APPENDIX 3

Level 2 Flora and Vegetation Survey

A

LEVEL 2

FLORA AND VEGETATION

SURVEY OF

PROPOSED SAND MINING AREA

AT

LOT 467, WARTON RD:

Prepared for

RPS

by

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May 2011

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EXECUTIVE SUMMARY

Rocla Quarry Products is proposing to extract sand from parts of mining leases M70/1088 and M70/1142, which are located on Lot 467 Jandakot Rd, Banjup. The survey area covered the proposed excavation area and was about 11.3 hectares.

A Level 2 survey was conducted in accordance with the Environmental Protection Authority's Guidance statement *No 51* .

The Rocla Warton Rd survey area lies near the western edge of the Southern River unit of the Bassendean Dune landform system. The survey area was therefore located near the western boundary of the Southern River vegetation complex. In addition, the survey area bushland

- is part of a north-south linkage between Gibbs Rd and the Jandakot Airport/Canningvale bushlands;
- has a Resource Enhancement wetland abutted the western survey area boundary and a Conservation category wetland abutted the eastern survey area boundary; and
- is part of BushForever site 390 'Fraser Rd Bushland, Banjup', which is contiguous with a number of other BushForever sites.

One hundred and fifty five (155) native plants were recorded in the Rocla Warton Rd survey area. Thirty eight (38) non-native species were also recorded. The number of native species recorded was probably a moderate number for the area (eleven hectares). The species richness of quadrats was greatest in the Banksia woodland and low in the dampland sites.

No Declared Rare Flora or Priority flora species were recorded in the Rocla Warton Rd survey area. Two plant species recorded in the survey area, *Hensmania turbinata* and *Pultenaea ochreata*, were considered to have regional significance.

Six vegetation units were described in the remnant bushland in the Rocla Warton Rd survey area. *Banksia attenuata-Banksia menziesii* low woodlands covered the dune crest and slopes that occupied most of the survey area. *Eucalyptus todtiana* occurred in scattered patches across the dune, but occurred more consistently on the lower slopes with the Banksia woodland. Transitional dryland vegetation in the form of mixed woodlands with scattered *Melaleuca preissiana* trees occurred on the gentle slopes along

the base of the dune on the western edges and parts of the eastern edges of the survey area. Small areas of wetland vegetation that included *Melaleuca preissiana* low closed forest and *Pericalymma ellipticum* heaths and *Schoenus subfascicularis* sedgelands (seasonal damplands) occurred in the south-western, north-western and south-eastern corners of the survey area.

The vegetation in the survey area was mostly rated Very Good to Excellent, with the vegetation condition rated Excellent at a number of sample locations on the dunes and flats. The condition of the wetland vegetation was Very Good to Excellent. Completely Degraded areas in the northern and southern parts of the survey area were former sand mines. Weed cover was generally low throughout the remnant bushland and were only abundant in the Completely Degraded areas.

Banksia spp. deaths, including recent deaths, were noted on some parts of the dune slopes in the survey area. The deaths and decline of *Banksia* trees at this site probably indicate the presence of the Dieback fungus *Phytophthera cinnamomi*. However, other agents such as fire and drought (including falling water tables), as well as other pathogens, may also be responsible for Banksia tree deaths. A dieback survey by accredited 'dieback interpreters' would be required to confirm if Dieback is present and if so, over what area.

Lomandra maritima was not recorded in the Rocla Warton Rd survey area. However, *Lomandra hermaphrodita* plants were recorded at all three of the quadrats located on the dune slopes and are probably scattered on the dune slopes. *Lomandra hermaphrodita* and *L. maritima* are two known food plants of the Graceful Sun Moth (*Synemon gratiosa).*

Mr Ted Griffin concluded that the Rocal Warton Rd dataset was probably sufficiently compatible with the Swan Coastal Plain dataset to obtain reliable PATN floristic determinations. The dune Banksia woodland vegetation sites were all most similar to Floristic Community Type (FCT) 23a. The *Schoenus subfascicularis* sedgeland vegetation was consistently similar to FCT5 dampland sites. The *Adenanthos cygnorum-Hypocalymma angustifolium* shrubland site had mixed affinities, but had strong affinity to dampland FCT4 vegetation. The *Melaleuca preissiana* low open forest vegetation had some affinity with dampland vegetation FCT5. Both the *Melaleuca preissiana* low open forest and *Adenanthos cygnorum-Hypocalymma angustifolium* shrubland vegetation were deemed to be wetland vegetation because of the floristic affinities and because of the presence and cover of obligate wetland species.

