Appendix C

Technical Memorandum (Emerge Associates 2017)

TECHNICAL MEMORANDUM

PROJECT NUMBER EP16-009(14)

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PROJECT NAME Lot 102 Farrall Road, Midvale

DATE 8/06/2017

PURPOSE Update to the flora and vegetation assessment

1. INTRODUCTION

1.1. Project background

Lot 102 Farrall Road Midvale, Western Australia (hereafter referred to as the site), is located approximately 20 kilometres (km) north east of the Perth Central Business District and is bound by Farrall Road to the west, rail reserve to the east and private holdings to the south. Peet Stratton Pty Ltd proposes to develop this site for urban uses as part of the wider Movida residential development and as broadly outlined in the *Farrall Road Local Structure Plan* (*Farrall Road LSP*).

The site contains areas of native vegetation which are significant because they comprise wetland and banksia woodland communities and because native vegetation on the eastern side of the coastal plain is generally poorly reserved.

The wetland vegetation within the site is associated with Bush Forever Site No. 309. This vegetation has previously been identified as being in excellent condition (Emerge Associates 2015) and is proposed to be retained and protected through the *Farrall Road LSP*.

The banksia woodland vegetation within the site has the potential to represent the 'banksia woodlands of the Swan Coastal Plain' 'threatened ecological community' (TEC), which was listed as 'endangered' under the *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) in September 2016. This TEC comprises multiple floristic community types (FCTs) of which some are also State listed TECs and 'priority ecological communities' (PECs).

The banksia woodland vegetation within the site is also known to include vegetation associated with FCT 20c, which represents the 'shrublands and woodlands of the eastern Swan Coastal Plain' TEC (Tauss & Associates 2016). The shrublands and woodlands of the eastern Swan Coastal Plain TEC is listed as 'endangered' under the EPBC Act and 'critically endangered' by the WA Minister for the Environment. Only two locations containing this type of vegetation are known, of which one is the Talbot Road Reserve located approximately 1 km east of the site.

Detailed site-specific flora and vegetation investigations have previously been conducted over the site by a number of parties, including Coffey Environments (2010), Emerge Associates (2015) and Tauss & Associates (2016). While the information obtained through these investigations is generally consistent, the understanding of plant community type and vegetation condition within the site has evolved over time. In particular the presence of the FCT 20c within the site was not confirmed until surveys by Tauss & Associates and Emerge Associates in May and June 2016.

Most of the FCT 20c vegetation within the site is in degraded condition and therefore does not qualify as the TEC. However, some small patches of FCT 20c vegetation in good or better condition are proposed to be impacted under the *Farrall Road LSP*. It is therefore important that the type, extent and condition of native vegetation within the site is accurately identified to inform future planning and approval processes.

1.2. **Purpose and scope of work**

Emerge Associates (Emerge) were engaged by Peet Stratton Pty Ltd to provide environmental consultancy services to examine and amalgamate multiple survey data recorded in the site. The purpose of this technical memorandum is to update the flora and vegetation information from Emerge Associates (2015) with information obtained by Emerge Associates in February and June 2016 and by Tauss & Associates in June 2016. Note relevant background information is provided in the Emerge Associates (2015) report and has not been repeated here. However, updated database searches for threatened and priority flora and threatened and priority ecological communities are provided to ensure the assessment is finalised using current information.

The scope of work was specifically to undertake a review of existing data and an additional vegetation assessment (to the standard required of a detailed survey in accordance with the Environmental Protection Authority's (EPA's) *Technical Guidance – Flora and Vegetation Surveys for Environmental Impact Assessment* (EPA 2016).

As part of this scope of work, the following tasks were undertaken:

- Desktop review of previous surveys pertaining to the site and updated database searches for threatened flora species and ecological communities.
- Compilation of an amalgamated list of flora species recorded during all previous surveys of the site.
- Mapping of amalgamated plant communities and vegetation condition.
- Identification of conservation significant flora and vegetation.
- Documentation of the updated desktop assessment, comparison of survey methodology and results.

2. UPDATES TO DATABASE SEARCHES FOR CONSERVATION SIGNIFICANT FLORA AND VEGETATION

2.1. Threatened and priority flora

A search was previously conducted for threatened and priority flora within a 5 km radius of the site using the Department of Parks and Wildlife's (DPaW) database (reference no. 03-1014FL) and the *Protected Matters Search Tool* (DoEE 2015) (Emerge Associates 2015). A total of 44 species comprising 21 threatened and 23 priority flora species were identified as potentially occurring in the wider local area as listed in **Table 1**. One priority '3' species, *Isopogon drummondii,* has been recorded within the site (Emerge Associates 2015; Tauss & Associates 2016). Since 2015 the conservation significance of three species listed in **Table 1** has changed as described below:

- *Centrolepis caespitosa* was previously listed as 'endangered' under the EPBC Act and is now listed as 'Priority 4'.
- *Stylidium longitubum* was previously listed as 'Priority 3' and is now listed as 'Priority 4'.
- *Thelymitra variegata* was previously listed as 'Priority 3' and is now listed as 'Priority 2'.

Table 1: Significant flora species known or likely to occur within 5 km of the site

Species	Level of significance[1]	
	State	EPBC Act
Acacia aphylla	T	VU
Andersonia gracilis	T	EN
Anigozanthos viridis subsp. *terraspectans*	T	VU
Anthocercis gracilis	T	VU
Caladenia huegelii	T	EN
Calectasia cyanea	T	CE
Calytrix breviseta subsp. *breviseta*	T	EN
Conospermum undulatum	T	VU
Darwinia foetida	T	CE
Diuris micrantha	T	VU
Diuris purdiei	T	EN
Drakaea elastica	T	EN
Drakaea micrantha	T	VU
Eucalyptus x balanites	T	EN
Grevillea curviloba subsp. *incurva*	T	EN
Lepidosperma rostratum	T	EN
Thelymitra dedmaniarum	T	EN
Thelymitra stellata	T	EN
Trithuria occidentalis	T	EN
Diplolaena andrewsii	T	-
Synaphea sp. Pinjarra Plain	T	-
Picris wagenitzii	P1	-

Species	Level of significance[1]	
	State	EPBC Act
Thelymitra magnifica	P1	-
Millotia tenuifolia var. *laevis*	P2	-
Phyllangium palustre	P2	-
Thelymitra variegata	P2	-
Acacia oncinophylla subsp. *oncinophylla*	P3	-
Acacia ridleyana	P3	-
Cyathochaeta teretifolia	P3	-
Eryngium sp. *subdecumbens*	P3	-
Halgania corymbosa	P3	-
Isopogon drummondii[†]	P3	-
Meionectes tenuifolia	P3	-
Pithocarpa corymbulosa	P3	-
Tetratheca pilifera	P3	-
Thysanotus anceps	P3	-
Centrolepis caespitosa	P4	-
Darwinia pimelioides	P4	-
Lasiopetalum bracteatum	P4	-
Persoonia sulcata	P4	-
Senecio leucoglossus	P4	-
Stylidium longitubum	P4	-
Thysanotus glaucus	P4	-
Thysanotus isantherus	P4	-

[1]T=threatened, CR=critically endangered, E=endangered, VU=vulnerable, P1=Priority 1, P2=Priority 2, P3=Priority 3, P4=Priority 4.
[†]Recorded within the site

2.2. Threatened and priority ecological communities

A search was previously conducted of DPaW's database (reference no. 08-01014EC) and the *Protected Matters Search Tool* (DoEE 2015) to identify known locations of TECs and PECs within 10 km of the site (Emerge Associates 2015). Since these searches were conducted the 'banksia woodlands of the Swan Coastal Plain' TEC (banksia woodland TEC) was listed under the EPBC Act on the 16th September 2016. The banksia woodland TEC is comprised of a wide variety of banksia dominated FCTs. Some of these FCTs had previously been listed as a TEC or PEC at a State level.

Including the banksia woodland TEC, six TECs and two PECs (of which one community is both a TEC and a PEC) occur within the wider local area as listed in **Table *2***.

Table 2: TECs and PECs known or likely to occur within 10 km of the site.

Code	Community name	TEC/ PEC	Level of significance	
			State	EPBC Act
3a	*Corymbia calophylla - Kingia australis* woodlands on heavy soils, Swan Coastal Plain	TEC	Critically Endangered	Endangered
3c	*Corymbia calophylla – Xanthorrhoea preissii* woodlands and shrublands of the Swan Coastal Plain	TEC	Critically Endangered	Endangered
20c	Shrublands and woodlands of the eastern side of the Swan Coastal Plain	TEC	Critically endangered	Endangered
20a	*Banksia attenuata* woodland over species rich dense shrublands	TEC	Endangered	Endangered (Banksia woodlands of the Swan Coastal Plain)
20b	*Banksia attenuata* and/or *Eucalyptus marginata* woodlands of the eastern side of the Swan Coastal Plain	TEC	Endangered	
21c	Low lying *Banksia attenuata* woodlands or shrublands	TEC/ PEC	Priority 3	
Com 5 Markey	Central Northern Darling Scarp Granite Shrubland Community	PEC	Priority 4	-

Diagnostic characteristics and condition thresholds are provided to assist in identifying the 'banksia woodlands TEC' (DoEE 2016). Detailed listing advice is also available for the 3a and 3b TECs (DoEE 2017). Whilst listing advice and an *Interim Recovery Plan* exist for the 'shrublands and woodlands of the eastern side of the Swan Coastal Plain' TEC (DoEE 2017), no diagnostic characteristics or condition thresholds are provided. The description of the 'central granite shrublands' PEC is the only advice available for this community.

3. SUMMARY OF PREVIOUS SURVEYS RESULTS

The previous surveys undertaken in the site are summarised in **Table 3.**

Table 3: Summary of field surveys in 2016

Survey timing	Survey scale	Surveyor	Likely *Banksia* spp. woodland FCT/s
October and November 2006	Wider region including the site	Coffey	Unknown
October 2014	Wider region including the site	Emerge Associates	Inconclusive (most likely FCT 21c)
February 2016	Site only (vegetation condition re-mapped and one additional quadrat installed and surveyed)	Emerge Associates	Inconclusive
May and June 2016	Site only (wetland vegetation not sampled)	Tauss & Associates	FCT 20c and FCT 21c

3.1. Coffey Environments (2010)

Coffey Environments (Coffey) undertook a flora and vegetation assessment of the site and the area region in October and November 2010 (Coffey Environments 2010). A total of 125 flora species (36 native and 89 non-native) were recorded across the wider region. No threatened or priority flora species were recorded. Four plant communities were recorded in the site:

- *Melaleuca preissiana* forest in the south-western corner of the site
- *Corymbia calophylla - Melaleuca preissiana* low forest also in the south-western corner of the site
- *Banksia* spp. woodland across the majority of the site
- *Corymbia calophylla* trees over pasture in the northern and central western portions.

