supports a breeding, roosting, refuge or feeding site for Priority 1, Priority 2, Priority 3 or Priority 4 fauna.	H
34		The wetland supports an occurrence of a Threatened Ecological Community, Priority 1 or Priority 2 ecological community.	H
35		The wetland supports an occurrence of a Priority 3 or Priority 4 ecological community or a breeding, roosting, refuge or feeding site for significant fauna.	I
		Cultural	
36	Representative-ness	The wetland or its immediate surrounds is identified for its natural values on a national or State heritage list or the wetland supports other known regional heritage values.	H

Attributes/ functions/ values	General criteria	Criteria	Score
37		The wetland or its immediate surrounds is identified for its natural values on a municipal heritage list or the wetland supports other known local heritage values.	I
38		The wetland or its immediate surrounds is identified on a national, State or local list or register for its Aboriginal cultural value (e.g. Department of Aboriginal Affairs register).	H
39		The wetland is important to the local community either nationally or state wide for its natural values.	H
40		The wetland is or has the potential to be a site for public or private based recreation.	I
41		The wetland is likely to support heritage, cultural or social values; however, the value cannot be confirmed or the value has been disturbed and are no longer as important or significant. The wetland did support heritage, cultural or social values; however, these have been significantly disturbed and are no longer important or the values have been removed.	I L
Scientific and educational			
42	Representative-ness	The wetland supports known important teaching or research characteristics and for this reason is an existing or potential education or research site. Note, the wetland must still support the relevant teaching or research characteristics. The wetland has the potential to be used as a study or research site.	H I
43		The wetland supports known scientific, geoheritage or geoconservation values.	H
44		The wetland did support scientific or educational values; however, these have been significantly disturbed and are no longer as important or the values have been removed.	L

SECONDARY EVALUATION TALLY

Attributes/functions/values	Scores		
	High	Intermediate	Low
Geomorphology	III		I
Wetland processes		II	
Linkages		I	
Habitats		I	
Flora	I	I	III
Fauna		II	I
Cultural		I	
Scientific and educational			I
Total score	4	8	5
Defining attributes/functions/values	Geomorphology		
Applicable management category	Resource Enhancement / Rehabilitation Potential		

DPAW EVALUATION OF MUW UFI NO. 15136 (PORTION WITHIN SITE)

MUW UFI No. 15136 (whole of area within site)

PRELIMINARY EVALUATION CRITERIA

No.	Criteria	Y/N
1	The wetland is currently recognised as internationally or nationally significant for its natural values. Lists/registers include: The Ramsar Convention on Wetlands State government endorsed candidate sites for the Ramsar Convention on Wetlands Directory of Important Wetlands in Australia National Heritage List Or equivalent.	N
2	The wetland is spatially dominated by vegetation in a good or better condition using the vegetation condition scale outlined in Appendix B and is identified as significant for its natural values under one or more of the following: Conservation Reserves for Western Australia Systems 1, 2, 3, 5 Conservation Reserves for Western Australia, The Darling System – System 6 A Systematic Overview of Environmental Values of the Wetlands, Rivers and Estuaries of the Busselton – Walpole Region The Environmental Significance of Wetlands in the Perth to Bunbury Region Bush Forever, Swan Bioplan or equivalent.	N
3	The wetland supports a breeding, roosting, or refuge site or a critical feeding site for populations of fauna listed by the Australian Government (for example, Environment Protection and Biodiversity Conservation Act 1999, migratory bird agreements such as JAMBA, CAMBA and RoKAMBA) or the State (for example, Threatened and Specially Protected Fauna listed under the Wildlife Conservation Act 1950).	N
4	The wetland is spatially dominated by vegetation in a good or better condition using the vegetation condition scale outlined in Appendix B and supports one or more of the following: An occurrence of a Threatened Ecological Community A confirmed occurrence of a Priority 1 or Priority 2 Ecological Community A confirmed occurrence of a Declared Rare (Threatened) flora species.	N
5	Equal to or greater than 90% of the wetland supports vegetation in a good or better condition using the vegetation condition scale outlined in Appendix B.	N
6	The wetland is spatially dominated by vegetation in a good or better condition using the vegetation condition scale outlined in Appendix B and is known to support internationally, nationally or state-wide scientific values including geoheritage and geoconservation.	N
7	The wetland is spatially dominated by vegetation in a good or better condition using the vegetation condition scale outlined in Appendix B and meets one of	

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No.	Criteria	Y/N
	the following: ≤10% of wetlands of the same type are assigned Conservation management category within the Swan Coastal Plain (by area) ≤10% of all wetlands in the same consanguineous suite are assigned Conservation management category (by area) ≤10% of wetlands of the same type in its consanguineous suite are assigned Conservation management category (by area) best representative of its type within its consanguineous suite domain.	N

Note: If a wetland does not satisfy any of the above preliminary evaluation criteria or, does satisfy the preliminary evaluation criteria but is not considered to be commensurate with the values of a Conservation management category wetland then a secondary evaluation including a full site assessment is required. Refer to Step 3 and 4 of the evaluation procedure which indicates the process for conducting a secondary evaluation.

SECONDARY EVALUATION CRITERIA

Attributes/ functions/ values	General criteria	Criteria	Score
Geomorphology			
1	Representative-ness	≤20% of wetlands of the same type are assigned Conservation on the Swan Coastal Plain by area.	H
2		≤20% of wetlands in the same consanguineous suite are assigned Conservation by area.	H
3		≤20% of wetlands of the same type in the same consanguineous suite are assigned Conservation by area.	H
4		The wetland is outstanding in some geomorphic aspect, for example size, origin, height relative to sea level, depth, age.	H
5	Naturalness	Alteration to the wetland's geomorphology by % area: < 25% altered 25-75% altered > 75% altered.	 H I L
6	Scarcity	The wetland exhibits unusual geomorphology or unusual internal geomorphic features compared to other wetlands of the same type in the consanguineous suite.	H
7		The wetland is the best example of its type in its consanguineous suite.	H
Wetland processes			
8	Representative-ness	The wetland is an important component of the natural hydrological cycle providing natural functions (e.g. flood protection and recharge/discharge). The wetland's vegetation, geomorphology, hydrology or sediments are modified; however, the wetland is still a component of the hydrological cycle providing natural and artificial functions (e.g. flood remediation, recharge/discharge and hydrological storage). The wetland's vegetation, geomorphology, hydrology or sediments are modified to the extent that the wetlands hydrological functions are artificial such as storage, or the wetland has been disconnected from the natural hydrological cycle and no longer provides natural attributes and functions.	H I L
9		The wetland supports a representative process (e.g. wetland process typical of the wetland's hydrological setting, sediment accretionary process typical of the wetland's geomorphic setting or hydrochemical process typical of the wetland's geological setting).	H

Attributes/ functions/ values	General criteria	Criteria	Score
10	Naturalness	The wetland is not subject to altered wetland processes or, is subject to altered wetland processes and the wetland's natural attributes and functions are maintained. The wetland is subject to altered wetland processes and the wetland's natural attributes and functions have been changed; however, they have the potential to be rehabilitated. The wetland is subject to altered wetland processes to the extent that the wetland no longer supports natural attributes and functions.	H I L
11	Scarcity	The wetland exhibits unusual processes (e.g. hydrological, sedimentological, chemical, biological) compared to other wetlands of the same type in the consanguineous suite.	H
Linkages			
12	Representative-ness	The wetland is a hydrological link in a larger or more complex and intact system.	H
13	Naturalness	The wetland is part of a continuous ecological linkage or wildlife corridor, or a regionally significant ecological linkage or wildlife corridor connecting bushland or wetland areas. The wetland is part of a fragmented ecological linkage or wildlife corridor. The wetland is disturbed and isolated, surrounded by either a built or highly disturbed environment with no nearby native vegetation or waterways to support an intact or fragmented ecological linkage or wildlife corridor.	H I L
14	Scarcity	The wetland has unusual hydrological, hydrochemical or ecological linkages with adjacent wetland or bushland.	I
Habitats			
15	Representative-ness	The wetland is isolated from other undisturbed wetlands or bushland and as a result, maintains important ecological or genetic fauna or flora diversity within its consanguineous suite domain.	H
16		The wetland contains evidence of surface water that is vital to maintaining regionally significant populations of native aquatic or terrestrial flora or fauna.	H
17		The wetland provides a nursery for native fauna populations, or maintains fauna populations at a vulnerable stage of their life cycle.	H
18	Naturalness	The wetland supports habitats that are unaltered or the wetland has been altered and its natural habitats are maintained.	H

Attributes/ functions/ values	General criteria	Criteria	Score
37		The wetland or its immediate surrounds is identified for its natural values on a municipal heritage list or the wetland supports other known local heritage values.	I
38		The wetland or its immediate surrounds is identified on a national, State or local list or register for its Aboriginal cultural value (e.g. Department of Aboriginal Affairs register).	H
39		The wetland is important to the local community either nationally or state wide for its natural values.	H
40		The wetland is or has the potential to be a site for public or private based recreation.	I
41		The wetland is likely to support heritage, cultural or social values; however, the value cannot be confirmed or the value has been disturbed and are no longer as important or significant.	I
		The wetland did support heritage, cultural or social values; however, these have been significantly disturbed and are no longer important or the values have been removed.	L
Scientific and educational			
42	Representative-ness	The wetland supports known important teaching or research characteristics and for this reason is an existing or potential education or research site. Note, the wetland must still support the relevant teaching or research characteristics.	H
		The wetland has the potential to be used as a study or research site.	I
43		The wetland supports known scientific, geoheritage or geoconservation values.	H
44		The wetland did support scientific or educational values; however, these have been significantly disturbed and are no longer as important or the values have been removed.	L

SECONDARY EVALUATION TALLY

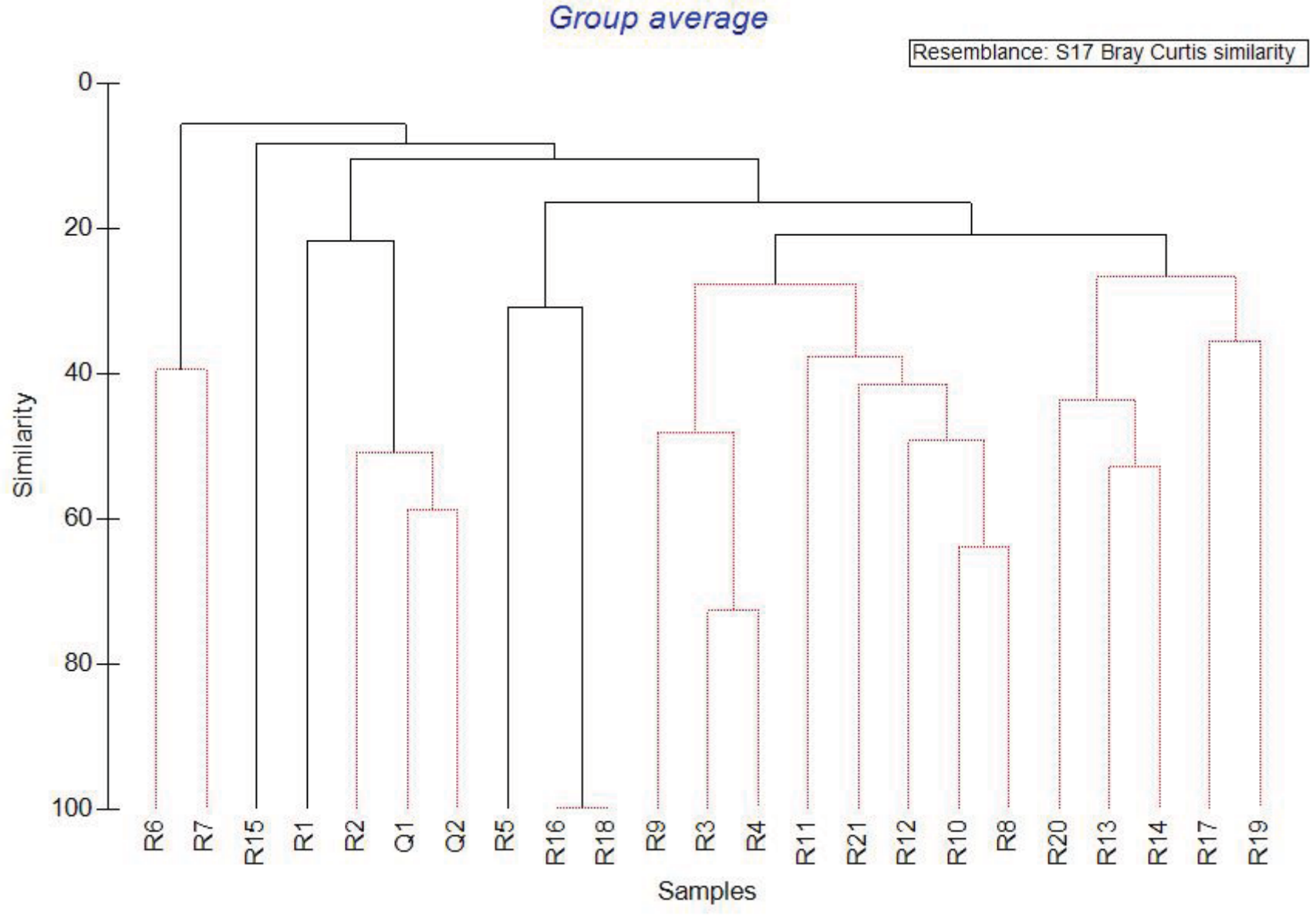
Attributes/functions/values	Scores		
	High	Intermediate	Low
Geomorphology	III		I
Wetland processes		I	I
Linkages		I	
Habitats			I
Flora	I	I	II
Fauna	I	II	I
Cultural		I	I
Scientific and educational			I
Total score	5	6	8
Defining attributes/functions/values	Geomorphology		
Applicable management category	Multiple Use		