No Threatened Ecological Communities or Priority Ecological Communities were found to be present in the vegetation units in the survey area, although vegetation unit 'AcHa' had some affinity with FCT22, a Priority Ecological Community (Priority 2). FCT's were inferred for two described vegetation units.

Using the criteria for determination of regional significance of natural areas set out in the EPA Guidance Statement No. 10, the Rocla Warton Rd survey area was assessed as regionally significant for flora and vegetation on the following grounds:

- Representation of ecological communities (less than 10% of Southern River Complex is protected); and
- Maintaining linkages (part of a 'regionally significant but not contiguous linkage of bushland/wetland area').

1.0 INTRODUCTION

1.1 Background

Rocla Quarry Products is proposing to extract sand from parts of mining leases M70/1088 and M70/1142, which are located in Lot 467 Jandakot Rd, Banjup.

RPS Environmental recommended that a Level 2 flora and vegetation survey of the area, including a targeted search for Declared Rare Flora (DRF), should be undertaken to meet part of the approvals requirements.

1.2 Purpose of the study

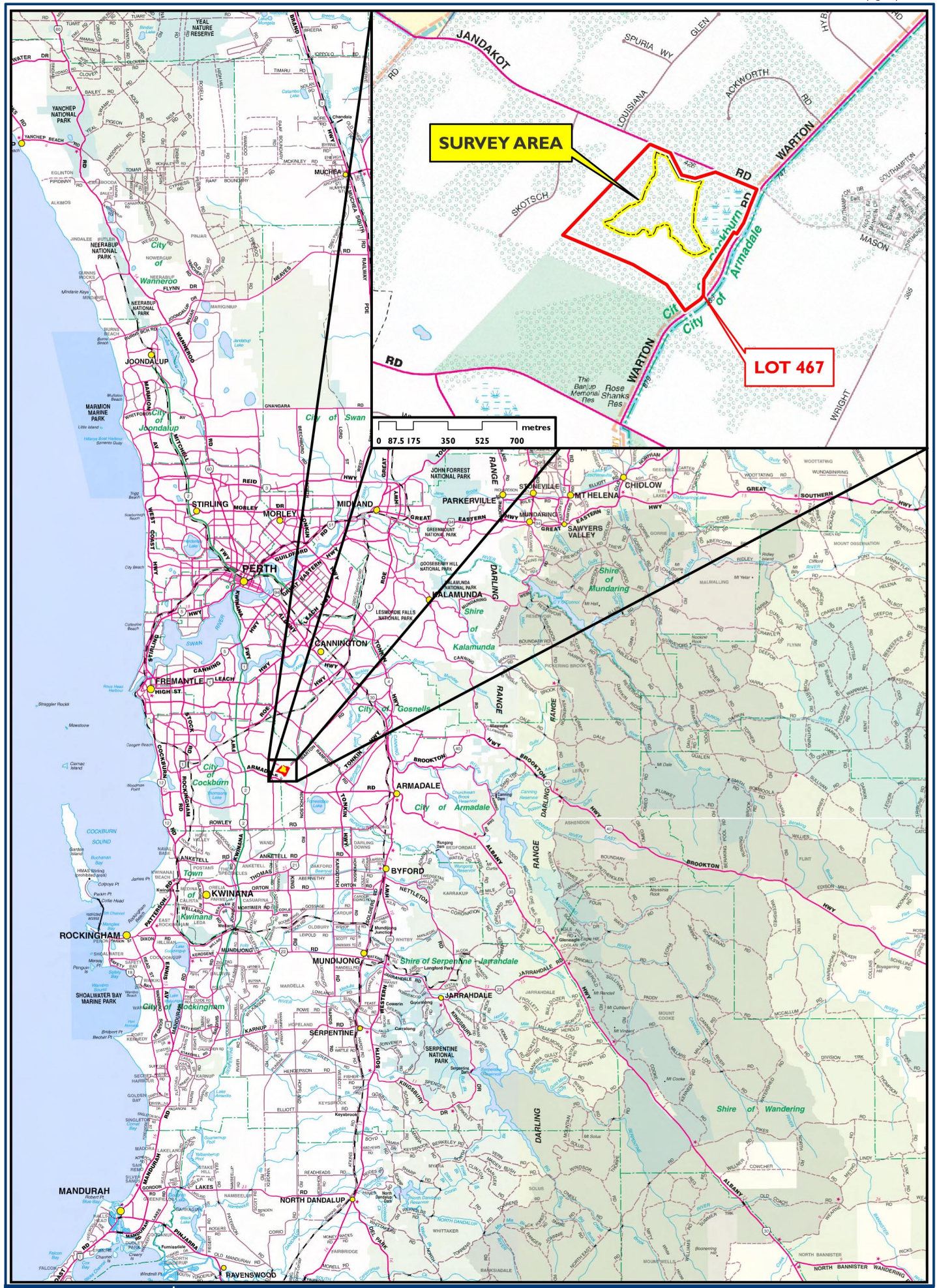
The purpose of the Level 2 flora and vegetation survey of Lot 467 Jandakot Rd was to:

- list the flora in the survey area, including any Significant flora;
- map the vegetation and the vegetation condition in the survey area, including a delineation of wetland vegetation boundaries;
- Record quadrats and analyse the quadrat data to determine the vegetation values in the survey area;
- conduct a targeted search for *Caladenia huegelii* and other DRF in the survey area;
- report on the survey results.

The Level 2 survey was conducted in accordance with the Environmental Protection Authority's (2004) *Guidance for the assessment of Environmental Factors – Terrestial Flora and Vegetation Surveys for Environmental Impact Assessment in Western Australia (No 51)*.

1.3 The survey area

The survey area covered the proposed excavation area in the Mining Lease areas M70/1088 and M70/1142 in Lot 467 Jandakot Rd, Banjup (here after referred to as 'Rocla Warton Rd' survey area; see Figure 1). The survey area mostly excluded the adjacent Conservation and Resource Enhancement Geomorphic wetland areas. The size of the survey area was approximately 11.3 hectares.



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Date: 20.05.11
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Version: A
Drafted by: SC
Source: Landgate, 2008

Figure 1

Site Location

2.0 SITE DESCRIPTION AND BACKGROUND INFORMATION

2.1 Physical Environment

2.1.1 Climate

The Swan Coastal Plain, which includes the survey area, has a Mediterranean type climate with hot, dry summers and mild, wet winters.

2.1.2 Geomorphology of the survey area

The Swan Coastal Plain consists of a series of geomorphological elements which are sub-parallel to the present coastline (McArthur and Bettenay, 1960; Churchward and McArthur, 1980). Each of these geomorphic elements has distinctive geology, vegetation, topography and soils.

The Rocla Warton Rd survey area lies near the western edge of the Southern River unit (McArthur and Bettenay, 1960). The Southern River unit and the Bassendean unit are two of the three units within the Bassendean Dune system, the oldest and furthest inland of the three main aeolian dune systems on the Swan Coastal Plain. The three units of the Bassendean Dune system differ mainly in the nature of associated swamps, with the Bassendean unit having peaty podzols in the swamps and the Southern River unit having swamps which often have a clay base as a result of sand blowing over alluvial soils (Churchward and McArthur, 1980).

2.2 Flora and vegetation background

2.2.1 Vegetation

2.2.1.1 Regional vegetation

Beard (1980) defined boundaries for botanical provinces, districts and subdistricts for Western Australia on the basis of his vegetation mapping of the State. In this framework, the survey area lies in the Drummond Botanical Subdistrict (more or less equivalent to the Swan Coastal Plain and part of the Dandaragan Plateau) of the Darling Botanical District of the South Western Botanical Province of Western Australia.