The two plant communities in the south-western corner of the site were inferred to represent FCT 11 'wet forests and woodlands'. The *Banksia* spp. woodland community was inferred to represent FCT 23a 'central *Banksia attenuata – B. menziesii* woodlands'. The *Corymbia calophylla* trees were identified as being too degraded to assign a FCT. The wetland vegetation in the south-west corner was assessed as being in 'excellent' condition. The remainder of the site was assessed as being in 'degraded' condition.

3.2. Emerge Associates (2015)

Emerge undertook a flora, vegetation and wetland assessment of the site and the wider area on 7th and 8th October 2014 (Emerge Associates 2015). Vegetation condition was mapped at scale appropriate to the size of the large survey area (approximately 89 ha). Eleven survey locations (two quadrats, four relevés and four 'points of interest') were sampled within the site and 158 flora species (86 native and 72 non-native) were recorded across the wider area. Six individuals of *Isopogon drummondii* (P3) were recorded on the eastern edge of the site. Four plant communities were identified and mapped within the site:

- *Melaleuca preissiana* woodland (**Mp**)
- *Banksia* spp. woodland (**BaBm**)
- *Corymbia calophylla* woodland (**Cc**)
- non-native species with occasional native trees and shrubs (parkland cleared).

Based on the composition of species present the **Mp** community was inferred to represent FCT 11. Statistical analysis using data collected from two quadrats showed the **BaBm** community had the highest similarity (38 %) to Gibson *et al.* (1994) sites representing FCT 21c 'low lying *Banksia attenuata* woodlands and shrublands'. However, this was not conclusive as the community also showed similarities to sites representing FCT 23a (36 % similarity) and FCT 20c (33 % similarity). The potential for the **BaBm** community to represent FCT 20c 'eastern shrublands and woodlands' was noted due to the close proximity of the site to the Talbot Road Reserve. However, sample data from **BaBm** included a range of species not typically associated with FCT 20c, which in conjunction to the near wetland landscape position of this vegetation, lead to the assignment of vegetation to FCT 21c.

The **Cc** community was inferred to have once represented FCT 3c '*Corymbia calophylla* – *Xanthorrhoea preissii* woodlands and shrublands'. However, due to the low diversity of native species in this community it was not considered to represent any FCT.

The **Mp** vegetation was the highest quality in the site and assessed as being in 'excellent' condition. The **BaBm** vegetation was assessed as primarily being in 'degraded' condition with one area of 'good' vegetation in the south eastern portion of the site. The **Cc** vegetation was assessed as being in 'degraded' condition. The remainder of the site was deemed to be in 'completely degraded' condition.

The **BaBm** vegetation showed the highest similarity to FCT 21c, which was a PEC (P3) at the time of the Emerge Associates (2015) survey. No other TECs or PECs were identified as occurring in the site.

3.3. Emerge Associates (2016)

During February 2016 staff from Emerge Associates met on site with representatives from the Threatened Species and Communities Branch of DPaW. Following this visit DPaW advised that the banksia vegetation in the site should be considered a TEC, nominating either FCT 20a, 20c or 3a as potentially appropriate community types.

To confirm the extent of TEC within the site, Emerge Associates remapped vegetation condition at a finer scale in February 2016. From this survey one relatively small patch of **BaBm** vegetation in the central eastern portion of the site, that was previously assessed as being in 'degraded' condition (Emerge Associates 2015), was reassessed to be in 'good' condition.

Emerge Associates also sampled an additional quadrat in the aforementioned patch of good condition vegetation. Comparison of this quadrat to the Gibson *et al.* (1994) dataset was inconclusive, indicating similarity to a range of FCTs. However, as this quadrat was assessed outside of the optimal season for flora surveys in south west of Western Australia (spring), this result was understood to provide a limited account of the flora that were potentially present.

Emerge Associates also completed a targeted survey for *Isopogon drummondii* (P3) in February 2016, coinciding with the main flowering season of the species. Including the six individuals previously recorded in the site (Emerge Associates 2015), a total of 14 individuals were recorded in the eastern portion of the site within the **BaBm** vegetation.

3.4. Tauss & Associates (2016)

Tauss and Associates Biodiversity Consultants (Tauss & Associates) undertook a flora and vegetation assessment of the site on 29th May and 12th June 2016 (Tauss & Associates 2016). Vegetation condition was assessed across the site. A total of 12 quadrat locations were sampled in the upland vegetation in the site and 134 flora species (106 native and 28 non-native) were recorded. Twelve individuals of *Isopogon drummondii* (P3) were recorded, in approximately the same areas as indicated from previous surveys. Five plant communities were identified and mapped within the site:

- *Melaleuca preissiana* forest
- *Banksia menziesii* woodland
- *Banksia ilicifolia – B. menziesii – B. attenuata* woodland
- *Corymbia calophylla* woodland
- *Eucalyptus* sp. – *Allocasuarina fraseriana* trees over non-native grasses ('parkland cleared').

The Tauss & Associates (2016) assessment focused on the upland banksia vegetation within the site. No samples were taken in the *Melaleuca preissiana* forest community. The *Corymbia calophylla* woodland and parkland cleared communities were considered too degraded for floristic analysis and were also not sampled. Of the 12 quadrats sampled, 11 were located within the *Banksia menziesii* woodland community and one within the *Banksia ilicifolia – B. menziesii – B. attenuata* woodland community. Tauss & Associates (2016) identified that the *Banksia menziesii* woodland community was present in both woodland and 'low shrubland' forms.

Tauss & Associates (2016) compared numerous iterations of their quadrat data to sites within the Gibson *et al.* (1994) dataset. Their analysis indicated that quadrats located in the *Banksia menziesii* community in 'good' or better condition were most similar to FCT 20c. However, some quadrats also showed a close similarity to sites representing FCTs 6, 20a, 20b, 21c and 23a. The quadrat located in the *Banksia ilicifolia – B. menziesii – B. attenuata* woodland grouped with a range of FCTs including FCT 4, 6, 21a, 21c, 22 and 23b, but was concluded to represent FCT 21c.

The *Melaleuca preissiana* community was assessed as being in 'very good' to 'excellent' condition. The *Banksia menziesii* woodland community was assessed as ranging from 'degraded' to 'excellent' condition. The *Banksia ilicifolia – B. menziesii – B. attenuata* community was identified as a mosaic of regenerating banksia vegetation amongst stands of non-native grasses in 'degraded' to 'good' condition. The parkland cleared communities were assessed as being in 'degraded' to 'completely degraded' condition.

Tauss & Associates (2016) identified the 'shrublands and woodlands of the eastern Swan Coastal Plain' TEC as occurring on the eastern side of the site where vegetation representing FCT 20c had been mapped as present in 'good' or better condition. The *Banksia ilicifolia – B. menziesii – B. attenuata* community was identified as FCT 21c, which was listed as a PEC (P3) but not a TEC at the time of the Tauss & Associates (2016) survey. Subsequently, the banksia woodland TEC was listed under the EPBC Act in September 2016. FCT 21c is one of a variety of FCTs associated with the banksia woodland TEC. To qualify as the TEC a patch of banksia woodland must meet minimum size and condition criteria. The minimum patch size for vegetation in 'good' condition is 2 ha (DoEE 2016). The vegetation classified as FCT 21c by Tauss & Associates (2016) was less than 2 ha in size and so would not comprise the banksia woodland TEC.

4. METHODS

The following section outlines methods for the survey undertaken by Emerge Associates within the site in June 2016 and the amalgamation of new information with the results of previous surveys.

4.1. Field survey

4.1.1. Quadrat sampling

One quadrat (Q3) was sampled within the **BaBm** vegetation in the central eastern portion of the site (synonymous with *'Banksia menziesii* woodland' described by Tauss & Associates (2016) and **BaBm** community described by Emerge Associates (2015)). This quadrat had previously been installed by Emerge Associates in February 2016. It consisted of a semi-permanent 10 m x 10 m sample area defined using wooden stakes bound by measuring tape. The position of the quadrat was recorded with a hand-held GPS unit, as shown on **Figure 2.** The locations of Emerge Associates (2015) sample locations are also shown on **Figure 2**.

The quadrat was surveyed in June 2016 and data recorded included:

- site details (site name, site number, observers, date, location)
- environmental information (slope, aspect, bare-ground, rock outcropping soil type and colour class, litter layer, topographical position, time since last fire event)
- biological information (vegetation structure and condition, degree of disturbance, species present and 'foliage projective cover' (FPC)).

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. Flora species not native to Western Australia are denoted by an asterisk (*) in text and raw data.

4.1.2. Vegetation condition

The site was traversed on foot and the composition and condition of vegetation was recorded. Photographs were taken throughout the field visit to show particular site conditions. Vegetation condition was assigned at Q3, as well as noted and mapped across the upland vegetation in the site using the Keighery (1994) vegetation condition assessment scale. The condition of the banksia vegetation was subsequently also assessed using the condition scale provided in the conservation advice for the banksia woodland TEC (DoEE 2016), which incorporates the Keighery (1994) scale (as shown in **Table 4**).

Table 4: Vegetation condition scale applied during the field assessment

Condition	Definition (Keighery 1994)	Indicator (DoEE 2016)	
		Typical native vegetation composition	Typical weed cover
Pristine	Pristine or nearly so, no obvious signs of disturbance.	Native plant species diversity fully retained or almost so	Zero or close to
Excellent	Vegetation structure intact, disturbance affecting individual species and weeds are non-aggressive species.	High native plant species diversity	Less than 10%
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	Moderate native plant species diversity	5-20%
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.	Low native plant species diversity	5-50%
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.	Very low native plant species diversity	20-70%
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.	Very low to no native species diversity	Greater than 70%

4.2. Mapping, data analysis and amalgamation

4.2.1. Flora species

A species list was compiled from information reported from previous surveys, the Q3 sample and observations made during traverses of the site. Some differences were present between taxa recorded by Emerge Associates (2015), Tauss & Associates (2016) and the Emerge June 2016 survey. A review of herbarium specimens (Emerge Associates 2015) and collection of additional field samples was undertaken in February and June 2016 to verify the identity of these species.