Attributes/ functions/ values	General criteria	Criteria	Score
		The wetland supports habitats that are altered; however, the habitats are still identifiable and have the potential to be rehabilitated. The wetland is altered and as a result is no longer supporting natural habitats which can be rehabilitated.	I L
19	Scarcity	The wetland supports habitats that are unusual compared to other wetlands of the same type on the Swan Coastal Plain.	H
		Flora	
20	Representative-ness	The wetland's current diversity of native flora is similar to what would be expected in an unaltered state. The wetland supports a reduced diversity of native flora due to human induced disturbances. The wetland supports a significantly reduced diversity of native flora species due to human induced disturbances.	H I L
21		The wetland is identified in a vegetation complex (Heddle et al. 1980) which is represented by: ≤30% of the pre-European extent 30-50% of the pre-European extent.	H I
22	Naturalness	Using the vegetation condition scale outlined in Appendix B, the wetland's vegetation condition by area is: ≥ 75% Good, Very Good, Excellent or Pristine 25-75% Good, Very Good, Excellent or Pristine < 25% Good, Very Good, Excellent or Pristine.	H I L
23		The wetland or ≥ 50% of the wetland boundary is surrounded by land dominated by remnant native vegetation. The wetland or 10-50% of the wetland boundary is surrounded by land dominated by remnant native vegetation. The wetland or < 10% of the wetland boundary is surrounded by land dominated by remnant native vegetation.	H I L
24	Scarcity	The wetland supports an occurrence of Declared Rare, Priority 1, Priority 2, Priority 3 or Priority 4 flora, or an occurrence of 3 or more significant flora taxa.	H
25		The wetland is likely to support Declared Rare, Priority 1, Priority 2, Priority 3 or Priority 4 flora; however, the occurrence cannot be located or its habitat has been altered and is no longer in a natural state.	I
26		The wetland supports an occurrence of a Threatened Ecological Community, Priority 1 or Priority 2 ecological community.	H

Attributes/ functions/ values	General criteria	Criteria	Score
27		The wetland supports an occurrence of a Priority 3 or Priority 4 ecological community.	I
		Fauna	
28	Representative-ness	The wetland is an ecological refuge for regionally significant fauna species or fauna assemblages. The wetland has the potential to be an ecological refuge but is disturbed and its attributes and functions require rehabilitation.	H I
29		The wetland supports a permanent or seasonal feeding, breeding, roosting or watering site for regionally significant native fauna. The wetland supports a permanent or seasonal feeding, breeding, roosting or watering site for regional or local fauna but only in association with other surrounding natural areas.	H I
30	Naturalness	The wetland's current diversity of native fauna is similar to what would be expected in an unaltered state, or the wetland supports diverse fauna compared to other wetlands of the same type. The wetland supports a reduced diversity of fauna compared to other wetlands of the same type.	H I
31		The wetland supports limited attributes and functions for fauna populations due to human induced disturbances.	L
32	Scarcity	The wetland is likely to support a breeding, roosting, refuge or feeding site for populations of fauna listed by the Commonwealth (e.g. EPBC Act 1999, JAMBA, CAMBA, RoKAMBA Agreements) or the State (e.g. Threatened or Specially Protected Fauna listed under the Wildlife Conservation Act 1950). Evidence of foraging by Carnaby's	H
33		The wetland supports a breeding, roosting, refuge or feeding site for Priority 1, Priority 2, Priority 3 or Priority 4 fauna.	H
34		The wetland supports an occurrence of a Threatened Ecological Community, Priority 1 or Priority 2 ecological community.	H
35		The wetland supports an occurrence of a Priority 3 or Priority 4 ecological community or a breeding, roosting, refuge or feeding site for significant fauna.	I
		Cultural	
36	Representative-ness	The wetland or its immediate surrounds is identified for its natural values on a national or State heritage list or the wetland supports other known regional heritage values.	H