Appendix A provides a list of species recorded in the site during by Emerge Associates (2015), Tauss & Associates (2016) and the current survey and outlines the process undertaken in taxonomic determinations.

Emerge Associates recorded six individuals of *Isopogon drummondii* (P3) within the site in 2015. Subsequently a total of 14 *I. drummondii* (P3) individuals were recorded in February 2016. Tauss & Associates (2016) recorded 12 individuals. Additional searches within areas of suitable habitat were undertaken in June 2016 confirming that 14 individuals are known to be present in the site.

4.2.2. Plant communities

The plant communities previously mapped by Emerge Associates (2015) within the site were re-assessed at a finer scale during the current surveys. The plant communities were mapped on aerial photography (1:15,000) from the survey notes and boundaries were interpreted from aerial photography.

The boundary for the **Mp** community was retained as previously defined (Emerge Associates 2015) This community was not sampled by Emerge Associates or Tauss & Associates in 2016. The description and composition of the **Cc** community in the northern portion of the site was consistent between Emerge Associates (2015) and Tauss & Associates (2016). This community was also not sampled in 2016 but finer scale mapping of the community boundary was completed.

The boundary and species composition of the **BaBm** community (Emerge Associates 2015) was specifically reviewed during the current survey to assist in confirming the extent of TEC/s. The separation of two banksia woodland communities by Tauss & Associates (2016) (*Banksia menziesii* woodland and *Banksia ilicifolia – B. menziesii – B. attenuata* woodland) was adopted by Emerge Associates. The low lying western portion of the **BaBm** community was separated and mapped as a *Banksia ilicifolia – B. menziesii – B. attenuata* woodland community (**Bima**). This community was not identified during the Emerge Associates (2015) survey, but is considered appropriate given previous statistical similarity of vegetation to FCT 21c and the low lying near wetland position of banksia vegetation within the site. However, no additional sampling was undertaken by Emerge Associates in 2016 to separate this community based on floristics.

The **Bima** vegetation was described according to the dominant species present using the structural formation descriptions of the *National Vegetation Inventory System* (NVIS) (ESCAVI 2003).

The boundaries of the **BaBm** and **Bima** communities were mapped at finer scale during the current survey than reported by Tauss & Associates (2016) and included additional isolated patches that had not previously been recorded. This resulted in a slight increase to the area reported for **Bima** compared to Tauss & Associates (2016).

Note that observations landform and vegetation within the site suggest ecotones are present between the **BaBm**, **Bima** and **Mp** communities. Therefore the boundaries between these communities are, in reality, not as well defined as suggested by plant community mapping.

4.2.3.Vegetation condition

The condition of the **Mp** community in the south western corner of the site was similar between Emerge Associates (2015) and Tauss & Associates (2016), being 'excellent' and 'very good' to 'good', respectively. The **Cc** community in the northern portion of the site was recorded as being in 'degraded' condition during both previous surveys. The 'parkland cleared' vegetation was recorded as being in 'completely degraded' condition during both the previous surveys due to dominance by non-native species.

In Emerge Associates (2015) the majority of then **BaBm** vegetation within the site was mapped as degraded, with one area of relatively intact **BaBm** vegetation in the south eastern corner of the site identified as being in 'good' condition. Following the finer scale mapping undertaken across the site in February 2016 and consultation with the DPaW, part of the patch of **BaBm** vegetation in the south

eastern corner of the site was upgraded from 'good' to 'very good' condition. One patch of **BaBm** vegetation in the central eastern portion of the site was also upgraded from 'degraded' to 'good'.

This result was only partly consistent with the vegetation condition reported by Tauss & Associates (2016), who had classified the **BaBm** vegetation in the south east corner as being in 'very good to excellent' condition and mapped three small patches of **BaBm** (referred to as *Banksia menziesii* woodland' in Tauss & Associates (2016)) in 'good' condition in the central eastern portion of the site.

One of the patches identified by Tauss & Associates (2016) aligned with the central eastern patch mapped by Emerge Associates in February 2016. A second patch related to a historic fence line which, while containing a variety of native flora species, was considered too small in area to be separated as a patch. However, the third additional patch, which was located to the north of the central eastern patch identified by Emerge in February 2016, was accepted to be in good condition. When reviewed in June this patch was determined to contain a variety of annual native herb species that were not visible during the February assessment. The patch therefore had some structural modification, a low (but evident) diversity of native species and moderate to high cover of non-native weed species (<50 %), thus meeting criteria for 'good' condition vegetation.

Tauss & Associates (2016) also mapped the **Bima** community (*Banksia ilicifolia – B. menziesii – B. attenuata* in Tauss & Associates (2016)) as being in 'good' condition. Additional inspection of the **Bima** community by Emerge Associates in June 2016 determined that the classification of 'degraded' condition, as per the fine scale condition mapping undertaken by Emerge Associates in February 2016, was appropriate. A 'degraded' classification is also consistent with the subsequently released conservation advice for the banksia woodland TEC (DoEE 2016). Specifically, the **Bima** vegetation does not meet criteria for 'good' condition due to structural modification, very low diversity and cover of native species and high cover of non-native weed species (50-70 %).

4.2.4. Floristic community type assignment

No revaluation was undertaken of FCT for the **Mp** or **Cc** communities and these are considered to be as reported in Emerge Associates (2015).

The FCT of the **BaBm** vegetation in the site was reanalysed using the species data collected during the June 2016 survey of Q3. The **Bima** plant community was not reanalysed due to the 'degraded' condition of this vegetation. The previous FCT assignment for other plant communities was retained as per Emerge Associates (2015).

The data recorded in Q3 was compared to the regional FCT dataset *A Floristic survey of the southern Swan Coastal Plain* by Gibson *et al.* (1994). The sample data (presence/absence) was reconciled with 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). As data from a localised survey is often spatially correlated, the data for Q3 was compared to Gibson *et al*. (1994) separately. This removed the influence of spatial correlation when assigning a FCT. Classification was then undertaken using a group-average hierarchical clustering

technique using the Bray-Curtis distance measure and further refined using a similarity probability measure (significance level of 0.05).

Where the sample tended to cluster with a grouping of different FCTs, individual sample point similarity was assessed separately to assist in differentiation. Ultimately the cluster analysis, as well as contextual information relating to the soils, landforms and known locations of FCTs within the region was considered in the final determination of an FCT for **BaBm** within the site.

As outlined in **Section 5.5**, the statistical analysis undertaken using data collected in June 2016 by Emerge Associates indicated that the **BaBm** vegetation represented FCT 20c consistent with the FCT assignment by Tauss & Associates (2016).

Sampling of the **Bima** plant community was not undertaken by Emerge Associates in 2016 and the assignment of FCT 21c by Tauss & Associates (2016) is accepted. As the name suggests, this FCT occurs in low-lying areas and is often found adjacent to wetlands. The low lying landform of the western side of the site, combined with proximity to **Mp** wetland vegetation, indicates FCT 21c is an appropriate assignment for at least part of the banksia vegetation within the site. The Emerge Associates (2015) statistical analysis indicated the potential presence of FCT 21c.

4.2.5.Threatened ecological communities

The presence of some form of TEC vegetation within the site was confirmed by representatives of DPaW in February 2016. Subsequently, Tauss & Associates (2016) identified the presence of the EPBC Act listed TEC 'shrublands and woodlands of the eastern Swan Coastal Plain' within **BaBm** vegetation within the site (referred to as *Banksia menziesii* woodland in Tauss & Associates (2016)). The presence of this TEC is confirmed by the current survey (refer to **Section 5.6**)

FCT 21c was associated with a PEC (P3) but not a TEC at the time of the Tauss & Associates (2016) survey. Subsequently, the banksia woodlands TEC was listed on the 16th September 2016. FCT 21c is one of a variety of FCTs associated with this TEC. To qualify as the banksia woodland TEC a patch must meet minimum criteria for size and condition (DoEE 2016).

Based on the results of the current assessment the area of **Bima** community within the site is 'degraded' (as outlined in **Section 5.4**) and therefore does not qualify as a patch of the banksia woodland TEC. The equivalent plant community mapped by Tauss & Associates (2016) (*Banksia ilicifolia – B. menziesii – B. attenuata*) classified **Bima** as being in 'good' condition. If this result was accepted the **Bima** vegetation would regardless still not meet minimum size threshold to be considered a patch of the banksia woodland TEC. The patch of **Bima**, including the additional areas mapped by Emerge Associates in 2016, extends over 0.85 ha and to be considered the banksia woodland TEC a patch of 'good' condition vegetation must be larger than 2 ha (DoEE 2016). Therefore, irrespective of whether the **Bima** vegetation within the site is classed as being in 'good' or 'degraded' condition, it would not be considered a patch of the banksia woodland TEC.

4.3. Survey limitations

It is important to note the specific constraints imposed on surveys and the degree to which these may have limited survey outcomes. An evaluation of the survey methodology against standard constraints outlined in the EPA document *Technical Guidance – Flora and Vegetation Surveys for Environmental Impact Assessment* (EPA 2016) is provided in **Table 5**.