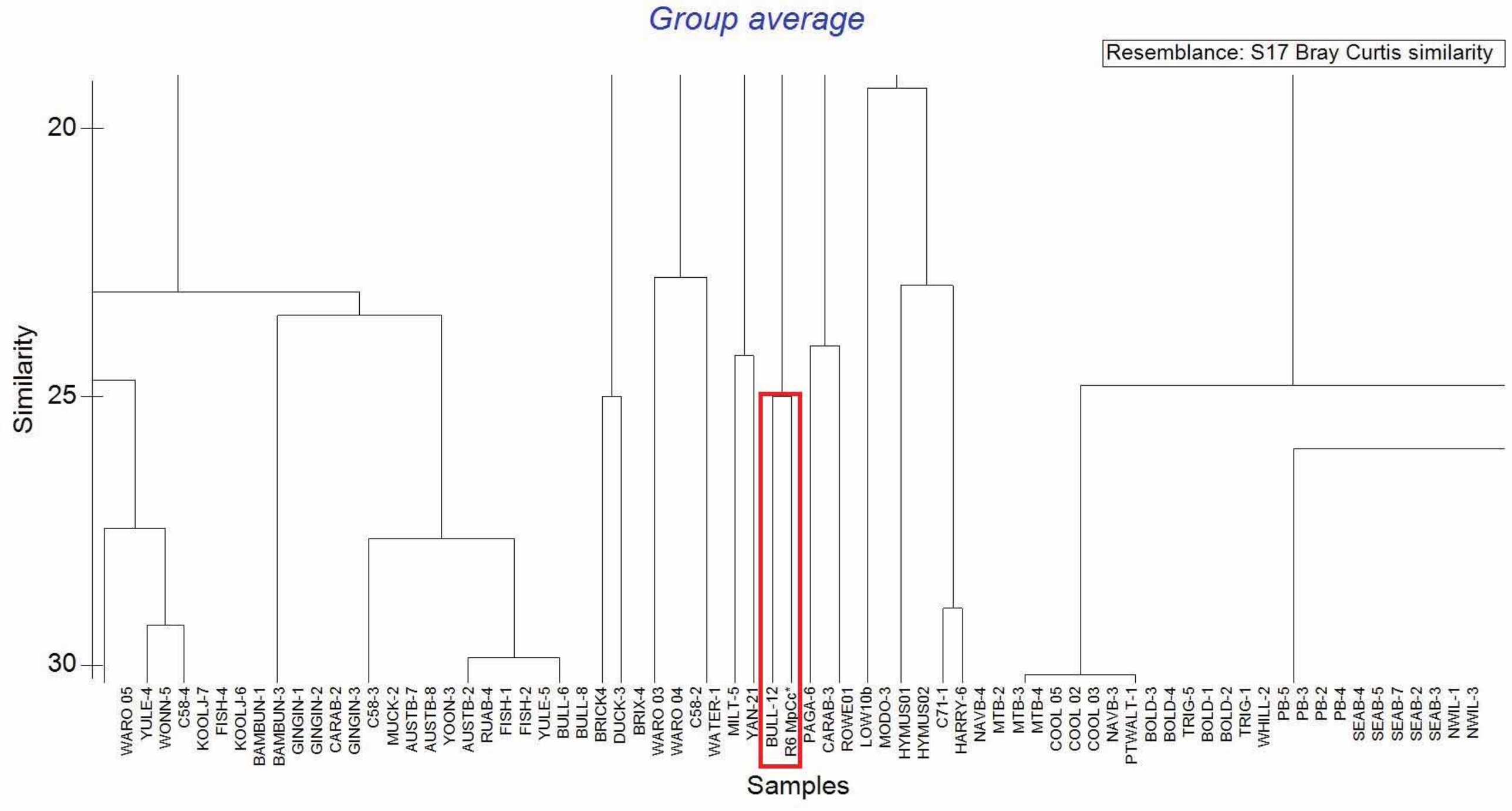
APPENDIX C

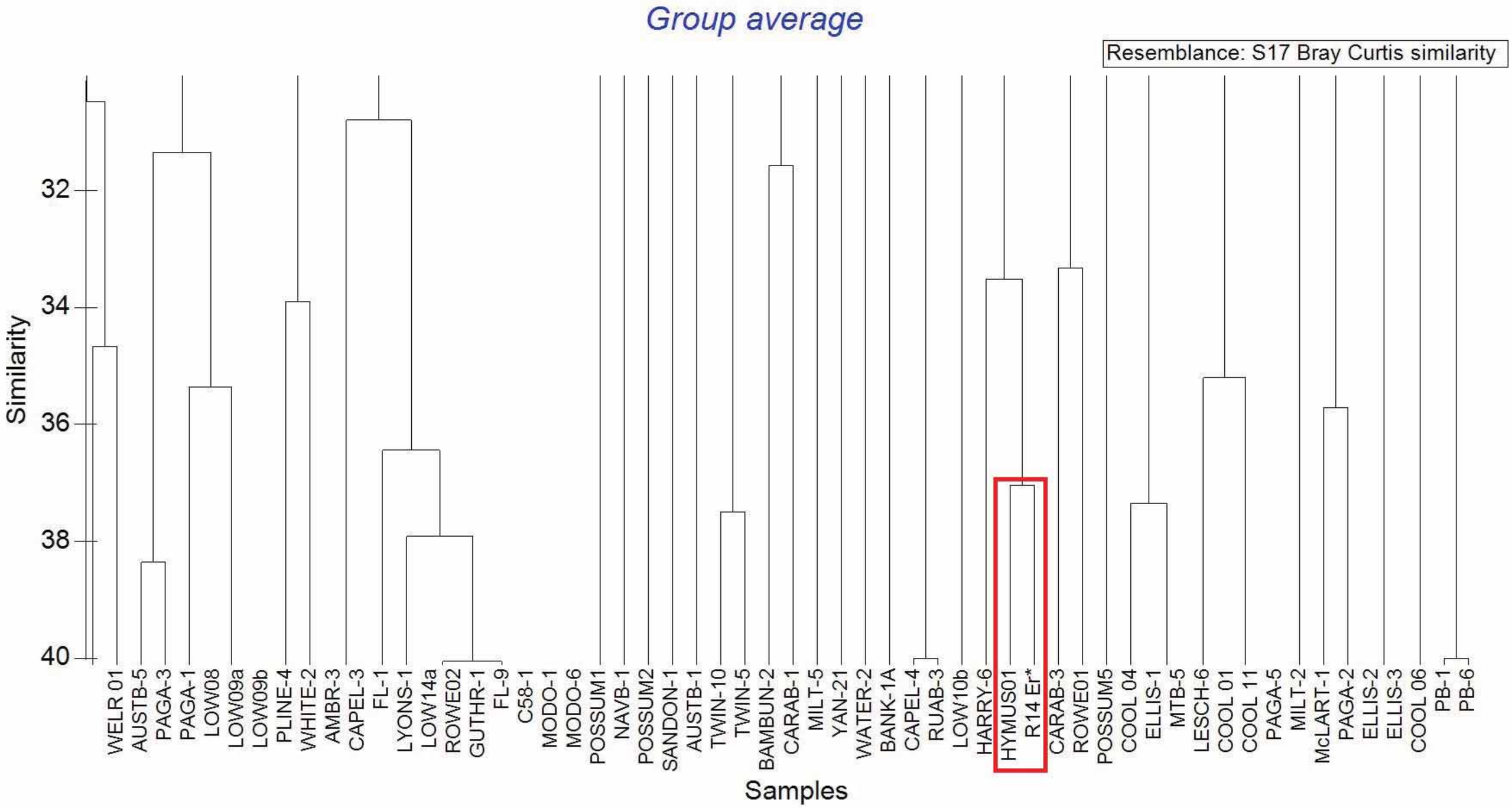
PLANT COMMUNITY DENDROGRAM

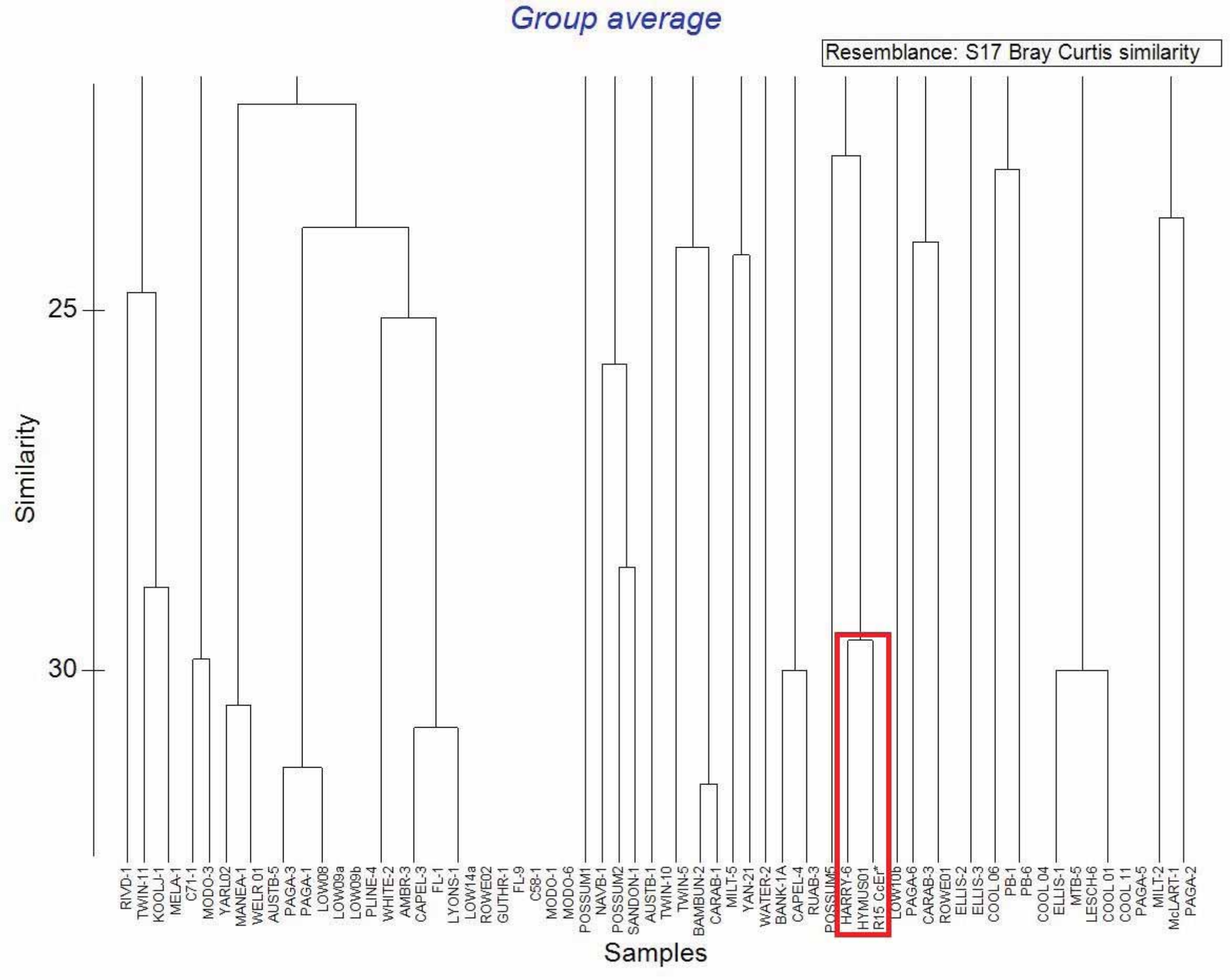

Group average
Resemblance: S17 Bray Curtis similarity
Similarity
0
20
40
60
80
100
R6
R7
R15
R1
R2
Q1
Q2
R5
R16
R18
R9
R3
R4
R11
R21
R12
R10
R8
R20
R13
R14
R17
R19
Samples

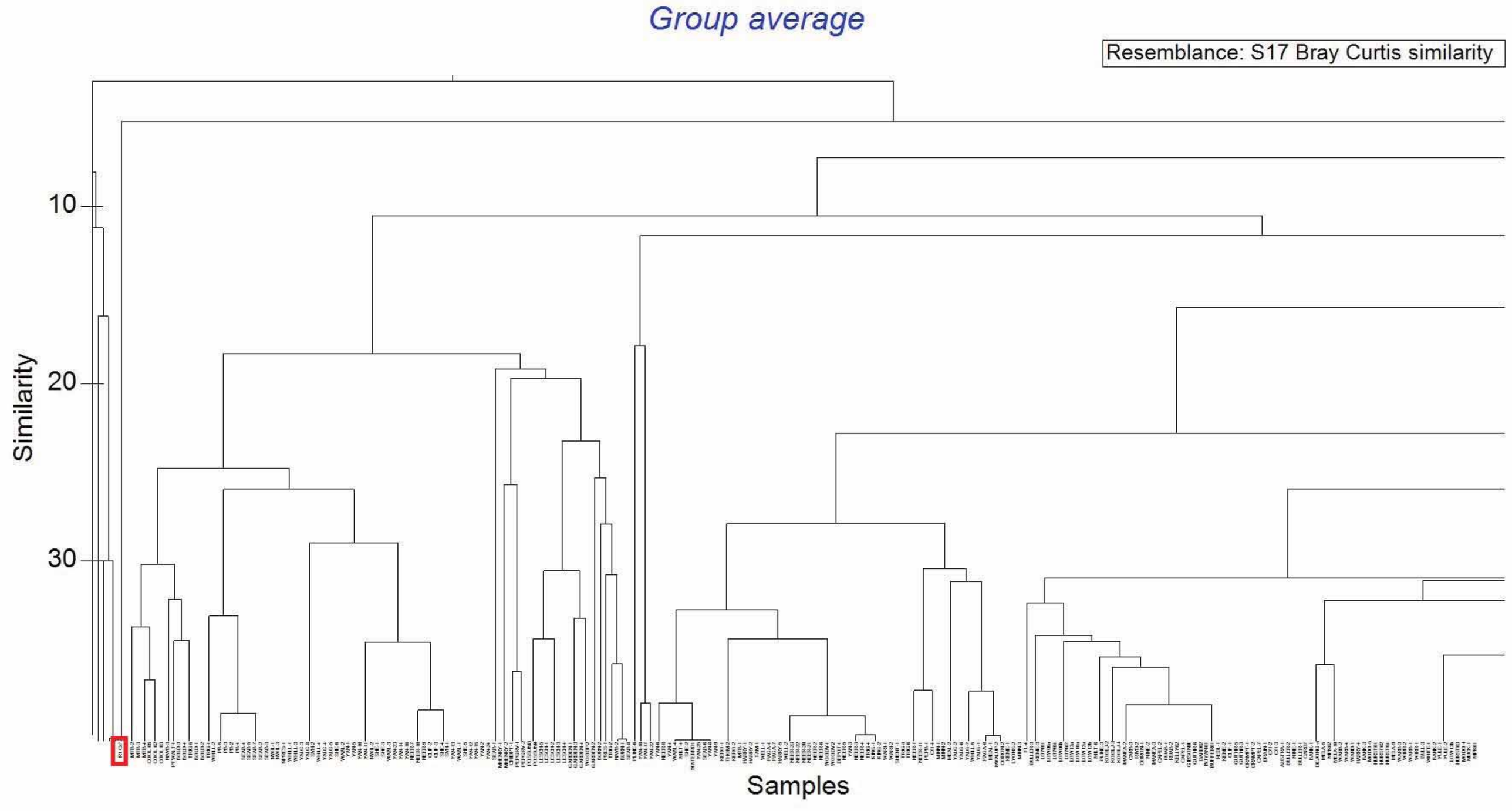
APPENDIX D

FLORISTIC COMMUNITY TYPE ANALYSIS RESULTS


Group average
Resemblance: S17 Bray Curtis similarity
Similarity
20
25
30
Samples
WARO 05
YULE-4
WONN-5
C58-4
KOOLJ-7
FISH-4
KOOLJ-6
BAMBUN-1
BAMBUN-3
GINGIN-1
GINGIN-2
CARAB-2
GINGIN-3
C58-3
MUCK-2
AUSTB-7
AUSTB-8
YOON-3
AUSTB-2
RUAB-4
FISH-1
FISH-2
YULE-5
BULL-6
BULL-8
BRICK4
DUCK-3
BRIX-4
WARO 03
WARO 04
C58-2
WATER-1
MILT-5
YAN-21
BULL-12
R6 MpCc*
PAGA-6
CARAB-3
ROWE01
LOW10b
MODO-3
HYMUS01
HYMUS02
C71-1
HARRY-6
NAVB-4
MTB-2
MTB-3
MTB-4
COOL 05
COOL 02
COOL 03
NAVB-3
PTWALT-1
BOLD-3
BOLD-4
TRIG-5
BOLD-1
BOLD-2
TRIG-1
WHILL-2
PB-5
PB-3
PB-2
PB-4
SEAB-4
SEAB-5
SEAB-7
SEAB-2
SEAB-3
NWIL-1
NWIL-3


Group average
Resemblance: S17 Bray Curtis similarity
Similarity
32
34
36
38
40
Samples
WELR 01
AUSTB-5
PAGA-3
PAGA-1
LOW08
LOW09a
LOW09b
PLINE-4
WHITE-2
AMBR-3
CAPEL-3
FL-1
LYONS-1
LOW14a
ROWE02
GUTHR-1
FL-9
C58-1
MODO-1
MODO-6
POSSUM1
NAVB-1
POSSUM2
SANDON-1
AUSTB-1
TWIN-10
TWIN-5
BAMBUN-2
CARAB-1
MILT-5
YAN-21
WATER-2
BANK-1A
CAPEL-4
RUAB-3
LOW10b
HARRY-6
HYMUS01
R14 Er*
CARAB-3
ROWE01
POSSUM5
COOL 04
ELLIS-1
MTB-5
LESCH-6
COOL 01
COOL 11
PAGA-5
MILT-2
McLART-1
PAGA-2
ELLIS-2
ELLIS-3
COOL 06
PB-1
PB-6


Group average
Resemblance: S17 Bray Curtis similarity
Similarity
25
30
Samples
RIVD-1
TWIN-11
KOOLJ-1
MELA-1
C71-1
MODO-3
YARL02
MANEA-1
WELR 01
AUSTB-5
PAGA-3
PAGA-1
LOW08
LOW09a
LOW09b
PLINE-4
WHITE-2
AMBR-3
CAPEL-3
FL-1
LYONS-1
LOW14a
ROWE02
GUTHR-1
FL-9
C58-1
MODO-1
MODO-6
POSSUM1
NAVB-1
POSSUM2
SANDON-1
AUSTB-1
TWIN-10
TWIN-5
BAMBUN-2
CARAB-1
MILT-5
YAN-21
WATER-2
BANK-1A
CAPEL-4
RUAB-3
POSSUM5
HARRY-6
HYMUS01
R15 CcEr*
LOW10b
PAGA-6
CARAB-3
ROWE01
ELLIS-2
ELLIS-3
COOL 06
PB-1
PB-6
COOL 04
ELLIS-1
MTB-5
LESCH-6
COOL 01
COOL 11
PAGA-5
MILT-2
McLART-1
PAGA-2


Group average
Resemblance: S17 Bray Curtis similarity
Similarity
10
20
30
Samples

Group average

Resemblance: S17 Bray Curtis similarity

Similarity

30

35

40

45

CRAMPT-1 21a
CRAMPT-2 21a
CAPEL-7 21a
DRAIN-1 21a
C71-2 21a
C71-3 21a
AUSTRA-1 21a
BULLER-2 21a
NINE-1 21a
BULLER-1 21a
CARD7 21a
TWIN-7 21c
TWIN-8 21c
BANK-1 22
DEJONG-A22
MELA-5 22
MPK02 22
MELA-10 22
WARB-2 22
WARB-422
WAND-123a
HARRY-423a
BANK-323a
MODO-5 23a
HURST01 23a
HURST02 23a
HURST04 23a
MELA-9 23b
WARB-323a
WIRR-223a
WARB-123a
WIRR-123a
BULL-3 23a
WHITE-1 23a
BANK-2 23a
YULE-1 23a
YULE-2 23a
LOW13B 23a
HURST03 23a
MODO-4 23a
MUCK-1 23b
MPK01 23b
MPK03 23b
MELA-2 23b
MILT-3 23b
MELA-7 23b
MELA-6 23b
MELA-8 23b
MILT-8 23b
MELA-3 23b
ELDO-1 23b
MILT-7 23b
RAAF-1 23b
PLINE-1 23b
PLINE-2 23b
RAAF-2 23b
RAAF-3 23b
SINT-1 23b
YAN-19 23b
YAN-20 23b
02
DEJONG-C21c
HYMUS03 21c
FL-5 21c
FL-6 21c
BULL-9 28
BULL-1 28
BULL-4 28
BULL-10 28
BULL-11 28
CARD8 20b
CARD9 20b
BURNRD0120b
YARL04 20b
CARD3 21a
BRICK2 20b
CARD1 20b
CARD2 20b
CARD5 20b
CARD6 20b
APBF-1 20a
APBF-2 20a
MS3 20a
GOLF-1 20a
LAND-1 20a
KOON-1 20a
KOON-2 20a
YULE-321c
TALB6 20c
TALB10 20c
TALB11 20c
TALB7 20c
TALB3 20c
TALB5 20c
TALB2 20c
TALB8 20c
TALB9 20c
WATER-33c
YARL01 3c
ELLEN-6 3c
DUCK-13c
DUCK-23c
TALB1 3c
TALB12 3c
TALB13 3c
PEARCE-23c
TALB4 3c
BURNRD023b
YARL03 3b
CARD12 3b
CARD13 3b
WARR0013b
WARR0023b
DUNS-1 3b
KOOLI-5 3b
LAMB1 3a
LAMB2 3a
BRICK5 3a
WARR0063a
BRICK1 3a
BRICK3 3a
BRICK8 3a
BRICK6 3a
BRICK7 3a
BRIX-2 3a
BRIX-5 3a
MUD-4 3a
MUD-5 3a

Samples

50 New Cross Rd
Kingsley, WA 6026
T 0429 061 094
E shane@plantecology.com.au

ABN 18 849 210 133

13 November 2014

Sarah Paul
Botanist
Emerge
Suite 4, 26 Railway Rd
Subiaco, WA 6oo8

Dear Sarah,

Pursuant to your email of the 7 November 2014, I have undertaken an analysis of the supplied data in order to determine the Floristic Community Type (FCT) of the plant community(ies) present at the Midvale site. This letter documents the results of that analysis.