Table 5: Evaluation of survey methodology against standard constraints outlined in EPA Technical Guidance – Flora and Vegetation Surveys for Environmental Impact Assessment

Constraint	Degree of limitation	Details
Availability of contextual information	No limitation	The broad scale contextual information described in Emerge Associates (2015) is adequate to place the site and vegetation in context.
	No limitation	Assignment of FCT was completed by comparison to the authoritative Gibson *et al* 1994 dataset. Gibson *et al.* (1994) collected data in the spring main flowering period and in many cases sampled plots multiple times to provide a complete species list. The site has been sampled in multiple seasons including spring and so comparison to the Gibson *et al.* (1994) dataset was deemed appropriate. Additionally, FCTs were not formally assigned to 'degraded' vegetation where insufficient evidence was available to justify an assignment.
Experience level of personnel	No limitation	This flora and vegetation assessment was undertaken by a qualified botanist with nine years of botanical experience in Western Australia. Technical review was undertaken by a senior environmental consultant with 15 years' experience in environmental science in Western Australia. The Tauss & Associates (2016) was completed by respected botanist with considerable experience in eth Swan Coastal Plain.
Suitability of timing / temporal coverage	No limitation	Vegetation surveys have been conducted in the site during spring, summer and winter. Therefore it is likely that plant species that are only visible during spring would have been in flower and/or visible at the time of survey. The survey timing was considered adequate to allow the detection of species for which seasonal timing is critical.
	No limitation	Comprehensive flora and vegetation assessments can require multiple visits, at different times of year, and over a period of a number of years, to enable observation of all species present. The site has been visited multiple times during 2015 and 2016 by Coffey, Emerge Associates and Tauss & Associates. Surveys have been undertaken during spring, summer and winter which provides an insight into vegetation condition during different seasons as well as a near-comprehensive species list. Therefore, according to the EPA guidelines this survey is considered to meet the requirements of a 'detailed' survey.
Spatial coverage / sampling intensity	No limitation	Site coverage was comprehensive (track logged).
	No limitation	A total of 163 species were recorded in the site of which 124 are native. Minimum species richness within site is estimated at between 161 (Jacknife1) and 151 (Chao2) species (refer species accumulation curve and estimates shown in **Section 5.7**). The number of species recorded in the site is greater than both of these statistical estimates and, demonstrates that survey effort was adequate to prepare a comprehensive species inventory for the site.
Influence of disturbance	Minor limitation	Time since fire is greater than 60 years as interpreted form aerial imagery and therefore short lived species more common after fire may not have been visible.
	No limitation	Historical ground disturbance was evident in parts of the site and high cover of non-native weed species is present in much of the site. The disturbance history of the site was considered when undertaking field sampling.
Adequacy of resources	No limitation	All resources required to perform the survey were available.
Access problems	No limitation	All parts of the site could be accessed as required.

5. RESULTS

The following section presents combined results for flora and vegetation assessment of the site, using information obtained from previous surveys, the field survey by Emerge Associates in June 2016 and current updates to conservation listings for native flora and vegetation.

5.1. Flora

A total of 124 native and 39 non-native (weed) species were recorded within the site during the Emerge Associates (2016) survey and previous surveys (Emerge Associates 2015; Tauss & Associates 2016). As the Emerge Associates (2016) and Tauss & Associates (2016) surveys focussed on upland vegetation and did not undertake sampling in wetland vegetation, the species list recorded may underestimate wetland flora species present in the site. Four issues of potential taxonomic differences were present between the Emerge (2015) and Tauss & Associates (2016) surveys. Two of these issues were resolved during the Emerge Associates surveys in 2016. The other two represent records of taxonomically similar species which both have potential to occur in the site.

A complete species list including detailed information regarding taxonomic differences is provided in **Appendix A** and sample data from Q3 in **Appendix B**.

5.2. Threatened and priority flora

No threatened flora species were recorded in the site.

A total of 14 individuals of *Isopogon drummondii* (P3) were recorded in vegetation on the eastern side of the site. No other threatened or priority flora species are considered to occur in the site.

The locations of these individuals are shown on **Figure 2**.

5.3. Plant communities

Five plant communities were identified within the site. Plant community **Mp** is present in the south-western corner of the site. Plant community **Cc** occurs in four small areas in the northern portion of the site. Plant community **BaBm** occurs in multiple patches in the eastern portion of the site. Plant community **Bima** occurs in one patch on the western side of the site and three smaller patches near plant community **Mp**. Plant community **PC** (parkland cleared) occupies the remainder of the site and comprises non-native species with occasional native shrubs and trees and includes non-vegetated tracks.

A description and the area of each plant community is provided in **Table 6** and the location of each plant community is shown on **Figure 2**. A representative photo of each plant community is provided in Plate 1 to Plate 5.

Table 6: Plant communities identified within the site

Plant community	Description	Area (ha)
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*.	1.63
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.	0.22
BaBm	Sparse to open woodland of *Banksia attenuata and Banksia menziesii* 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.	2.52
Bima	Open woodland to woodland of *Banksia ilicifolia, B. menziesii* and *B. attenuata* over scrubland to tall open shrubland of *Adenanthos cygnorum* and *Stirlingia latifolia* over low open shrubland *Acacia huegelii* and *Hemiandra pungens* over open native herbland and grassland of pasture weeds such as **Ehrharta calycina*.	0.85
PC	Sparse native and planted exotic trees over closed forb/grassland of pasture weeds	3.08
Total		8.30

*Plate 1: Plant community **Mp** in 'excellent' condition*

*Plate 2: Plant community **Cc** in 'degraded' condition*

*Plate 3: Plant community **BaBm** in 'very good' condition*

*Plate 4: Plant community **Bima** in 'degraded' condition*

*Plate 5: Plant community **PC** in 'completely degraded' condition*

5.4. Vegetation condition

The most intact vegetation is located in the south-western corner of the site and comprises the **Mp** plant community. This majority of this vegetation is in 'excellent' condition with a small portion near the southern boundary of the site in 'good' condition. This portion of vegetation in 'good' condition is separated by that in 'excellent' condition by a track that is in 'completely degraded' condition. Small areas on the edge of plant community **Mp** are in 'degraded' condition due to lack of native understorey and dominance of non-native pasture grasses.

According to the vegetation condition scale for the banksia woodland TEC (DoEE 2016), the majority of the **BaBm** plant community on the eastern side of the site is in 'degraded' condition, with very low native species diversity and severely altered structure. Two small areas (0.15 ha and 0.06 ha) in the central portion of the community are in 'good' condition, with obvious signs of disturbance but higher native species diversity and more intact structure than surrounding vegetation in 'degraded' condition. A portion of the community in the south-eastern corner is in 'good' and 'very good' condition and contained a relatively intact vegetation structure and higher native species diversity than areas of **BaBm** in lesser condition.

All of the **Bima** vegetation in the site is in 'degraded' condition. The structure of this community shows signs of alteration and the cover of non-native grasses such as **Ehrharta calycina* was high. Native species diversity was also very low.

All areas of **Cc** vegetation are in 'degraded' condition. The remainder of the site is in 'completely degraded' condition due to the high cover of non-native grasses. The condition of the vegetation in the site is detailed in **Table 7** and shown on **Figure 3**.

Table 7: Size of vegetation condition categories within the site

Condition category	Size (ha)
Pristine	0
Excellent	1.40
Very good	0.07
Good	0.53
Degraded	3.22
Completely degraded	3.08
Total	8.30

5.5. Floristic community type assignment

Plant community **Mp** was previously determined to represent FCT 11 (Emerge Associates 2015).

The cluster analysis of data collected by Emerge Associates during June 2016 grouped **BaBm** with nine Gibson *et al. (1994)* sites representing FCT 20c (37 % similarity) and one site representing FCT 21c (34 % similarity). The nine Gibson *et al. (1994)* sites representing FCT 20c were located within the nearby Talbot Road Reserve. The relevant portion of the cluster dendrogram for Q3 is provided in **Appendix 3**.

Statistical analysis of the **Bima** community was not performed as no sampling was undertaken in 2016. The **Bima** vegetation is inferred to have previously represented FCT 21c, as was reported by Tauss & Associates (2016). However, as this vegetation is in 'degraded' condition, it is not deemed to represent any FCT in its current state.

The remaining plant communities in the site were considered too degraded to assign to a FCT.

5.6. Threatened and priority ecological communities

Areas of FCT 20c in 'good' or better condition represent the Commonwealth and State listed TEC 'shrublands and woodlands of the eastern side of the Swan Coastal Plain'. No conservation advice is provided for this TEC and consequently minimum condition and patch size thresholds are not available. However, vegetation is typically only considered to represent a TEC if it is in 'good' or better condition. Therefore, only **BaBm** vegetation in 'good' and 'very good' condition within the site is considered to comprise the 'shrublands and woodlands of the eastern side of the Swan Coastal Plain' TEC. The area of this TEC within the site totals 0.49 ha and is shown on **Figure 4**.

No other TECs or PECs occur within the site.

5.7. Species richness and sampling adequacy

A total of 163 species were recorded from 24 sample locations (11 sampled by Emerge Associates (2015), 12 sampled by Tauss & Associates (2016) and one samples by Emerge Associates in 2016). A species accumulation curve derived from sample data is presented in **Plate 6**. After 24 samples the slope of the curve has flattened but has not reached its asymptote. This indicates that a small proportion of species likely remain undetected by sampling. However, species richness was estimated from Primer-6 at between 161 (Jacknife1) and 151 (Chao2). The survey effort was therefore adequate to prepare a comprehensive and representative species inventory.

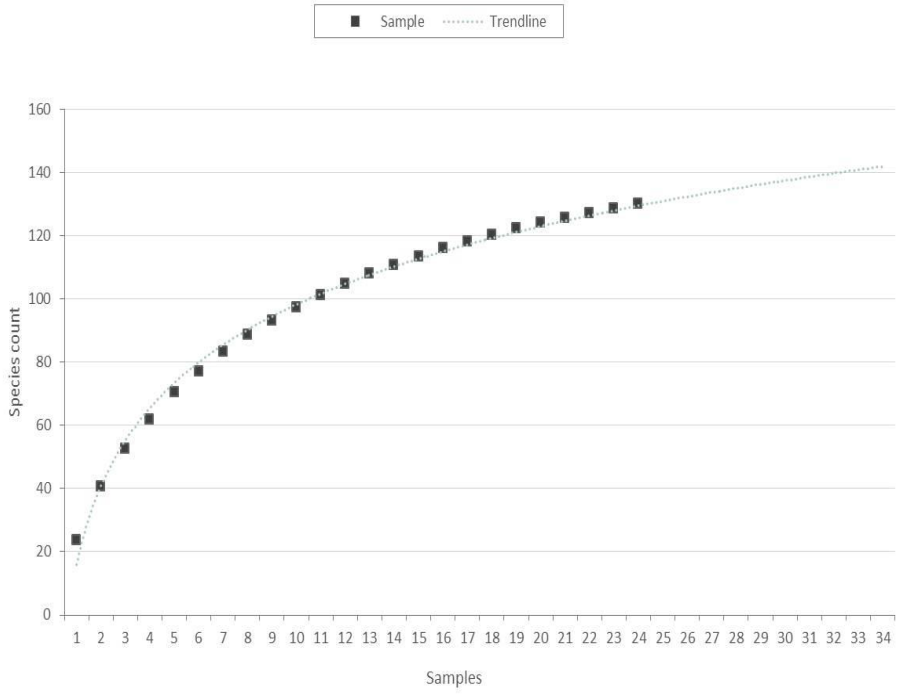


Plate 6: Species accumulation curve derived from sample data (y =35.683ln(x) + 16.016, R^2 = 0.9942)

6. CONCLUSIONS

A total of 14 individuals of *Isopogon drummondii* (P3) were recorded in native vegetation on the eastern side of the site. No other threatened or priority flora species were recorded or are considered likely to occur in the site.