1 Methods

Presently, a single consistent method for the determination of FCTs for vegetation data in the Swan Coastal Plain is not available. Therefore it is advisable to use a few diff methods and compare the output for a most likely result. All analyses described below were undertaken using R packages Cluster, Vegclust and Vegan.

1.1 Hierarchical Clustering

Hierarchical agglomerative clustering is the usual first stage in classifying vegetation data into community types. This involves calculating the similarity (or more often, the dissimilarity) between plots within the dataset and then sequentially fusing the plots into groups according to their similarity. This type of method was used in the analysis of the original Swan Coastal Plain dataset (Gibson et al 1994), but its use as the basis for assigning new plot data to the regional classification has some drawbacks. Firstly, a hierarchical clustering only applies to the relationships between plots, and the relative distances between them, within that particular dataset. The addition of new data often alters the relative distances and disrupts the clustering output. Secondly, as an unsupervised method, hierarchical clustering does not define rules for the membership of the defined groups, and so the addition of new plots requires the rebuilding of the entire hierarchy (De Cáceres and Wiser 2012).

For the analysis of the Midvale data, the data for the Swan Coastal Plain regional survey (Gibson et al. 1994) was downloaded from the NatureMap website. This is largely similar to the original survey except for one site (OATES-1), which has now been excluded. The species nomenclature of the original dataset was updated to be consistent with current usage. Where original names could not be matched clearly to the updated usage, those taxa were removed from the analysis. The new data from the Midvale survey was added to the matrix one plot a time to remove any effect of spatial correlation between the new plots. Each new dataset was then analysed calculating the Bray-Curtis distance coefficient (or resemblance measure) and the flexible beta linkage method (beta= -0.1). Assignment of the Midvale plot was to the nearest distinct group by inspection of the resulting dendrogram.

1.2 Nearest Neighbour

Another approach for assigning FCTs is to calculate a similarity or dissimilarity matrix for the combined new dataset and simply allocate each new plot to the FCT of the plot from the original dataset that shares the greatest similarity. There are a number of drawbacks with this method:

50 New Cross Rd
Kingsley, WA 6026
T 0429 061 094
E shane@plantecology.com.au

ABN 18 849 210 133

- the nearest neighbour may not be a 'near' neighbour;
- results may vary depending on the resemblance measure used; and
- the nearest neighbour may be a transitional site between groups and the similarity to a group as a whole may be limited.

The nearest neighbour to each of the Midvale plots was determined by calculating two different resemblance measures for comparison: the Bray-Curtis dissimilarity (a semi-metric distance measure) and the Hellinger distance (a metric distance measure).

1.3 Non-hierarchical clustering

Non-hierarchical clustering methods often allow new plot data to be added to previous classifications because they are based on the concept that each group or cluster is represented by a prototype i.e. either a centroid or a medoid (a 'type' plot) (De Cáceres and Wiser 2012). Therefore, new observations can be assigned to an existing classification by calculating the distance to the nearest prototype (which may considered a membership criterion). This approach is to be preferred to the hierarchical reconstruction approach because it defines numerical rules that can be consistently applied. However, it also means the original classification needs to be reanalysed using a different method, which can be problematic because not all sites from the original classification may be diagnostic for their respective clusters.

For the analysis of the Midvale data, the same updated Swan Coastal Plain dataset was used as for the hierarchical clustering analysis. After calculating a Bray-Curtis distance matrix, the dataset was then analysed using Fuzzy C-Means clustering in the R package 'Vegclust'. A fuzziness coefficient of 1.1 was chosen to minimise influence from noisy data points. FCTs with too few plots to reliably define determine a prototype (e.g. FCT 14 with two plots) were removed from the analysis. Similarly, some plots that were regularly being misclassified (such as those from clusters with large internal heterogeneity) were also removed. The final dataset consisted of 362 plots with 1316 taxa representing 38 FCTs. Each site of the Midvale data was then assigned a FCT using function 'vegclass' in the Vegclust package.

It should be noted that this approach for FCT assignment is preliminary and will need to be refined further before it can be used consistently.

2 Results

The results for the hierarchical clustering analysis show that the original dendrogram has been disrupted to some extent when analysing each plot (Table 1; Figures 1 and 2). Both plots fuse with a site from FCT 24 before fusing with a larger group of 21c sites. Midvale Q2 also fuses with Fl-4 (FCT 21a) before the fusion with the 21c sites.

The three nearest neighbours for each Midvale site using the Bray-Curtis distance and the Hellinger distance are shown in Tables 2 and 3, respectively. The nearest neighbour assignment for the plots was consistent between both resemblance measures, both being assigned to 23a. The next nearest neighbour for Midvale Q1 was also 23a for both resemblance measures. However, the next nearest neighbour for Midvale Q2 as measured by the Bray-Curtis distance belonged to FCT 21a. The third nearest neighbours for each site display a clear difference between the resemblance measures, with the Hellinger distance assigning Midvale Q1 to 23a compared to 21c, and Midvale Q2 to FCT 21a rather than FCT 23a for the Bray-Curtis distance.

50 New Cross Rd
Kingsley, WA 6026
T 0429 061 094
E shane@plantecology.com.au

ABN 18 849 210 133

The assignment of FCTs by non-hierarchical clustering is clearer. Both plots have been assigned to FCT 21c. This is consistent with the results of the hierarchical analysis (Table 4).

Table 1: Results of hierarchical analysis for plots from Midvale.

Site	FCT First fusion	FCT of nearest main group fusion	Likely FCT
Midvale Q1	24	21c	21c
Midvale Q2	24	21c	21c

Table 2: Results of Nearest Neighbour analysis using the Bray-Curtis dissimilarity coefficient

Site	FCT of Nearest Neighbour	FCT of 2nd Nearest Neighbour	FCT of 3rd Nearest Neighbour
Midvale Q1	23a	23a	21c
Midvale Q2	23a	21a	23a

Table 3: Results of Nearest Neighbour analysis using the Hellinger dissimilarity coefficient

Site	FCT of Nearest neighbour	FCT of 2nd Nearest Neighbour	FCT of 3rd Nearest neighbour
Midvale Q1	23a	23a	23a
Midvale Q2	23a	23a	21a

Table 4: Results of the non-hierarchical Fuzzy C-means analysis using the Bray-Curtis dissimilarity coefficient

Site	Midvale Q1	Midvale Q2
FCT Assignment	21c	21c

3 Discussion

The results the Midvale analyses indicate that the vegetation at that site belongs to FCT 21c 'Low lying *Banksia attenuata* woodlands or shrublands'. This vegetation type is categorised as a Priority Ecological Community (with the ranking of Priority 3) by the Department of Parks and Wildlife. This result is consistent with the description of the vegetation type in Gibson *et al.* (1994). FCT 21c occurs on mostly the Bassendean sands between Bunbury and Gingin. It has a strong presence of species from Species Group O, which includes *Banksia menziesii, Banksia attenuata, Dasypogon bromeliifolius, Scholtzia involucrata* and *Adenanthos cygnorum*. However, it is less species rich than other subgroups in FCT 21 (mean = 40.5), which is consistent with the data recorded at Midvale.

The condition of the vegetation under study is important in determining the FCT for that community. Sites that have been disturbed often have low species richness and this can affect the analysis. The two other potential FCTs for the Midvale site (21a and 23a) are both more

50 New Cross Rd
Kingsley, WA 6026
T 0429 061 094
E shane@plantecology.com.au

ABN 18 849 210 133

species rich than FCT 21c. FCT 21a shares many species with 21c, but *Adenanthos cygnorum* was not recorded in the original Swan Coastal Plain survey by Gibson *et al.* (1994) and it mainly occurs in the central Swan Coastal Plain. It is therefore unlikely that the Midvale communities could be considered as belonging to FCT 21a.

Assignment to FCT 23a would also be a reasonable outcome for the Midvale site. This FCT shares many species with FCT 21c and is widespread on the Swan Coastal Plain. It should also be noted that *Daviesia triflora* was recorded for Midvale Q2, and this species was not recorded for FCT 21c in the original Swan Coastal Plain survey (Gibson *et al.* 1994). Also, in the dendrogram for Midvale Q1, after fusing with sites from FCT 21c, the next major fusion is with a large grouping of sites from FCT 23a. It may be that the outcome of these analyses has been influenced by past disturbances within the site.

4 Summary

The results of both the hierarchical and non-hierarchical clustering methods indicate that the communities at Midvale represent FCT 21c, which is a Priority 3 ecological community. However, this is based on the structure of the vegetation at Midvale being largely unaltered. If past disturbances have affected the vegetation, then this will impact the reliability of any numerical analysis.

If you have any queries please do not hesitate to contact me.

Sincerely yours,

Dr Shane Chalwell

Plantecology Consulting.

50 New Cross Rd
Kingsley, WA 6026
T 0429 061 094
E shane@plantecology.com.au

ABN 18 849 210 133

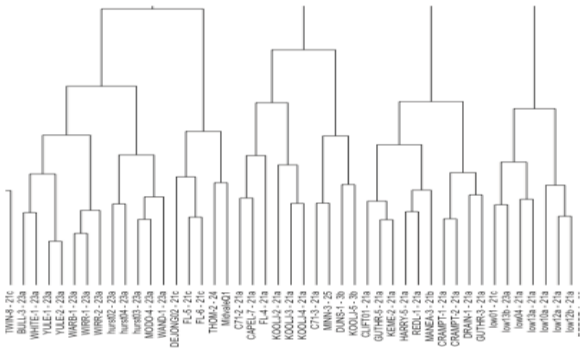


Figure 1: Hierarchical clustering dendrogram showing position of Midvale Q1 (only relevant section shown). FCT membership for original SCP sites appended to the plot name.

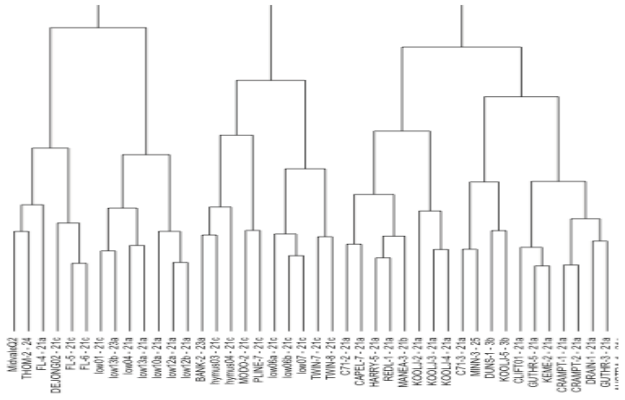


Figure 2: Hierarchical clustering dendrogram showing position of Midvale Q2 (only relevant section shown). FCT membership for original SCP sites appended to the plot name.

50 New Cross Rd
Kingsley, WA 6026
T 0429 061 094
E shane@plantecology.com.au

ABN 18 849 210 133

5 References

De Cáceres, M and Wiser, S.K. (2012) Towards consistency in vegetation classification, *Journal of Vegetation Science*, 23: 387-393

Gibson, N, Keighery, BJ, Keighery, GJ, Burbidge, AH and Lyons, MN (1994), *A floristic survey of the southern Swan Coastal Plain*, Unpublished Report for the Australian Heritage Commission prepared by the Department of Conservation and Land Management and the Conservation Council of Western Australia (Inc), Perth.

APPENDIX E

SPECIES LIST

Flora Species List -Various Allotments Midvale and Stratton

Note: * denotes introduced taxa, D denotes Declared Pest taxa and P3 denotes Priority 3 status.

Family	Species
Anacardiaceae	* *Schinus terebinthifolius*
Arecaceae	* *Washingtonia filifera*
Anarthriaceae	*Lyginia barbata* *Lyginia imberbis*
Apocynaceae	* *Gomphocarpus fruticosus*
Araceae	D *Zantedeschia aethiopica*
Araliaceae	*Trachymene pilosa*
Asparagaceae	* *Agave americana* D *Asparagus asparagoides* *Thysanotus manglesianus*
Asteraceae	* *Arctotheca calendula* * *Conyza bonariensis* * *Cotula coronopifolia* * *Hypochaeris glabra* *Podotheca gnaphalioides* * *Sonchus oleraceus* * *Ursinia anthemoides*
Boraginaceae	* *Echium plantagineum*
Brassicaceae	* *Brassica tournefortii* * *Raphanus raphanistrum*
Campanulaceae	* *Wahlenbergia capensis*
Casuarinaceae	*Allocasuarina fraseriana* *Allocasuarina humilis* * *Allocasuarina torulosa*
Centrolepidaceae	*Centrolepis aristata*
Colchicaceae	*Burchardia congesta*
Crassulaceae	* *Crassula glomerata* * *Crassula natans* var. *minus*
Cyperaceae	Cyperaceae sp. * *Cyperus tenellus* *Mesomelaena pseudostygia*

Flora Species List -Various Allotments Midvale and Stratton

Note: * denotes introduced taxa, D denotes Declared Pest taxa and P3 denotes Priority 3 status.