Five plant communities occur in the site. A total of 1.63 ha of plant community **Mp** is present in the south-western portion of the site in association with Bush Forever Site 309. **Mp** comprises wetland vegetation primarily in 'excellent' condition that represents FCT 11. The **Cc** plant community (0.22 ha) in the northern portion of the site comprises native trees over non-native species. This vegetation is in 'degraded' condition and subsequently does not represent a FCT. A large portion (3.08 ha) of the site comprises 'parkland cleared' which is dominated by non-native species and in 'completely degraded condition'.

Much of the banksia woodland vegetation in the site (**BaBm** and **Bima**) is present as a mosaic of native plants interspersed with bare ground and non-native pasture grasses. Plant community **BaBm** is located on the eastern side of the site and comprises 2.52 ha of vegetation in 'degraded' and 'good' condition. Statistical analysis, eastern Swan Coastal Plain location and presence of similar vegetation in nearby Talbot Road Reserve, indicates that this vegetation represents FCT 20c.

The **Bima** community was separated from **BaBm** on the western side of the site. This vegetation is dominated by non-native grasses and comprises 0.85 ha of vegetation in 'degraded' condition. The **Bima** community is likely to have once represented FCT 21c, but does not represent any FCT in its current state. Previous statistical analyses reported in Emerge Associates (2015) and the statistical analysis of Q3, indicated similarity of the adjacent **BaBm** vegetation with FCT 21c. This suggests that, while accepted as representing FCT 20c, the banksia woodland vegetation within the site may also have some affinity to FCT 21c.

The **BaBm** vegetation (FCT 20c) in 'good' and 'very good' condition represents the TEC 'shrublands and woodlands of the eastern side of the Swan Coastal Plain'. This TEC is listed as 'endangered' under the EPBC Act and 'critically endangered' by the WA Minister for the Environment. A total of 0.49 ha of this TEC is present in the site. No other TECs or PECs occur within the site.

Figures

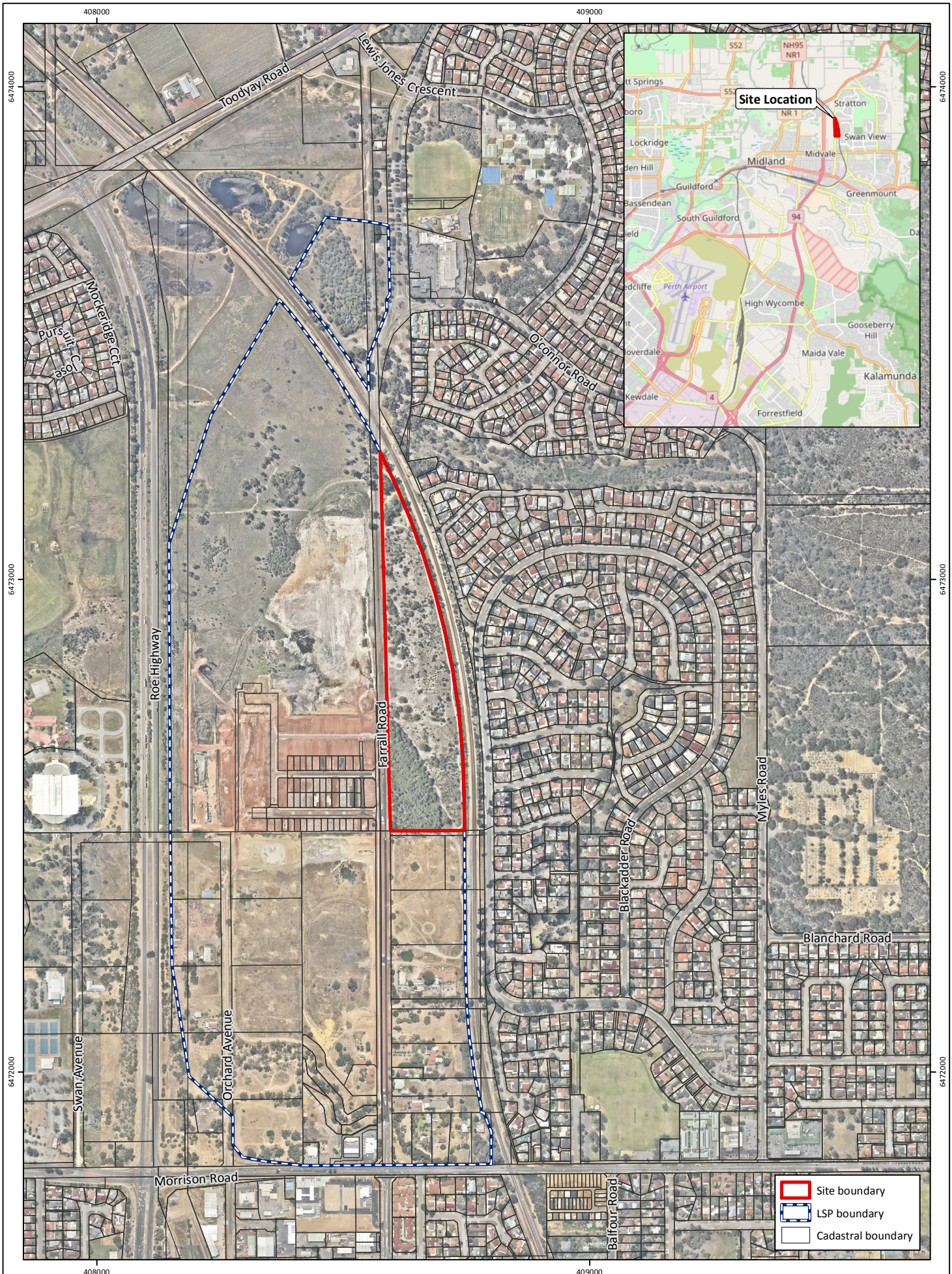


Figure 1: **Site Location**

Project:	EPA Section 38 Referral Lot 102 Farrall Road Midvale
Client:	Peet Stratton Pty Ltd

Plan Number:
EP16-009(14)--F58

Drawn:	KNM
Date:	31/05/2017
Checked:	RAO
Approved:	TAA
Date:	07/06/2017

N

0 100 200
Metres

Scale: 1:10,000@A4

GDA 1994 MGA Zone 50

emerge ASSOCIATES

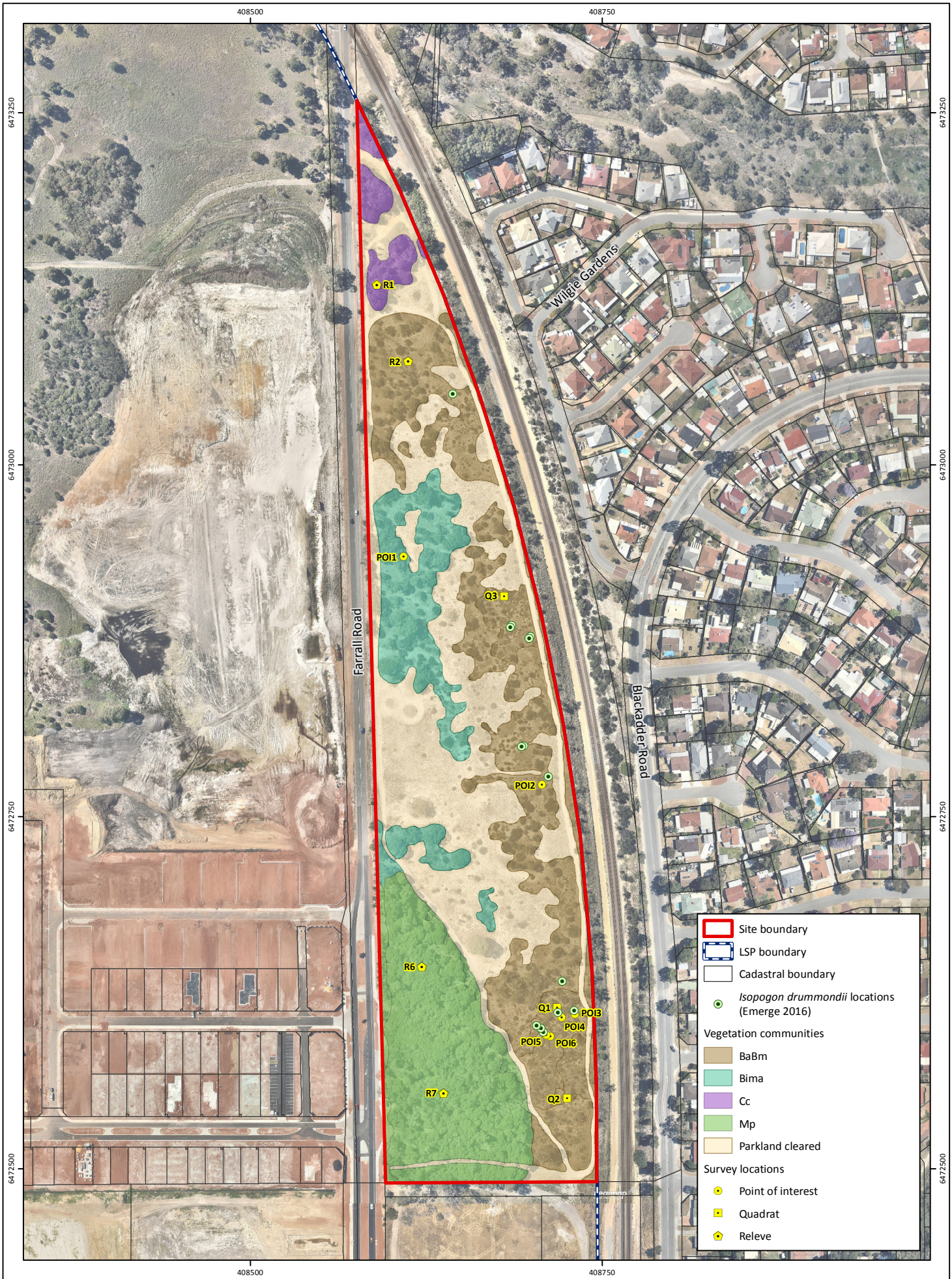


Figure 2: Plant Communities

Project:	EPA Section 38 Referral Lot 102 Farrall Road Midvale
Client:	Peet Stratton Pty Ltd

Plan Number:
EP16-009(14)--F59

Drawn:	KNM
Date:	31/05/2017
Checked:	RAO
Approved:	TAA
Date:	07/06/2017

N

0 50 100
Metres

Scale: 1:3,500@A4

GDA 1994 MGA Zone 50

emerge ASSOCIATES

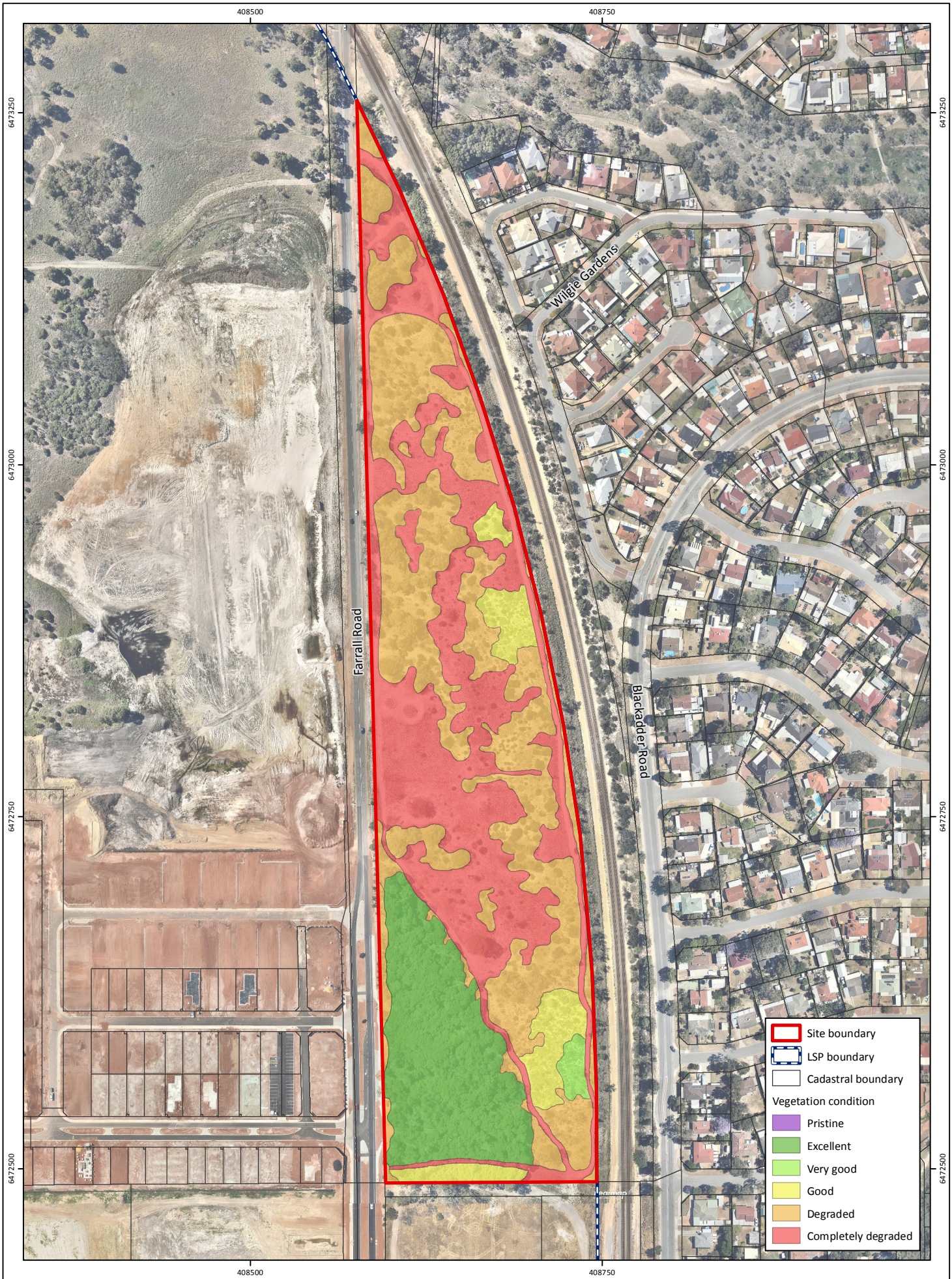


Figure 3: Vegetation Condition

Project: EPA Section 38 Referral
Lot 102 Farrall Road Midvale

Client: Peet Stratton Pty Ltd

Plan Number:
EP16-009(14)--F60

Drawn:	KNM
Date:	31/05/2017
Checked:	RAO
Approved:	TAA
Date:	07/06/2017

N

0 50 100
Metres

Scale: 1:3,500@A4

GDA 1994 MGA Zone 50

emerge ASSOCIATES

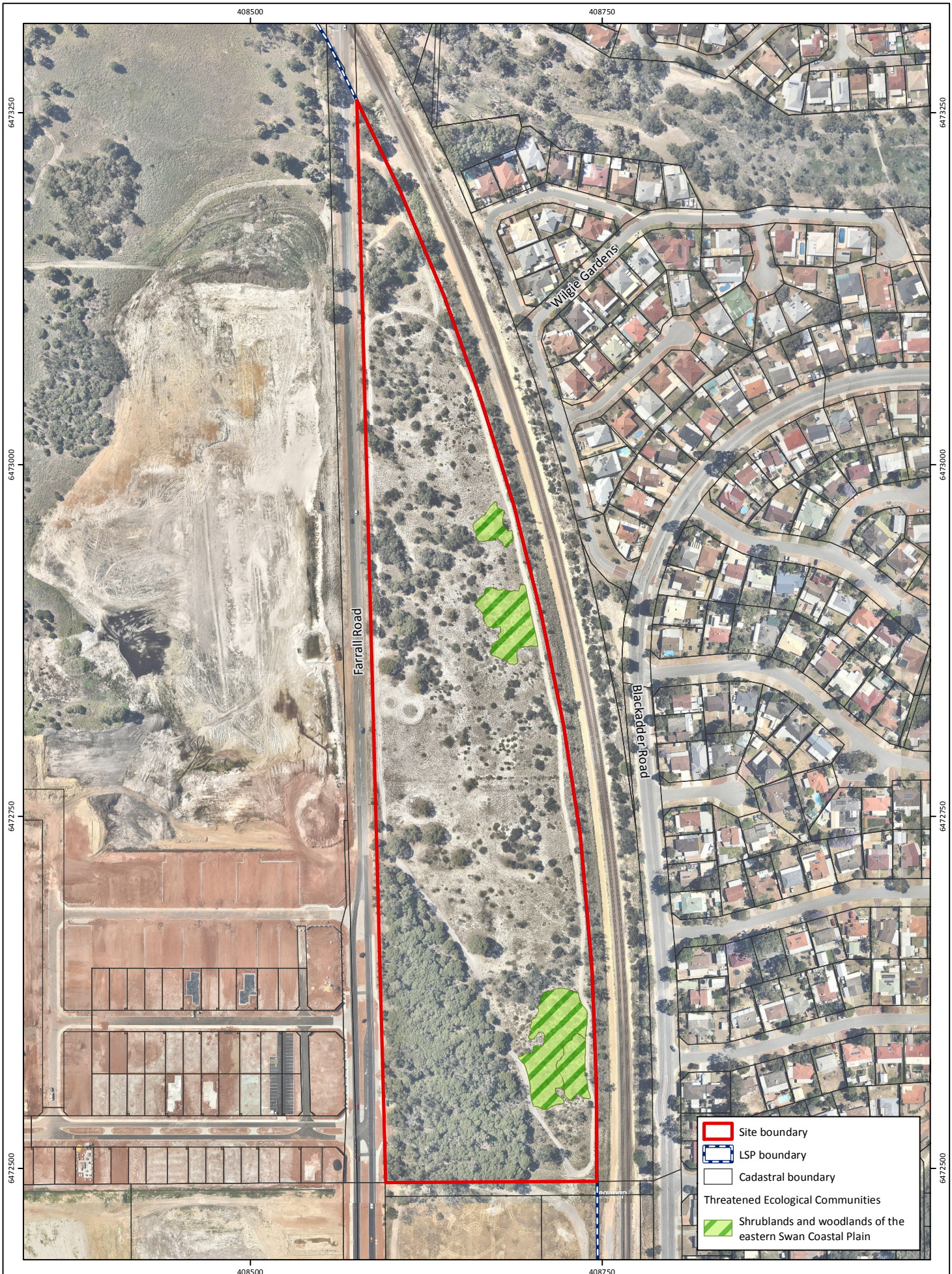


Figure 4: Threatened Ecological Communities

Project: EPA Section 38 Referral
Lot 102 Farrall Road Midvale

Client: Peet Stratton Pty Ltd

Plan Number:
EP16-009(14)--F61

Drawn:	KNM
Date:	31/05/2017
Checked:	RAO
Approved:	TAA
Date:	07/06/2017

N

0 50 100
Metres

Scale: 1:3,500@A4

GDA 1994 MGA Zone 50

emerge ASSOCIATES

Appendix A

Species List

Flora species list: Lot 102 Farrall Road, Midvale. Compilation of (a) Lot 102 results from Emerge Associates (2015), (b) all results from Tauss & Associates (2016) and (c) results from Quadrat 3 and opportunistic records from Emerge Associates (2016)