Family	Species
Dasypogonaceae	*Calectasia narragara*
	Dasypogon bromeliifolius
Dilleniaceae	*Hibbertia hypericoides*
	Hibbertia racemosa
Droseraceae	*Drosera erythrorhiza* subsp. *erythrorhiza*
	Drosera glanduligera
	Drosera menziesii subsp. *penicillaris*
Ericaceae	*Conostephium pendulum*
Euphorbiaceae	* *Ricinus communis*
Fabaceae	* *Acacia dealbata*
	* *Acacia longifolia*
	Acacia pulchella
	Acacia saligna
	Aotus gracillima
	Bossiaea eriocarpa
	* *Chamaecytisus palmensis*
	Daviesia triflora
	Gastrolobium ?ebracteolatum
	* *Genista linifolia*
	Gompholobium tomentosum
	Jacksonia floribunda
	Jacksonia furcellata
	Jacksonia lehmannii
	Jacksonia sternbergiana
	Kennedia prostrata
	* *Lotus subbiflorus*
	* *Lupinus angustifolius*
	* *Trifolium arvense*
	* *Trifolium campestre*
	* *Trifolium hirtum*
	* *Vicia sativa*
	Viminaria juncea
Geraniaceae	* *Erodium botrys*
	* *Pelargonium capitatum*
Goodeniaceae	*Dampiera linearis*
Haemodoraceae	*Anigozanthos humilis*
	Conostylis aculeata
	Haemodorum spicatum
	Phlebocarya ciliata

Flora Species List -Various Allotments Midvale and Stratton

Note: * denotes introduced taxa, D denotes Declared Pest taxa and P3 denotes Priority 3 status.

Family	Species
Hemerocallidaceae	*Caesia micrantha*
	Corynotheca micrantha var. *micrantha*
Iridaceae	* *Gladiolus caryophyllaceus*
	* *Gladiolus undulatus*
	* *Hesperantha falcata*
	* *Moraea flaccida*
	Patersonia occidentalis
	* *Romulea rosea*
	* *Watsonia meriana* var. *bulbillifera*
Juncaceae	* *Juncus bufonius*
	Juncus pallidus
Lamiaceae	*Hemiandra pungens*
Lentibulariaceae	*Utricularia multifida*
Loranthaceae	*Nuytsia floribunda*
Meliaceae	* *Melia azedarach*
Moraceae	* *Ficus carica*
Myrtaceae	*Astartea scoparia*
	Callistemon phoeniceus
	Calothamnus quadrifidus
	Calytrix flavescens
	Corymbia calophylla
	Eremaea pauciflora
	* *Eucalyptus camaldulensis*
	Eucalyptus marginata
	Eucalyptus rudis
	Eucalyptus todtiana
	Hypocalymma angustifolium
	Leptospermum erubescens
	* *Leptospermum laevigatum*
	Melaleuca lateritia
	* *Melaleuca nesophila*
	Melaleuca preissiana
	* *Melaleuca quinquenervia*
	Melaleuca rhaphiophylla
	Melaleuca scabra
	Melaleuca trichophylla
	Scholtzia involucrata
	Taxandria linearifolia

Flora Species List -Various Allotments Midvale and Stratton

Note: * denotes introduced taxa, D denotes Declared Pest taxa and P3 denotes Priority 3 status.

Family	Species
Orchidaceae	*Microtis media*
	Pterostylis sanguinea
	Pyrorchis nigricans
Orobanchaceae	* *Orobanche minor*
Oxalidaceae	* *Oxalis pes-caprae*
Papaveraceae	* *Fumaria capreolata*
Phytolaccaceae	* *Phytolacca octandra*
Pinaceae	* *Pinus pinaster*
Pittosporaceae	*Billardiera fraseri*
	Marianthus sp.
Plantaginaceae	* *Plantago lanceolata*
Poaceae	* *Aira caryophyllea*
	Amphipogon turbinatus
	* *Arundo donax*
	Austrostipa elegantissima
	* *Avena barbata*
	* *Brachypodium distachyon*
	* *Briza maxima*
	* *Briza minor*
	* *Bromus diandrus*
	* *Cortaderia selloana*
	* *Cynodon dactylon*
	* *Ehrharta calycina*
	* *Eragrostis curvula*
	* *Holcus lanatus*
	* *Lolium rigidum*
	* *Paspalum dilatatum*
Polygonaceae	* *Acetosella vulgaris*
	* *Rumex crispus*
Proteaceae	*Adenanthos cygnorum*
	Banksia attenuata
	Banksia ilicifolia
	Banksia menziesii
	Banksia nivea
	Conospermum stoechadis subsp. stoechadis
	Hakea varia

Flora Species List -Various Allotments Midvale and Stratton

Note: * denotes introduced taxa, D denotes Declared Pest taxa and P3 denotes Priority 3 status.

Family	Species
	P3 *Isopogon drummondii*
	Petrophile linearis
	Stirlingia latifolia
Ranunculaceae	* *Ranunculus muricatus*
Restionaceae	*Chordifex sinuosus*
	Dielsia stenostachya
	Hypolaena exsulca
Rutaceae	*Philotheca spicata*
Scrophulariaceae	* *Dischisma capitatum*
Solanaceae	* *Solanum nigrum*
Stylidiaceae	*Levenhookia stipitata*
Typhaceae	* *Typha orientalis*
Xanthorrhoeaceae	*Xanthorrhoea preissii*
Zamiaceae	*Macrozamia riedlei*

APPENDIX F

SPECIES LIST BY PLANT COMMUNITY

Species List by Plant Community - Various Allotments Midvale and Stratton

Note: * denotes introduced taxa, D denotes Declared Pest taxa and P3 denotes Priority 3 status.

		Plant Community										
	Species	**BaBm**	**Cc**	**CcEr**	**Er**	**ErMr**	**MpCc**	**Mr**	**Vj**	**CcM**	**R**	**Parkland Cleared**
*	*Acacia dealbata*					X						X
*	*Acacia longifolia*			X								X
	Acacia pulchella						X					
	Acacia saligna	X	X				X	X				
*	*Acetosella vulgaris*											X
	Adenanthos cygnorum	X	X								X	
*	*Agave americana*											X
*	*Aira caryophyllea*					X						X
	Allocasuarina fraseriana	X									X	
	Allocasuarina humilis	X										
*	*Allocasuarina torulosa*										X	
	Amphipogon turbinatus	X										
	Anigozanthos humilis	X										
	Aotus gracillima						X					
*	*Arctotheca calendula*		X			X						X
*	*Arundo donax*		X									X
D	*Asparagus asparagoides*	X					X			X		
	Astartea scoparia			X			X	X			X	
	Austrostipa elegantissima	X										
*	*Avena barbata*				X	X				X		X
	Banksia attenuata	X										
	Banksia ilicifolia	X										
	Banksia menziesii	X										
	Banksia nivea	X										
	Billardiera fraseri	X					X					
	Bossiaea eriocarpa	X					X					
*	*Brachypodium distachyon*											X
*	*Brassica tournefortii*											X
*	*Briza maxima*	X	X	X	X	X	X	X	X			X

Species List by Plant Community - Various Allotments Midvale and Stratton

Note: * denotes introduced taxa, D denotes Declared Pest taxa and P3 denotes Priority 3 status.

		Plant Community										
	Species	**BaBm**	**Cc**	**CcEr**	**Er**	**ErMr**	**MpCc**	**Mr**	**Vj**	**CcM**	**R**	**Parkland Cleared**
*	*Briza minor*	X			X	X		X			X	X
*	*Bromus diandrus*	X			X	X	X			X		X
	Burchardia congesta	X					X					
	Caesia micrantha						X					
	Calectasia narragara	X										
	Callistemon phoeniceus										X	
	Calothamnus quadrifidus										X	
	Calytrix flavescens	X										
	Centrolepis aristata							X			X	
*	*Chamaecytisus palmensis*		X									X
	Chordifex sinuosus	X										
	Conospermum stoechadis subsp. *stoechadis*	X										
	Conostephium pendulum	X										
	Conostylis aculeata	X					X				X	
*	*Conyza bonariensis*						X					X
*	*Cortaderia selloana*				X				X			X
	Corymbia calophylla		X	X	X		X			X	X	
	Corynotheca micrantha var. *micrantha*	X					X					
*	*Cotula coronopifolia*											X
*	*Crassula glomerata*	X										X
*	*Crassula natans* var. *minus*											X
*	*Cynodon dactylon*				X			X	X			X
	Cyperaceae sp.						X					
*	*Cyperus tenellus*				X							
	Dampiera linearis	X					X					
	Dasypogon bromeliifolius	X					X					
	Daviesia triflora	X										
	Desmocladus flexuosus											X
	Dielsia stenostachya			X			X		X			

Species List by Plant Community - Various Allotments Midvale and Stratton

Note: * denotes introduced taxa, D denotes Declared Pest taxa and P3 denotes Priority 3 status.

		Plant Community										
	Species	**BaBm**	**Cc**	**CcEr**	**Er**	**ErMr**	**MpCc**	**Mr**	**Vj**	**CcM**	**R**	**Parkland Cleared**
*	*Dischisma capitatum*	X										X
	Drosera erythrorhiza subsp. *erythrorhiza*						X					
	Drosera glanduligera											
	Drosera menziesii subsp. *penicillaris*	X					X					
*	*Echium plantagineum*					X		X			X	X
*	*Ehrharta calycina*	X	X	X	X	X	X	X		X		X
*	*Eragrostis curvula*	X	X			X		X			X	X
	Eremaea pauciflora	X										
*	*Erodium botrys*	X										X
*	*Eucalyptus camaldulensis*					X					X	X
	Eucalyptus marginata	X										
	Eucalyptus rudis			X	X	X					X	
	Eucalyptus todtiana	X										X
*	*Ficus carica*						X				X	
*	*Fumaria capreolata*	X		X		X	X			X		X
	Gastrolobium ?ebracteolatum						X					
*	*Genista linifolia*											X
*	*Gladiolus caryophyllaceus*	X	X								X	X
*	*Gladiolus undulatus*				X	X		X				X
*	*Gomphocarpus fruticosus*					X						X
	Gompholobium tomentosum	X	X									
	Haemodorum spicatum	X										
	Hakea varia						X					
	Hemiandra pungens	X					X					
*	*Hesperantha falcata*	X	X		X	X		X		X	X	X
	Hibbertia hypericoides	X					X					
	Hibbertia racemosa	X										
*	*Holcus lanatus*										X	X
	Hypocalymma angustifolium	X		X			X					

Species List by Plant Community - Various Allotments Midvale and Stratton

Note: * denotes introduced taxa, D denotes Declared Pest taxa and P3 denotes Priority 3 status.

		Plant Community										
	Species	**BaBm**	**Cc**	**CcEr**	**Er**	**ErMr**	**MpCc**	**Mr**	**Vj**	**CcM**	**R**	**Parkland Cleared**
*	*Hypochaeris glabra*	X		X		X	X					X
	Hypolaena exsulca	X		X								
P3	*Isopogon drummondii*	X										
	Jacksonia floribunda	X										
	Jacksonia furcellata		X				X					
	Jacksonia lehmannii	X										
	Jacksonia sternbergiana	X	X									
*	*Juncus bufonius*											X
	Juncus pallidus				X	X	X		X		X	
	Kennedia prostrata						X					
	Leptospermum erubescens	X										
*	*Leptospermum laevigatum*		X									
	Levenhookia stipitata	X										
*	*Lolium rigidum*											X
*	*Lotus subbiflorus*				X	X	X				X	X
*	*Lupinus angustifolius*		X									X
	Lyginia barbata	X										
	Lyginia imberbis	X										
	Macrozamia riedlei	X					X					
	Marianthus sp.						X					
	Melaleuca lateritia										X	
*	*Melaleuca nesophila*										X	
	Melaleuca preissiana				X		X	X		X		
*	*Melaleuca quinquenervia*										X	X
	Melaleuca rhaphiophylla				X	X		X	X	X	X	X
	Melaleuca scabra	X										
	Melaleuca trichophylla	X										
*	*Melia azedarach*				X							
	Mesomelaena pseudostygia	X										

Species List by Plant Community - Various Allotments Midvale and Stratton

Note: * denotes introduced taxa, D denotes Declared Pest taxa and P3 denotes Priority 3 status.

		Plant Community										
	Species	**BaBm**	**Cc**	**CcEr**	**Er**	**ErMr**	**MpCc**	**Mr**	**Vj**	**CcM**	**R**	**Parkland Cleared**
	Microtis media	X			X	X						
*	*Moraea flaccida*							X				X
	Nuytsia floribunda	X										
*	*Orobanche minor*						X					X
*	*Oxalis pes-caprae*					X					X	X
*	*Paspalum dilatatum*					X	X					X
	Patersonia occidentalis	X					X					
*	*Pelargonium capitatum*	X					X					
	Petrophile linearis	X										
	Philotheca spicata	X					X					
	Phlebocarya ciliata	X					X					
*	*Phytolacca octandra*				X		X					
*	*Pinus pinaster*										X	X
*	*Plantago lanceolata*					X						
	Podotheca gnaphalioides	X										
	Pterostylis sanguinea						X					
	Pyrorchis nigricans	X										
*	*Ranunculus muricatus*					X						
*	*Raphanus raphanistrum*					X						X
*	*Ricinus communis*		X									X
*	*Romulea rosea*											X
*	*Rumex crispus*						X					X
*	*Schinus terebinthifolius*						X			X		X
	Scholtzia involucrata	X										
*	*Solanum nigrum*					X	X					
*	*Sonchus oleraceus*			X		X				X		X
	Stirlingia latifolia	X										
	Taxandria linearifolia			X								
	Thysanotus manglesianus						X					

Species List by Plant Community - Various Allotments Midvale and Stratton

Note: * denotes introduced taxa, D denotes Declared Pest taxa and P3 denotes Priority 3 status.