	Scientific name	Emerge Associates (2015) (Lot 102 only)	Tauss & Associates (2016)	Emerge Associates (2016)
	Acacia applanata		X	X
	Acacia auronitens		X	X
	Acacia huegelii		X	
	Acacia pulchella	X		
	Acacia saligna	X	X	
	Acacia sessilis		X	
	Adenanthos cygnorum subsp. *cygnorum*	X	X	X
*	*Aira caryophyllea*			X
	Allocasuarina fraseriana	X	X	
	Allocasuarina humilis	X	X	X
	Amphipogon turbinatus	X	X	
	Anigozanthos humilis subsp. *humilis*	X	X	
	Anigozanthos manglesii subsp. *manglesii*		X	
	Aotus gracillima	X		
*	*Arctotheca calendula*	X	X	
	Arnocrinum preissii		X	X
*	*Arundo donax*	X	X	
*	*Asparagus asparagoides*	X	X	
	Astartea scoparia	X	X	
	Austrostipa elegantissima	X		
*	*Avena barbata*		X	
	Banksia attenuata	X	X	
	Banksia dallanneyi var. dallanneyi [1]		X	
	Banksia ilicifolia	X	X	
	Banksia menziesii	X	X	
	Banksia nivea subsp. *nivea* [1]	X		X
	Billardiera fraseri	X	X	
	Boronia ramosa subsp. *anethifolia*		X	
	Bossiaea eriocarpa	X	X	X
*	*Briza maxima*	X	X	X
*	*Briza minor*	X		
*	*Bromus diandrus*	X	X	
	Burchardia congesta	X	X	X
	Caesia ?micrantha (sterile)		X	
	Caesia micrantha	X		
	Caladenia flava subsp. *flava*		X	X
	Calandrinia corrigioloides		X	
	Calectasia narragara	X	X	
	Calytrix angulata		X	X
	Calytrix flavescens	X		X
*	*Chamaecytisus palmensis*	X	X	
	Chamaescilla corymbosa var. *corymbosa*		X	
	Chordifex sinuosus	X	X	
	Conospermum stoechadis subsp. *stoechadis*	X	X	
	Conostephium pendulum	X	X	X
	Conostylis aculeata	X	X	
	Conostylis aurea		X	X
	Corymbia calophylla	X	X	
	Corynotheca micrantha var. *micrantha*	X	X	
	Crassula colorata		X	
	Crassula glomerata	X		
	Cyathochaeta ?equitans (sterile)		X	

	Scientific name	Emerge Associates (2015) (Lot 102 only)	Tauss & Associates (2016)	Emerge Associates (2016)
	Cyperaceae sp.	X		
	Dampiera linearis	X	X	
	Dasypogon bromeliifolius	X	X	
	Dasypogon obliquifolius		X	X
	Daviesia triflora	X	X	X
	Desmocladus fasciculatus		X	X
	Dielsia stenostachya	X	X	
*	*Disa bracteata*		X	
*	*Dischisma capitatum*		X	
	Drosera erythrorhiza subsp. *erythrorhiza*	X		
	Drosera macrantha subsp. *macrantha*		X	
	Drosera menziesii subsp. *penicillaris*	X	X	X
	Drosera pallida		X	
	Drosera zonaria		X	X
*	*Ehrharta calycina*	X	X	X
*	*Ehrharta longiflora*		X	
*	*Eragrostis curvula*	X	X	X
	Eremaea pauciflora var. *pauciflora*	X	X	X
*	*Erodium botrys*	X		
	Erodium cygnorum			X
*	*Erodium sp.*		X	
	Eucalyptus marginata subsp. marginata	X	X	
	Eucalyptus rudis subsp. rudis		X	
	Eucalyptus todtiana	X	X	
	?Eutaxia virgata (sterile)		X	
*	*Fumaria capreolata*	X		
*	*Fumaria sp. (sterile)*		X	
	Gastrolobium ?bracteolatum	X		
	Gladiolus caryophyllaceus	X	X	X
	Gompholobium tomentosum	X	X	X
	Haemodorum laxum		X	X
	Haemodorum spicatum	X	X	X
	Hakea varia	X		
	Hemiandra pungens	X	X	X
*	*Hesperantha falcata*	X		
	Hibbertia huegelii		X	
	Hibbertia hypericoides	X	X	X
	Hibbertia racemosa	X		
	Hovea trisperma var. *trisperma*		X	
	Hypocalymma angustifolium subsp. Swan Coastal	X	X	
*	*Hypochaeris glabra*	X	X	X
	Hypolaena exsulca		X	X
	Isopogon drummondii	X	X	X
	Isotropis cuneifolia subsp. *cuneifolia*		X	
	Jacksonia floribunda	X	X	X
	Jacksonia furcellata	X	X	
	Jacksonia lehmannii [2]	X		X
	Jacksonia restioides [2]		X	
	Jacksonia sternbergiana	X	X	
	Kennedia prostrata		X	
	Leporella fimbriata		X	
	Leptospermum erubescens		X	
	Leptospermum laevigatum	X	X	
	Leucopogon conostephioides		X	
	Levenhookia stipitata	X		

	Scientific name	Emerge Associates (2015) (Lot 102 only)	Tauss & Associates (2016)	Emerge Associates (2016)
	Lomandra caespitosa		X	
	Lomandra hermaphrodita		X	X
	Lomandra preissii		X	X
	Lomandra spartea		X	
*	*Lupinus angustifolius*	X		
	Lyginia barbata	X	X	X
	Lyginia imberbis	X	X	
	Macrozamia fraseri [3]	X	X	
	Marianthus sp.	X		
	Melaleuca preissiana	X	X	
	Melaleuca rhaphiophylla	X	X	
	Melaleuca seriata [4]	X	X	
	Melaleuca trichophylla		X	X
*	*Melinis repens*	X	X	X
	Mesomelaena pseudostygia	X	X	X
	Microlaena stipoides		X	
	Microtis media	X		
*	*Monoculus monstrosus*		X	X
	Nuytsia floribunda	X	X	
*	*Oxalis pes-caprae*		X	
*	*Oxalis purpurea*		X	
	Patersonia occidentalis	X	X	X
	Pelargonium capitatum	X	X	
	Petrophile linearis	X	X	X
	Philotheca spicata	X	X	
	Phlebocarya ciliata	X	X	
	Phlebocarya filifolia		X	
	Podotheca gnaphalioides	X	X	X
	Pronaya fraseri		X	
	Pterostylis sanguinea	X		X
	Pyrorchis nigricans	X	X	X
*	*Ricinus communis*	X		
*	*Romulea rosea*		X	X
	Scaevola repens var. *repens*		X	
*	*Schinus terebinthifolius*		X	
	Schoenus caespititius		X	
	Scholtzia involucrata	X	X	
	Sonchus oleraceus		X	
	?Sparaxis bulbifera (sterile)		X	
	Stirlingia latifolia	X	X	
	Thelymitra crinita		X	
	Thysanotus manglesianus	X		
	Thysanotus manglesianus/patersonii		X	X
	Thysanotus sparteus		X	
	Trachymene pilosa	X	X	
	Trifolium arvense	X		
	Trifolium campestre	X		
	Trifolium hirtum	X		
	Ursinia anthemoides	X	X	X
	Verticordia densiflora var. *?densiflora* (sterile)		X	
	Viminaria juncea		X	
*	*Wahlenbergia capensis*	X		X
	Watsonia meriana var. *bulbillifera*	X		
	Watsonia sp.		X	
	Xanthorrhoea brunonis		X	

Scientific name	Emerge Associates (2015) (Lot 102 only)	Tauss & Associates (2016)	Emerge Associates (2016)
Xanthorrhoea preissii	X	X	

Note: * denotes introduced weed species

[1] Emerge (2015) recorded *B. nivea* subsp. *nivea* and Tauss & Associates (2016) recorded *B. dallanneyi* var. *dallanneyi.* Additional comparison of the *B. nivea* subsp. *nivea* specimen (Emerge 2015) with specimens from the West Australian Herbarium and identification keys indicated that the specimen was *B. nivea* subsp. *nivea.* However, taxonomic keys and WA herbarium specimens do not provide clear definition between the species. Examination of plants in the site during the Emerge (2016) surveys did not find presence of a lignotuber (a diagnostic characteristic of B. *dallanneyi* var. *dallanneyi*). Therefore, the Emerge specimen of *B. nivea* subsp. *nivea* is deemed to be correct but B*. dallanneyi* var. *dallanneyi* may also be present in the site. Both species are combined in analysis using the Gibson *et al.* (1994) dataset.

[2] Emerge (2015) recorded *J. lehmannii* and Tauss & Associates (2016) recorded *J. restioides* . Additional comparison of the Emerge (2015) and Emerge (2016) specimens with taxonomic keys confirmed *J. lehmannii. J. restioides* may also be present in the site.

[3] Emerge (2015) recorded *M. riedlei* and Tauss & Associates (2016) recorded *M. fraseri* . Additional examination of plants in the site during the Emerge (2016) survey classified them as *M. fraseri* . Both species are combined in analysis using the Gibson *et al.* (1994) dataset.

[4] Emerge (2015) recorded *Melaleuca scabra* and Tauss & Associates (2016) recorded *M. seriata* . Additional examination of Emerge specimens classified them as *M. seriata.*

Appendix B

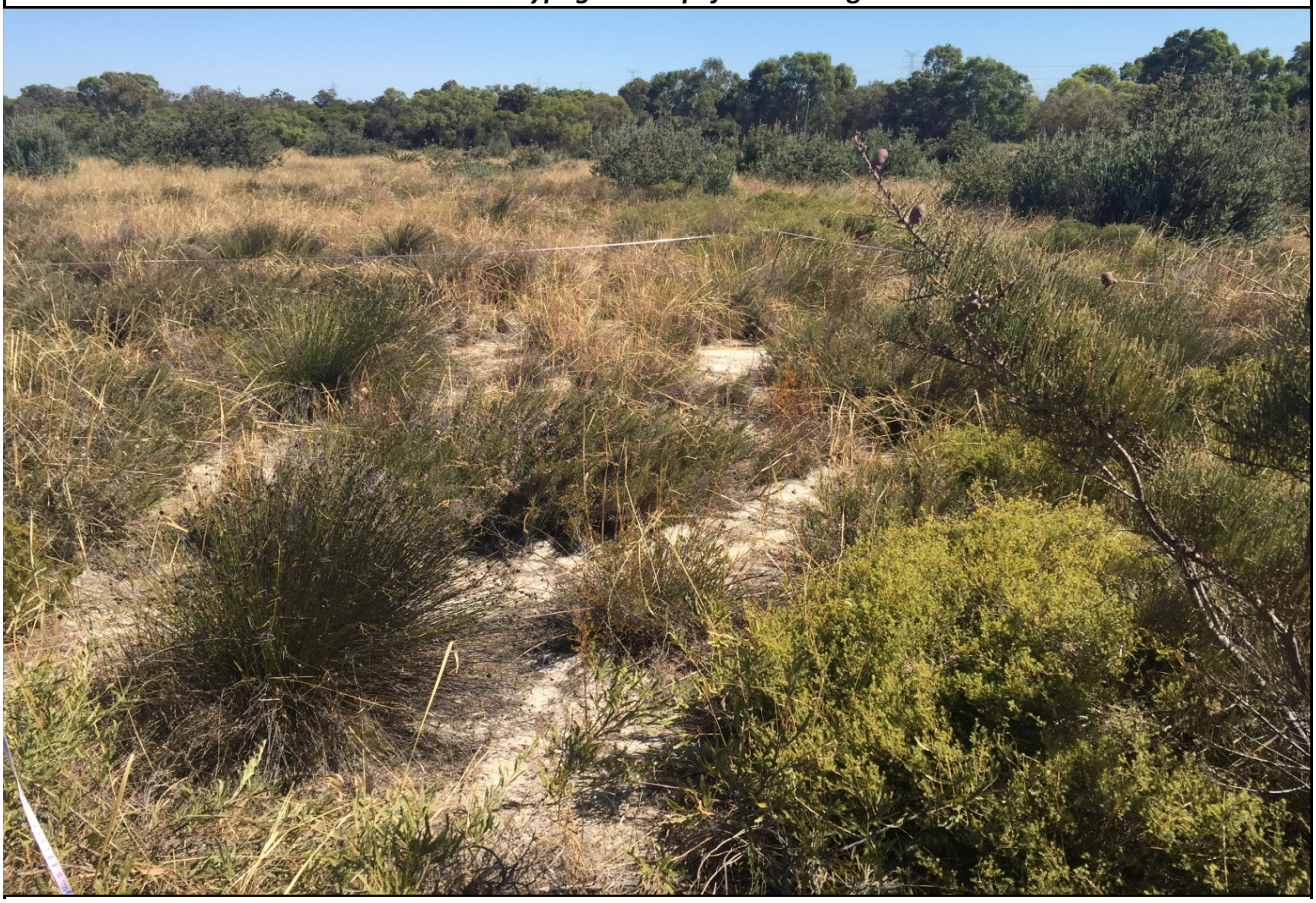
Quadrat Data

Site Details				
Locality	Stratton/Midvale	Photo No.	4003	
Date	9/06/2016	Juno sample Reference	-	
Author	SKP	Geographic datum and zone	GDA94	50
Sampling unit	Quadrat	Easting	408725.17	
Sample number	3	Northing	6472549.9	

Geographic and Habitat Data			
Aspect	-	Hydrology	Intact wetland to SW (BF)
Slope	-	Adjacent Vegetation	D Banksia woodland to N
Topographic position	F	Vegetation Condition	G-D
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

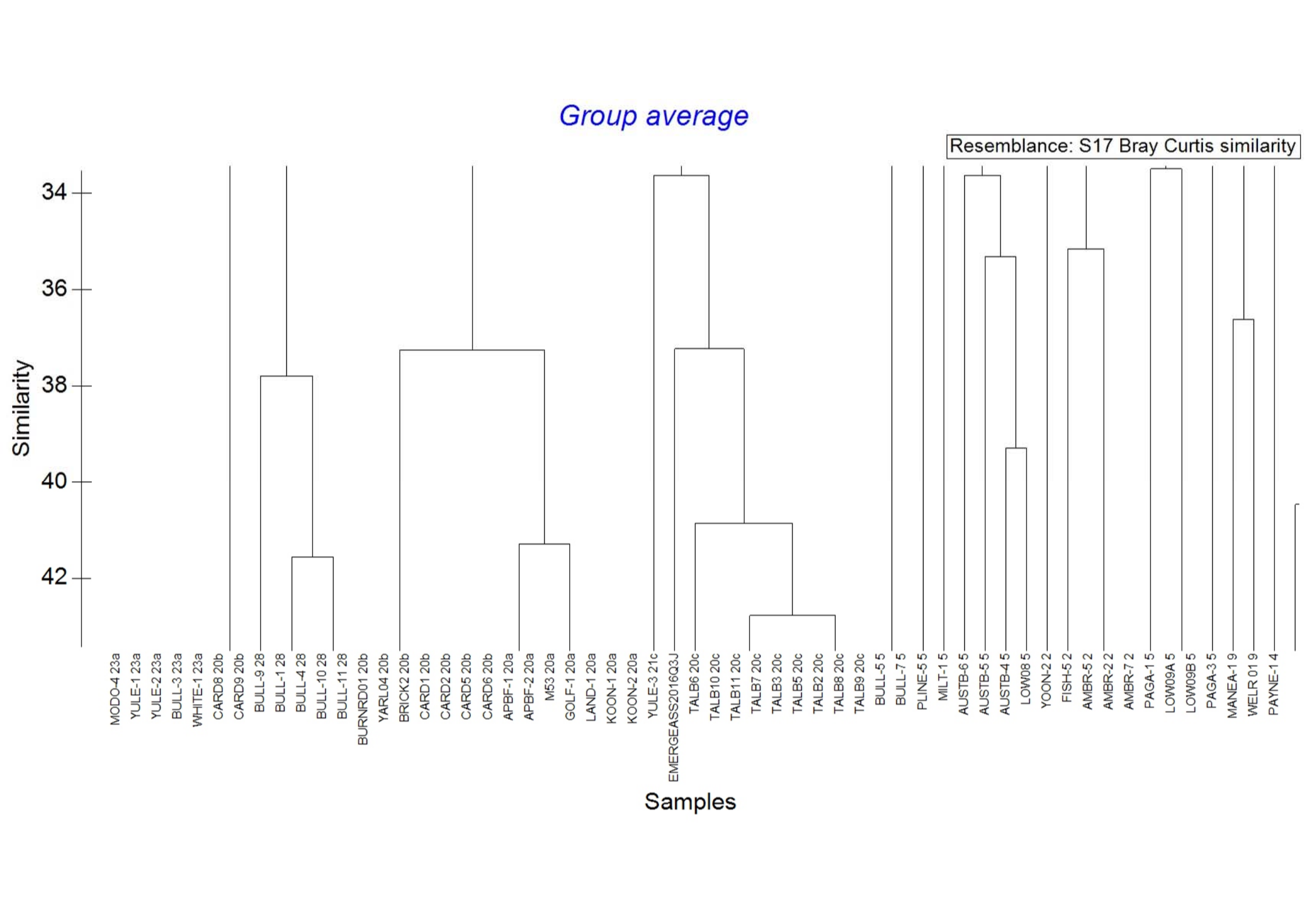
Sparse shrubland of *Adenanthos cygnorum* and *Allocasuarina humilis* over low shrubland *Eremaea pauciflora* , *Gompholobium tomentosum* , *Jacksonia floribunda* and *Daviesia triflora* over forb/sedgeland of *Mesomelaena pseudostygia* , *Podotheca gnaphalioides* , *Conostylis aculeata*, **Ursinia anthemoides* and *Dasypogon obliquifolius* and grassland weeds.



Q3 species data			
Coll. No.		**Species**	**% Cover**
	*	*Ehrharta calycina*	10
		Eremaea pauciflora	7
		Dasypogon obliquifolius	7
	*	*Aira caryophyllea*	5
		Gompholobium tomentosum	4
	*	*Hypochaeris glabra*	4
		Erodium cygnorum	4
		Adenanthos cygnorum subsp. *cygnorum*	3
1		*Daviesia triflora*	3
		Mesomelaena pseudostygia	3
		Jacksonia lehmannii	3
		Drosera menziesii subsp. *penicillaris*	3
		Hibbertia hypericoides	3
		Allocasuarina humilis	2
		Haemodorum spicatum	2
		Bossiaea eriocarpa	2
		Conostephium pendulum	2
		Jacksonia floribunda	2
		Podotheca gnaphalioides	2
2		*Melaleuca trichophylla*	2
		Drosera zonaria	2
	*	*Monoculus monstrosus*	2
		Haemodorum laxum	1
3	*	*Wahlenbergia capensis*	1
	*	*Eragrostis curvula*	1
		Gladiolus caryophyllaceus	1
	*	*Romulea rosea*	1
	*	*Ursinia anthemoides*	1
		Lomandra preissii	1
		Pyrorchis nigricans	1
		Burchardia congesta	0.5
4		*Acacia applanata*	0.5
5		*Acacia auronitens*	0.5
		Patersonia occidentalis	0.5
		Desmocladus fasciculatus	0.5
		Hemiandra pungens	0.5
		Banksia nivea subsp. *nivea*	0.5
6		*Conostylis aurea*	0.5
7		*Calytrix angulata*	0.5
		Thysanotus manglesianus/patersonii	0.5
		Petrophile linearis	opp
		Isopogon drummondii	opp
		Melinis repens	opp
		Lomandra hermaphrodita	opp
		Hypolaena exsulca	opp
	*	*Briza maxima*	opp
8		*Arnocrinum preissii*	opp
		Lyginia barbata	opp

Appendix C

Cluster Dendrogram


Group average
Resemblance: S17 Bray Curtis similarity
Similarity
34
36
38
40
42
MODO-4 23a
YULE-1 23a
YULE-2 23a
BULL-3 23a
WHITE-1 23a
CARD8 20b
CARD9 20b
BULL-9 28
BULL-1 28
BULL-4 28
BULL-10 28
BULL-11 28
BURNRD01 20b
YARL04 20b
BRICK2 20b
CARD1 20b
CARD2 20b
CARD5 20b
CARD6 20b
APBF-1 20a
APBF-2 20a
M53 20a
GOLF-1 20a
LAND-1 20a
KOON-1 20a
KOON-2 20a
YULE-3 21c
EMERGEASS2016Q3J
TALB6 20c
TALB10 20c
TALB11 20c
TALB7 20c
TALB3 20c
TALB5 20c
TALB2 20c
TALB8 20c
TALB9 20c
BULL-5 5
BULL-7 5
PLINE-5 5
MILT-1 5
AUSTB-6 5
AUSTB-5 5
AUSTB-4 5
LOW08 5
YOON-2 2
FISH-5 2
AMBR-5 2
AMBR-2 2
AMBR-7 2
PAGA-1 5
LOW09A 5
LOW09B 5
PAGA-3 5
MANEA-1 9
WELR 01 9
PAYNE-1 4
Samples