		Plant Community										
	Species	**BaBm**	**Cc**	**CcEr**	**Er**	**ErMr**	**MpCc**	**Mr**	**Vj**	**CcM**	**R**	**Parkland Cleared**
	Trachymene pilosa	X					X					
*	*Trifolium arvense*	X	X		X						X	X
*	*Trifolium campestre*		X			X	X	X				X
*	*Trifolium hirtum*		X									X
*	*Typha orientalis*				X						X	X
*	*Ursinia anthemoides*	X									X	X
	Utricularia multifida											X
*	*Vicia sativa*			X							X	X
	Viminaria juncea				X				X			
*	*Wahlenbergia capensis*	X									X	X
*	*Washingtonia filifera*					X						
*	*Watsonia meriana* var. *bulbillifera*	X		X		X						X
	Xanthorrhoea preissii	X					X					
D	*Zantedeschia aethiopica*				X	X	X			X		

APPENDIX G

INDIVIDUAL SURVEY SITE DATA

Site Details					
Locality	Stratton/Midvale	Photo No.			
Date	7/10/2014	Juno sample Reference			
Author	SKP and STT	Geographic datum and zone		GDA94	50
Sampling unit	Quadrat	Easting		408718	
Sample number	1	Northing		6472614	
Geographic and Habitat Data					
Aspect	-	Hydrology	Intact wetland to W (BF)		
Slope	-	Adjacent Vegetation	D Banksia woodland to N		
Topographic position	F	Vegetation Condition	G		
Altitude	-	Time since fire	>5 years		
Bare ground %	10	Disturbance	weeds		
Soil type/texture	sand	Rock type	0		
Soil colour	white over grey	Rock %	0		
Microclimate		Litter type and %	5 % leaf		
Vegetation Description					
Banksia menziesii and B. attenuata (opportunistic - juveniles in quadrat) over shrubland of Adenanthos cygnorum over low shrubland Macrozamia, Stirlingia latifolia over forb/sedgeland of Mesomelaena pseudostygia, Lyginia spp., Conostylis, Dasypogon.					

Strata			**Observations**
	Height	Total % Cover	
Emergent tree			
Canopy			
Sub-canopy			
Lower tree			
Upper shrub			
Lower shrub			
Upper herb			
Middle herb			
Lower herb			

Coll. No.	**Species**	**Layer**	**Life Form**	**Height**	**Habit**	**% Cover**
ST29	Drosera menziesii subsp. penicillaris					1
ST30	Calytrix flavescens					2
ST31	Dampiera linearis					2
	Banksia menziesii					3
	Banksia attenuata					2
	Adenanthos cygnorum					10
	Macrozamia riedlei					3
	Stirlingia latifolia					2
	Conostylis aculeata					2
	Bossiaea eriocarpa					2
	Petrophile linearis					2
	Erodium botrys					1
	Scholtzia involucrata					1
	Amphipogon turbinatus					1
	Briza maxima					1
	Gompholobium tomentosum					1
	Mesomelaena pseudostygia					6
	Burchardia congesta					1

Coll. No.	Species	Layer	Life Form	Height	Habit	% Cover
	Ursinia anthemoides					2
	Dasypogon bromeliifolius					4
	Conostephium pendulum					1
	Wahlenbergia capensis					0.5
	Hypochaeris glabra					0.5
	Bromus diandrus					0.5
	Ehrharta calycina					8
	Briza maxima					1
	Pyrorchis nigricans					1
	Jacksonia floribunda					1
	Hibbertia hypericoides					2
ST32	Melaleuca trichophylla					2
ST33	Calectasia narragara					1
ST34	Lyginia barbata					10
ST35	Amphipogon turbinatus					opp.
ST36	Hemiandra pungens					opp.
ST37	Hibbertia racemosa					opp.
ST38	Hesperantha falcata					opp.

Site Details					
Locality	Stratton/Midvale	Photo No.			
Date	7/10/2014	Photo direction			
Author	SKP and STT	Geographic datum and zone		GDA94	50
Sampling unit	Quadrat	Easting		408725	
Sample number	2	Northing		6472550	
Geographic and Habitat Data					
Aspect	W	Hydrology	intact wetland to W (BF)		
Slope	Gentle	Adjacent Vegetation	intact wetland to W (BF)		
Topographic position	Slope	Vegetation Condition	G. D to S of quadrat		
Altitude		Time since fire	>5 years		
Bare ground %	5	Disturbance	weeds, clearing, grazing		
Soil type/texture	sand	Rock type			
Soil colour	white over grey	Rock %			
Microclimate		Litter type and %	10 leaf		

Vegetation Description

Banksia menziesii Open woodland over low shrubland of Hibbertia spp. and Stirlingia over sedge/forbland Mesomelaena pseudostygia and Conostylis

Strata			Observations
	Height	Total % Cover	
Emergent tree			
Canopy			
Sub-canopy			
Lower tree			
Upper shrub			
Lower shrub			
Upper herb			
Middle herb			
Lower herb			

Coll. No.	Species	Layer	Life Form	Height	Habit	% Cover
	Banksia menziesii					25
	Allocasuarina humilis					5
	Gompholobium tomentosum					2
	Conostylis aculeata					3
	Conostephium pendulum					3
	Gladiolus caryophyllaceus					0.5
	Macrozamia riedlei					2
	Stirlingia latifolia					2
	Burchardia congesta					1
	Podotheca gnaphalioides					1
	Drosera menziesii subsp. penicillaris					1
	Ehrharta calycina					5
	Ursinia anthemoides					3
	Hibbertia racemosa					1
	Briza maxima					2
	Amphipogon turbinatus					2
	Petrophile linearis					2
	Corynotheca micrantha var. micrantha					1

Coll. No.	Species	Layer	Life Form	Height	Habit	% Cover
	Bossiaea eriocarpa					2
	Hypochaeris glabra					1
	Mesomelaena pseudostygia					4
	Daviesia triflora					1
	Microtis media					1
	Calytrix flavescens					3
	Dasypogon bromeliifolius					4
	Nuytsia floribunda					2
	Hibbertia hypericoides					2
	Phlebocarya ciliata					1
	Haemodorum spicatum					1
	Gladiolus caryophyllaceus					0.5
	Lyginia imberbis					1
	Anigozanthos humilis					0.5
	Hesperantha falcata					0.5
ST40	Trachymene pilosa					0.5
ST39	Levenhookia stipitata					0.5
ST42	Austrostipa elegentissima					0.5
ST43	Scholtzia involucrata					1
	Patersonia occidentalis					1
ST41	Hypolaena exsulca					1
	Lyginia barbata					1
	Asparagus asparagoides					opp.
	Fumaria capreolata					opp.
	Watsonia meriana var. bulbillifera					opp.
	Eucalyptus marginata					opp.
ST44	Billardiera fraseri					opp.
	Briza minor					opp.
	Hypocalymma angustifolium					opp.
	Philotheca spicata					opp.

Site Details					
Locality	Stratton/Midvale	Photo No.			
Date	7/10/2014	Photo direction			
Author	SKP and STT	Geographic datum and zone		GDA94	50
Sampling unit	Releve	Easting		408589	
Sample number	1	Northing		6473128	
Geographic and Habitat Data					
Aspect		Hydrology			
Slope		Adjacent Vegetation	Wetland to NW		
Topographic position	Flat	Vegetation Condition	D		
Altitude		Time since fire	>5 years		
Bare ground %	0	Disturbance	weeds, clearing		
Soil type/texture	organic	Rock type	None		
Soil colour	dark brown	Rock %	0		
Microclimate		Litter type and %	40 leaf		

Vegetation Description

Open woodland of Corymbia calophylla over shrubland of Jacksonia sternbergiana and Adenanthos cygnorum over weeds.

Strata			Observations
	Height	Total % Cover	Euc seedlings present - regen marri?
Emergent tree			ST05
Canopy			
Sub-canopy			
Lower tree			
Upper shrub			
Lower shrub			
Upper herb			
Middle herb			
Lower herb			

Coll. No.	Species	Layer	Life Form	Height	Habit	% Cover
	Corymbia calophylla					25
	Jacksonia sternbergiana					20
	Adenanthos cygnorum					5
	Lupinus angustifolius					3
ST02	Leptospermum laevigatum					2
	Chamaecytisus palmensis					2
	Ehrharta calycina					10
	Briza maxima					5
	Gladiolus caryophyllaceus					1
	Jacksonia furcellata					10
	Eragrostis curvula					10
	Gompholobium tomentosum					0.5
ST01	Trifolium campestre					2
ST03	Trifolium arvense					2
ST04	Trifolium hirtum					2
ST05	Corymbia calophylla					2
ST06	Hesperantha falcata					1

Site Details					
Locality	Stratton/Midvale	Photo No.			
Date	7/10/2014	Photo direction			
Author	SKP and STT	Geographic datum and zone		GDA94	50
Sampling unit	Releve	Easting		408612	
Sample number	2	Northing		6473074	
Geographic and Habitat Data					
Aspect		Hydrology			
Slope		Adjacent Vegetation	D wetland		
Topographic position	Flat	Vegetation Condition	D		
Altitude		Time since fire	>5 years		
Bare ground %	4%	Disturbance	weeds, clearing		
Soil type/texture	sand	Rock type	None		
Soil colour	white over grey	Rock %	0		
Microclimate		Litter type and %	5 twig/leaf		

Vegetation Description

Open Woodland of E.?tod, Banksia attenuata, Banksia menziesii over open shrubland of Eremaea and Adenanthos cygnorum

Strata			Observations
	Height	Total % Cover	
Emergent tree			
Canopy			
Sub-canopy			
Lower tree			
Upper shrub			
Lower shrub			
Upper herb			
Middle herb			
Lower herb			

Coll. No.	Species	Layer	Life Form	Height	Habit	% Cover
ST07	Eucalyptus todtiana					3
	Banksia attenuata					5
	Banksia menziesii					4
	Stirlingia latifolia					3
ST10	Eremaea pauciflora					4
	Jacksonia floribunda					3
ST08	Adenanthos cygnorum					5
	Scholtzia involucrata					2
	Gladiolus caryophyllaceus					4
	Briza maxima					10
	Ehrharta calycina					2
	Hibbertia hypericoides					1
	Gompholobium tomentosum					1
	Ursinia anthemoides					4
ST09	Erodium botrys					4
	Hypochaeris glabra					4
	Trifolium arvense					2
ST12	Conostephium pendulum					1

Coll. No.	Species	Layer	Life Form	Height	Habit	% Cover
	Hibbertia hypericoides					1
	Daviesia triflora					2
	Acacia saligna					3
	Gladiolus caryophyllaceus					1
ST13	Podotheca gnathalioides					0.5
ST14	Microtis media					0.5
	Petrophile linearis					1
	Eragrostis curvula					2
ST15	Dasypogon bromeliifolius					1
	Xanthorrhoea preissii					opp.
	Bossiaea eriocarpa					opp.
	Burchardia congesta					opp.
ST16	Phlebocarya ciliata					opp.
ST17	Conostephium pendulum					opp.
	Jacksonia sternbergiana					opp.
ST18	Dischisma capitatum					opp.
	Allocasuarina humilis					opp.
ST19	Isopogon drummondii					opp.
ST20	Melaleuca scabra					opp.
	Conostylis aculeata					opp.
	Banksia ilicifolia					opp.
	Nuytsia floribunda					opp.
ST21	Lyginia imberbis					opp.
	Macrozamia riedlei					opp.

Site Details					
Locality	Stratton/Midvale	Photo No.			
Date	7/10/2014	Photo direction			
Author	SKP and STT	Geographic datum and zone		GDA94	50
Sampling unit	Releve	Easting		408493	
Sample number	3	Northing		6473613	
Geographic and Habitat Data					
Aspect		Hydrology	moist		
Slope		Adjacent Vegetation			
Topographic position	Flat	Vegetation Condition	D		
Altitude		Time since fire	> 5 years		
Bare ground %	0	Disturbance	weeds, loss of U/S		
Soil type/texture	organic	Rock type	None		
Soil colour	dark brown	Rock %	0		
Microclimate		Litter type and %	dead grass 10%		

Vegetation Description

Open forest of Melaleuca preissiana and Corymbia calophylla over pasture weeds

Strata			Observations
	Height	Total % Cover	
Emergent tree			young marri seedlings present
Canopy			
Sub-canopy			
Lower tree			
Upper shrub			
Lower shrub			
Upper herb			
Middle herb			
Lower herb			

Coll. No.	Species	Layer	Life Form	Height	Habit	% Cover
	Corymbia calophylla					10
	Melaleuca preissiana					50
ST45	Bromus diandrus					50
	Fumaria capreolata					3
	Ehrharta calycina					10
	Zanthedeschia aethiopica					1
	Schinus terebinthefolius					2
	Pelargonium capitatum					3
ST46	Conyza bonariensis					2
	Juncus pallidus					1
	Astartea scoparia					1
ST47	Paspalum dilatum					2
	Trifolium campestre					3
	Hypochaeris glabra					2
	Lotus subbiflorus					2
	Ficus carica					opp.
ST48	Rumex crispus					opp.
	Solanum nigrum					opp.

Coll. No.	Species	Layer	Life Form	Height	Habit	% Cover
	Phytolacca octandra					opp.
	Kennedia prostrata					opp.
	Acacia saligna					opp.
	Dielsia stenostachya					opp.

Site Details					
Locality	Stratton/Midvale	Photo No.			
Date	7/10/2014	Photo direction			
Author	SKP and STT	Geographic datum and zone		GDA94	50
Sampling unit	Releve	Easting		408512	
Sample number	4	Northing		6473529	
Geographic and Habitat Data					
Aspect		Hydrology	moist		
Slope		Adjacent Vegetation			
Topographic position	Flat	Vegetation Condition	D		
Altitude		Time since fire	>5 years		
Bare ground %	0	Disturbance	weeds, loss of US		
Soil type/texture	organic	Rock type	None		
Soil colour	brown	Rock %	0		
Microclimate		Litter type and %			

Vegetation Description

LOF of Melaleuca preissiana with isolated Corymbia calophylla over occasinal native understorey species and weeds.

Strata			Observations
	Height	Total % Cover	
Emergent tree			
Canopy			
Sub-canopy			
Lower tree			
Upper shrub			
Lower shrub			
Upper herb			
Middle herb			
Lower herb			

Coll. No.	Species	Layer	Life Form	Height	Habit	% Cover
	Melaleuca preissiana					50
	Astartea scoparia					4
	Corymbia calophylla					4
ST49	Juncus pallidus					3
	Bromus diandrus					40
	Fumaria capreolata					10
	Briza maxima					5
	Ehrharta calycina					10
	Pelargonium capitatum					5
	Zanthedeschia aethiopica					2
	Orobanche minor					0.5

Site Details					
Locality	Stratton/Midvale	Photo No.			
Date	7/10/2014	Photo direction			
Author	SKP and STT	Geographic datum and zone		GDA94	50
Sampling unit	Releve	Easting		408415	
Sample number	5	Northing		6473653	
Geographic and Habitat Data					
Aspect	NW	Hydrology			
Slope	gentle	Adjacent Vegetation			
Topographic position	slope	Vegetation Condition	D		
Altitude		Time since fire			
Bare ground %	302	Disturbance			
Soil type/texture		Rock type	laterite and pebbles		
Soil colour		Rock %	5		
Microclimate		Litter type and %			
Vegetation Description					

Shrubland of Melaleuca rhaphiophylla and M. preissiana over occasional native forbs and weeds.

Strata			Observations
	Height	Total % Cover	
Emergent tree			
Canopy			
Sub-canopy			
Lower tree			
Upper shrub			
Lower shrub			
Upper herb			
Middle herb			
Lower herb			

Coll. No.	Species	Layer	Life Form	Height	Habit	% Cover
ST50	Melaleuca lateritia					40
	Adenanthos cygnorum					5
	Eragrostis curvula					10
	Conostylis aculeata					1
	Hesperantha falcata					1
	Ursinia anthemoides					2
	Typha orientalis					1
	Juncus pallidus					1
ST51	Melaleuca rhaphiophylla					20
	Wahlenbergia capensis					0.5
	Lotus subbiflorus					2
	Gladiolus caryophyllaceus					1
	Astartea scoparia					5
	Melaleuca lateritia					10
ST52	Eucalyptus camaldulensis					6
	Allocasuarina fraseriana					1
	Corymbia calophylla					1
	Briza minor					2

Coll. No.	Species	Layer	Life Form	Height	Habit	% Cover
	Calothamnus quadrifidus					1
	Echium vulgare					2
ST53	Centrolepis aristata					10

Site Details					
Locality	Stratton/Midvale	Photo No.			
Date	7/10/2014	Photo direction			
Author	SKP and STT	Geographic datum and zone		GDA94	50
Sampling unit	Releve	Easting		408622	
Sample number	6	Northing		6472644	
Geographic and Habitat Data					
Aspect		Hydrology			
Slope		Adjacent Vegetation	Banksia woodland		
Topographic position	Flat	Vegetation Condition	VG-E		
Altitude		Time since fire	>5 years		
Bare ground %	0	Disturbance	weeds		
Soil type/texture	organic	Rock type	None		
Soil colour	dark brown	Rock %	0		
Microclimate		Litter type and %			

Vegetation Description

LOF Melaleuca preissiana over closed rushland of Dielsia stenostachya

Strata			Observations
	Height	Total % Cover	
Emergent tree			
Canopy			
Sub-canopy			
Lower tree			
Upper shrub			
Lower shrub			
Upper herb			
Middle herb			
Lower herb			

Coll. No.	Species	Layer	Life Form	Height	Habit	% Cover
	Melaleuca preissiana					65
ST57	Caesia micrantha					5
st58	Marianthus sp.					1
st59	Dielsia stenostachya					70
	Pterostylis sanguinea					0.5
	Xanthorrhoea preissii					1
	Burchardia congesta					2
	Asparagus asparagoides					1
ST60	Patersonia occidentalis					1
	Corynotheca micrantha var. micrantha					2
	Drosera menziesii subsp. penicillaris					0.5
	Hypocalymma angustifolium					opp.
	Acacia saligna					0.5
	Conostylis aculeata					opp.
	Dasypogon bromeliifolius					opp.
	Astartea scoparia					opp.
	Philotheca spicata					opp.
	Trachymene pilosa					opp.

Coll. No.	Species	Layer	Life Form	Height	Habit	% Cover
	Macrozamia riedlei					opp.
	Thysanotus manglesianus					opp.
	Dampiera linearis					opp.
	Drosera erythrorhiza subsp. erythrorhiza					opp.
	Bossiaea eriocarpa					opp.
	Hibbertia hypericoides					opp.
	Acacia pulchella					opp.
	Gastrolobium ?ebracteolatum					opp.

Site Details					
Locality	Stratton/Midvale	Photo No.			
Date	7/10/2014	Photo direction			
Author	SKP and STT	Geographic datum and zone		GDA94	50
Sampling unit	Releve	Easting		408637	
Sample number	7	Northing		6472554	
Geographic and Habitat Data					
Aspect		Hydrology			
Slope		Adjacent Vegetation			
Topographic position	Flat	Vegetation Condition	VG -E		
Altitude		Time since fire	>5 years		
Bare ground %	0	Disturbance	weeds		
Soil type/texture	organic	Rock type	None		
Soil colour	brown	Rock %	0		
Microclimate		Litter type and %	leaf 20		

Vegetation Description

LOF Melaleuca preissiana over OS Astartea scoparia, Hakea varia over rush/sedge/forbland.

Strata			Observations
	Height	Total % Cover	
Emergent tree			
Canopy			
Sub-canopy			
Lower tree			
Upper shrub			
Lower shrub			
Upper herb			
Middle herb			
Lower herb			

Coll. No.	Species	Layer	Life Form	Height	Habit	% Cover
	Melaleuca preissiana					70
	Aotus gracillima					1
	Xanthorrhoea preissii					3
	Dielsia stenostachya					30
	Acacia pulchella					2
	Astartea scoparia					1
	Corymbia calophylla					0.5
	Billardiera fraseri					0.5
	Jacksonia furcellata					1
	Hakea varia					1
	Billardiera fraseri					1
	Cyperaceae sp.					4
	Hemiandra pungens					opp.
	Phlebocarya ciliata					opp.

Site Details					
Locality	Stratton/Midvale	Photo No.			
Date	8/10/2014	Photo direction			
Author	SKP and STT	Geographic datum and zone		GDA94	50
Sampling unit	Releve	Easting		408546	
Sample number	8	Northing		6472544	
Geographic and Habitat Data					
Aspect		Hydrology	moist		
Slope		Adjacent Vegetation			
Topographic position	Flat	Vegetation Condition	D		
Altitude		Time since fire	>5 years		
Bare ground %		Disturbance	weeds, clearing		
Soil type/texture	organic	Rock type	None		
Soil colour	dark brown	Rock %	0		
Microclimate		Litter type and %	leaf 5%		

Vegetation Description

OW Eucalyptus rudis over weeds

Strata			Observations
	Height	Total % Cover	Rubbish dumped
Emergent tree			
Canopy			
Sub-canopy			
Lower tree			
Upper shrub			
Lower shrub			
Upper herb			
Middle herb			
Lower herb			

Coll. No.	Species	Layer	Life Form	Height	Habit	% Cover
	Ehrharta calycina					30
	Eucalyptus rudis					30
	Briza maxima					20
	Briza minor					10
	Lotus subbiflorus					30
	Avena barbata					10
	Bromus diandrus					10

Site Details					
Locality	Stratton/Midvale	Photo No.			
Date	8/10/2014	Photo direction			
Author	SKP and STT	Geographic datum and zone		GDA94	50
Sampling unit	Releve	Easting		408562	
Sample number	9	Northing		6472600	
Geographic and Habitat Data					
Aspect		Hydrology	moist		
Slope		Adjacent Vegetation			
Topographic position	Flat	Vegetation Condition	D		
Altitude		Time since fire	> 5 years		
Bare ground %	none except track	Disturbance	weeds, clearing		
Soil type/texture	organic	Rock type	None		
Soil colour	brown	Rock %	0		
Microclimate		Litter type and %			

Vegetation Description

OW Corymbia calophylla over LW Melaleuca spp. over weed dominated understorey

Strata			Observations
	Height	Total % Cover	
Emergent tree			
Canopy			
Sub-canopy			
Lower tree			
Upper shrub			
Lower shrub			
Upper herb			
Middle herb			
Lower herb			

Coll. No.	Species	Layer	Life Form	Height	Habit	% Cover
	Corymbia calophylla					10
	Melaleuca preissiana					10
	Melaleuca rhaphiophylla					20
	Asparagus asparagoides					3
	Schinus terebinthefolius					5
	Avena barbata					3
	Ehrharta calycina					40
	Bromus diandrus					10
	Zanthedeschia aethiopica					5
	Fumaria capreolata					5
ST64	Sonchus oleraceus					1
ST06	Hesperantha falcata					3

Site Details					
Locality	Stratton/Midvale	Photo No.			
Date	8/10/2014	Photo direction			
Author	SKP and STT	Geographic datum and zone		GDA94	50
Sampling unit	Releve	Easting		408473	
Sample number	10	Northing		6472650	
Geographic and Habitat Data					
Aspect		Hydrology	moist		
Slope		Adjacent Vegetation			
Topographic position	Flat	Vegetation Condition	D		
Altitude		Time since fire	>5 years		
Bare ground %	0	Disturbance	clearing, weeds		
Soil type/texture	organic	Rock type	None		
Soil colour	brown	Rock %	0		
Microclimate		Litter type and %			

Vegetation Description

LOW Eucalyptus rudis and Melaleuca rhaphiophylla over weeds

Strata			Observations
	Height	Total % Cover	
Emergent tree			
Canopy			
Sub-canopy			
Lower tree			
Upper shrub			
Lower shrub			
Upper herb			
Middle herb			
Lower herb			

Coll. No.	Species	Layer	Life Form	Height	Habit	% Cover
	Eucalyptus rudis					15
	Melaleuca rhaphiophylla					20
	Lotus subbiflorus					60
	Hesperantha falcata					5
	Briza minor					5
ST65	Gladiolus undulatus					4
	Avena barbata					10
	Ehrharta calycina					5

Site Details					
Locality	Stratton/Midvale	Photo No.			
Date	8/10/2014	Photo direction			
Author	SKP and STT	Geographic datum and zone		GDA94	50
Sampling unit	Releve	Easting		408461	
Sample number	11	Northing		6472712	
Geographic and Habitat Data					
Aspect		Hydrology	moist, near standing water		
Slope		Adjacent Vegetation			
Topographic position	Flat	Vegetation Condition	D		
Altitude		Time since fire			
Bare ground %	0	Disturbance	weeds, clearing		
Soil type/texture	organic	Rock type	None		
Soil colour	dark brown	Rock %	0		
Microclimate		Litter type and %	Twig 30%		

Vegetation Description

Woodland of Eucalyptus rudis over sparse shrubland Melaleuca rhaphiophylla over weeds

Strata			Observations
	Height	Total % Cover	
Emergent tree			
Canopy			
Sub-canopy			
Lower tree			
Upper shrub			
Lower shrub			
Upper herb			
Middle herb			
Lower herb			

Coll. No.	Species	Layer	Life Form	Height	Habit	% Cover
	Eucalyptus rudis					30
	Melaleuca rhaphiophylla					3
	Briza maxima					10
	Briza minor					1
	Paspalum dilatum					30
	Ehrharta calycina					10
	Gomphocarpus fruticosus					1
	Microtis media					0.5
	Juncus pallidus					3
	Zanthedeschia aethiopica					2
	Acacia dealbata					1

Site Details					
Locality	Stratton/Midvale	Photo No.			
Date	8/10/2014	Photo direction			
Author	SKP and STT	Geographic datum and zone		GDA94	50
Sampling unit	Releve	Easting			
Sample number	12	Northing			
Geographic and Habitat Data					
Aspect		Hydrology			
Slope		Adjacent Vegetation			
Topographic position	Flat	Vegetation Condition	D-CD		
Altitude		Time since fire	>5 years		
Bare ground %	10 track	Disturbance	weeds, clearing		
Soil type/texture	organic	Rock type	None		
Soil colour	dark	Rock %	0		
Microclimate		Litter type and %			

Vegetation Description

E. rudis OW over sparse Melaleuca rhaphiophylla over weed dominated understorey

Strata			Observations
	Height	Total % Cover	
Emergent tree			
Canopy			
Sub-canopy			
Lower tree			
Upper shrub			
Lower shrub			
Upper herb			
Middle herb			
Lower herb			

Coll. No.	Species	Layer	Life Form	Height	Habit	% Cover
	Eucalyptus rudis					5
	Melaleuca rhaphiophylla					10
	Ehrharta calycina					70
	Bromus diandrus					10
	Avena barbata					10
	Hypochaeris glabra					3
	Trifolium campestre					4
	Hesperantha falcata					2
	Solanum nigrum					2
	Echium vulgare					1
ST69	Raphanus raphanistrum					opp.
ST70	Ranunculus muricatus					opp.

Site Details					
Locality	Stratton/Midvale	Photo No.			
Date	8/10/2014	Photo direction			
Author	SKP and STT	Geographic datum and zone		GDA94	50
Sampling unit	Releve	Easting		408439	
Sample number	13	Northing		6472823	
Geographic and Habitat Data					
Aspect		Hydrology			
Slope		Adjacent Vegetation			
Topographic position	Flat	Vegetation Condition	D		
Altitude		Time since fire	>5 years		
Bare ground %	0	Disturbance	weeds, clearing		
Soil type/texture	organic	Rock type	None		
Soil colour	dark brown	Rock %	0		
Microclimate		Litter type and %			

Vegetation Description

Woodland of Eucalyptus rudis over weeds. Typha in standing water.

Strata			Observations
	Height	Total % Cover	
Emergent tree			
Canopy			
Sub-canopy			
Lower tree			
Upper shrub			
Lower shrub			
Upper herb			
Middle herb			
Lower herb			

Coll. No.	Species	Layer	Life Form	Height	Habit	% Cover
	Eucalyptus rudis					50
	Typha orientalis					10
	Zanthedeschia aethiopica					2
	Cyndon dactylon					80
	Phytolacca octandra					10

Site Details					
Locality	Stratton/Midvale	Photo No.			
Date	8/10/2014	Photo direction			
Author	SKP and STT	Geographic datum and zone		GDA94	50
Sampling unit	Releve	Easting		408533	
Sample number	14	Northing		6472822	
Geographic and Habitat Data					
Aspect		Hydrology	moist		
Slope		Adjacent Vegetation			
Topographic position	Flat	Vegetation Condition	D		
Altitude		Time since fire	>5 years		
Bare ground %	0	Disturbance	Weeds, clearing		
Soil type/texture	organic	Rock type	None		
Soil colour	brown	Rock %	0		
Microclimate		Litter type and %	leaf 50		

Vegetation Description

OF Eucalyptus rudis over weed dominated understorey

Strata			Observations
	Height	Total % Cover	
Emergent tree			
Canopy			
Sub-canopy			
Lower tree			
Upper shrub			
Lower shrub			
Upper herb			
Middle herb			
Lower herb			

Coll. No.	Species	Layer	Life Form	Height	Habit	% Cover
	Eucalyptus rudis					75
	Cyndon dactylon					10
	Microtis media					0.5
	Briza maxima					3
ST71	Melia azedarach					1
	Zanthedeschia aethiopica					1
	Melaleuca preissiana					1

Site Details					
Locality	Stratton/Midvale	Photo No.			
Date	8/10/2014	Photo direction			
Author	SKP and STT	Geographic datum and zone		GDA94	50
Sampling unit	Releve	Easting		408562	
Sample number	15	Northing		6472728	
Geographic and Habitat Data					
Aspect		Hydrology			
Slope		Adjacent Vegetation			
Topographic position	F	Vegetation Condition	D		
Altitude		Time since fire	>5 years		
Bare ground %	0	Disturbance	weeds, clearing		
Soil type/texture	organic	Rock type	None		
Soil colour	dark brown	Rock %	0		
Microclimate		Litter type and %			

Vegetation Description

Eucalyptus rudis and Corymbia calophylla W over weed dominated understorey and track

Strata			Observations
	Height	Total % Cover	
Emergent tree			
Canopy			
Sub-canopy			
Lower tree			
Upper shrub			
Lower shrub			
Upper herb			
Middle herb			
Lower herb			

Coll. No.	Species	Layer	Life Form	Height	Habit	% Cover
	Corymbia calophylla					10
	Eucalyptus rudis					10
	Acacia longifolia					5
ST72	Taxandria linearifolia					20
	Vicia sativa					3
	Fumaria capreolata					3
	Briza maxima					10
	Ehrharta calycina					20
	Watsonia meriana var. bulbillifera					10
	Sonchus oleraceus					2
	Hypochaeris glabra					2
	Dielsia stenostachya					1
ST41	Hypolaena exsulca					1
	Hypocalymma angustifolium					2
	Astartea scoparia					2
	Eucalyptus todtiana					3
	Utricularia multifida					0.5

Site Details					
Locality	Stratton/Midvale	Photo No.			
Date	8/10/2014	Photo direction			
Author	SKP and STT	Geographic datum and zone		GDA94	50
Sampling unit	Releve	Easting		408383	
Sample number	16	Northing		6473030	
Geographic and Habitat Data					
Aspect		Hydrology			
Slope		Adjacent Vegetation			
Topographic position	Float	Vegetation Condition	D		
Altitude		Time since fire	>5 years		
Bare ground %	20	Disturbance	weeds		
Soil type/texture	organic	Rock type	None		
Soil colour	dark brown	Rock %	0		
Microclimate		Litter type and %			

Vegetation Description

Closed shrubland of Melaleuca rhaphiophylla over weed dominated understorey

Strata			Observations
	Height	Total % Cover	
Emergent tree			
Canopy			
Sub-canopy			
Lower tree			
Upper shrub			
Lower shrub			
Upper herb			
Middle herb			
Lower herb			

Coll. No.	Species	Layer	Life Form	Height	Habit	% Cover
	Melaleuca rhaphiophylla					40
	Hesperantha falcata					10
	Briza minor					10
	Centrolepis aristata					5
	Trifolium campestre					5
	Astartea scoparia					opp.
	Melaleuca preissiana					opp.

Site Details					
Locality	Stratton/Midvale	Photo No.			
Date	8/10/2014	Photo direction			
Author	SKP and STT	Geographic datum and zone		GDA94	50
Sampling unit	Releve	Easting		408398	
Sample number	17	Northing		6473062	
Geographic and Habitat Data					
Aspect		Hydrology	moist		
Slope		Adjacent Vegetation			
Topographic position	Flat	Vegetation Condition	D		
Altitude		Time since fire	>5 years		
Bare ground %	0	Disturbance	weeds		
Soil type/texture	organic	Rock type	None		
Soil colour	dark brown	Rock %	0		
Microclimate		Litter type and %			
Vegetation Description					

Talll shrubland of Viminaria juncea over open sedgeland of Dielsia stenostachya, Juncus and weeds

Strata			Observations
	Height	Total % Cover	Small patch of intact understorey
Emergent tree			most of community with weed dominated
Canopy			understorey
Sub-canopy			
Lower tree			
Upper shrub			
Lower shrub			
Upper herb			
Middle herb			
Lower herb			

Coll. No.	Species	Layer	Life Form	Height	Habit	% Cover
	Viminaria juncea					30
	Dielsia stenostachya					20
	Melaleuca rhaphiophylla					5
	Juncus pallidus					5
	Cortaderia selloana					opp.
	Briza maxima					5
	Cyndon dactylon					20

Site Details					
Locality	Stratton/Midvale	Photo No.			
Date	8/10/2014	Photo direction			
Author	SKP and STT	Geographic datum and zone		GDA94	50
Sampling unit	Releve	Easting		408380	
Sample number	18	Northing		6473104	
Geographic and Habitat Data					
Aspect		Hydrology			
Slope		Adjacent Vegetation			
Topographic position	Float	Vegetation Condition	D		
Altitude		Time since fire	>5 years		
Bare ground %	20	Disturbance	weeds		
Soil type/texture	organic	Rock type	None		
Soil colour	dark brown	Rock %	0		
Microclimate		Litter type and %			

Vegetation Description

Closed shrubland of Melaleuca rhaphiophylla over weed dominated understorey

Strata			Observations
	Height	Total % Cover	
Emergent tree			
Canopy			
Sub-canopy			
Lower tree			
Upper shrub			
Lower shrub			
Upper herb			
Middle herb			
Lower herb			

Coll. No.	Species	Layer	Life Form	Height	Habit	% Cover
	Melaleuca rhaphiophylla					40
	Hesperantha falcata					10
	Briza minor					10
	Centrolepis aristata					5
	Trifolium campestre					5
	Astartea scoparia					opp.
	Melaleuca preissiana					opp.

Site Details					
Locality	Stratton/Midvale	Photo No.			
Date	8/10/2014	Photo direction			
Author	SKP and STT	Geographic datum and zone		GDA94	50
Sampling unit	Releve	Easting		408393	
Sample number	19	Northing		6473128	
Geographic and Habitat Data					
Aspect		Hydrology			
Slope		Adjacent Vegetation			
Topographic position	Flat	Vegetation Condition	D		
Altitude		Time since fire	>5 years		
Bare ground %	2	Disturbance	weeds, clearing		
Soil type/texture	organic	Rock type	None		
Soil colour	dark brown	Rock %	0		
Microclimate		Litter type and %	twig 10		

Vegetation Description

Patch of Acacia saligna, melaleuca spp. to the west.

Strata			Observations
	Height	Total % Cover	
Emergent tree			
Canopy			
Sub-canopy			
Lower tree			
Upper shrub			
Lower shrub			
Upper herb			
Middle herb			
Lower herb			

Coll. No.	Species	Layer	Life Form	Height	Habit	% Cover
	Acacia saligna					30
	Melaleuca preissiana					10
	Melaleuca rhaphiophylla					10
	Ehrharta calycina					50
	Eragrostis curvula					20
	Gladiolus undulatus					5
	Briza maxima					5
	Briza minor					2
	Cyndon dactylon					20
	Hesperantha falcata					4
	Echium vulgare					Opp.

Site Details					
Locality	Stratton/Midvale	Photo No.			
Date	8/10/2014	Photo direction			
Author	SKP and STT	Geographic datum and zone		GDA94	50
Sampling unit	Releve	Easting		408387	
Sample number	20	Northing		6473178	
Geographic and Habitat Data					
Aspect		Hydrology	moist		
Slope		Adjacent Vegetation			
Topographic position	Flat	Vegetation Condition	D		
Altitude		Time since fire	>5 years		
Bare ground %	5	Disturbance	weeds, clearing		
Soil type/texture	organic	Rock type	None		
Soil colour	Dark brown	Rock %	0		
Microclimate		Litter type and %	leaf 5		

Vegetation Description

W Eucalyptus rudis over weeds

Strata			Observations
	Height	Total % Cover	
Emergent tree			
Canopy			
Sub-canopy			
Lower tree			
Upper shrub			
Lower shrub			
Upper herb			
Middle herb			
Lower herb			

Coll. No.	Species	Layer	Life Form	Height	Habit	% Cover
	Eucalyptus rudis					30
	Cyndon dactylon					20
	Juncus pallidus					3
	Gladiolus undulatus					20
	Trifolium arvense					4
	Hesperantha falcata					4
	Briza maxima					2
	Cyperus tenellus					1
	Microtis media					0.5
	Melaleuca rhaphiophylla					opp.
	Cortaderia selloana					opp.
	Viminaria juncea					opp.

Site Details					
Locality	Stratton/Midvale	Photo No.			
Date	8/10/2014	Photo direction			
Author	SKP and STT	Geographic datum and zone		GDA94	50
Sampling unit	Releve	Easting		408378	
Sample number	21	Northing		6472037	
Geographic and Habitat Data					
Aspect	S	Hydrology	creekline		
Slope	steep (eroded)	Adjacent Vegetation			
Topographic position	Creekline	Vegetation Condition	D		
Altitude		Time since fire	>5 years		
Bare ground %	40	Disturbance	weeds, clearing, erosion		
Soil type/texture		Rock type	laterite pebbles		
Soil colour		Rock %	1		
Microclimate		Litter type and %			

Vegetation Description

OW Eucalytpus rudis and E. camaldulensis over weeds with occasional Melaleuca rhaphiophylla.

Strata			Observations
	Height	Total % Cover	Deeply incised creekline channel
Emergent tree			
Canopy			
Sub-canopy			
Lower tree			
Upper shrub			
Lower shrub			
Upper herb			
Middle herb			
Lower herb			

Coll. No.	Species	Layer	Life Form	Height	Habit	% Cover
	Eucalyptus rudis					10
	Eucalyptus camaldulensis					10
	Melaleuca rhaphiophylla					2
	Washingtonia filifera					1
	Fumaria capreolata					5
	Oxalis pes-caprae					4
	Watsonia meriana var. bulbillifera					10
	Eragrostis curvula					10
	Aira caryophyllea					2
	Briza minor					3
	Hesperantha falcata					3
	Avena barbata					5
	Ehrharta calycina					10
	Zanthedeschia aethiopica					2
	Sonchus oleraceus					2
	Trifolium campestre					4
	Briza maxima					3
	Solanum nigrum					1

Coll. No.	Species	Layer	Life Form	Height	Habit	% Cover
	Plantago lanceolata					1