Heddle *et al* (1980) mapped the vegetation of part of the Drummond Botanical Subdistrict at a very broad scale, describing a series of vegetation complexes. These are related groups of vegetation associations found on particular landform-soil units (geomorphic elements, see above). They mapped a total of 38 vegetation complexes on the Swan Coastal Plain. The Rocla Warton Rd survey area is located near the western boundary of the Southern River Complex (Figure 2). The Southern River Complex was described as consisting of ‘an open woodland of Marri-Jarrah-Banksia

on the elevated areas and a fringing woodland of *E. rudis-M. rhaphiophylla* along the streams' (Heddle *et al*., 1980). The vegetation of the 'Bassendean Complex-Central and South', the adjacent Complex to the west, was described as ranging from 'woodland of Jarrah-Sheoak-Banksia on the sand dunes to a low woodland of *Melaleuca* spp. and sedgelands on the low-lying depressions and swamps' (Heddle *et al*., 1980). It was also noted that 'it includes the transition area of Jarrah and Pricklybark (*Eucalyptus todtiana*) in the vicinity of Perth'.

More recently, an alternative analysis of the plant assemblages on the Swan Coastal Plain south of Gingin Brook was carried out using a floristic approach (Gibson *et al*., 1994) and was extended in 2000. This work identified 66 floristic community types in four floristic 'Super Groups' for the southern Swan Coastal Plain. These units are defined at a similar level of synthesis to that of Heddle *et al*. (Trudgen, 1999). The four 'super groups' of sites correlate closely with the major geomorphological elements on the Swan Coastal Plain (and also to rainfall), with the exception of one group which contained the seasonal wetlands, which includes sites across all geomorphological groups (Gibson *et al*., 1994). Floristic community types have not been mapped across the Swan Coastal Plain.

2.2.1.2 Rare vegetation: Threatened Ecological Communities (TEC's) and Priority Ecological Communities (PEC's)

The Department of Conservation and Land Management has developed a procedure for identifying 'Threatened Ecological Communities' (Department of Environmental Protection 2000b; English and Blythe 1997). Threatened Ecological Communities (TEC's) are assigned to one of four categories: 'Presumed Totally Destroyed'; 'Critically Endangered'; 'Endangered' or 'Vulnerable' (Department of Environmental Protection, 2000b).

On the Swan Coastal Plain, twenty five potential Threatened Ecological Communities, delineated by a number of floristic and other studies, have been assessed for threatened ecological community status. Of these, twenty four have been confirmed as 'threatened' (Department of Environmental Protection 2000b). Currently eighteen Floristic Community Types on the Swan Coastal Plain, as identified by Gibson *et al*. (1994), are recognized as Threatened Ecological Communities (Department of Environment and Conservation website, May 2011 (unpublished)).

Priority Ecological Communities (PECs) include 'possible threatened ecological communities that do not meet survey criteria or are not adequately defined' (DEC,

unpublished). These are added to the DEC's PEC's list under Priorities 1, 2 and 3. Priority 4 status is given to "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. Conservation Dependent ecological communities are placed in Priority 5 (DEC, unpublished). The list of PECs (Department of Environment and Conservation website, May 2011 (unpublished)) includes some that are Floristic Community Types (FCT's) as identified by Gibson *et al*. (1994).

A search of the Department of Environment and Conservation's TEC and PEC database found that there were a number of TEC's and PEC's recorded within a 5 kilometre radius of the survey area (Figure 3):

- TEC SCP08 (Vulnerable): 'Herb rich shrublands in clay pans';
- TEC SCP10a (Endangered): 'Shrublands on dry clay flats';
- PEC SCP22 (Priority 2): '*Banksia ilicifolia* woodlands, southern Swan Coastal Plain (type 22)';
- PEC SCP21c (Priority 3): 'Low lying *Banksia attenuata* woodlands or shrublands (type 21c)'.

2.2.1.3 BushForever Sites

The Rocla Warton Rd survey area is part of BushForever site 390 'Fraser Rd Bushland, Banjup' (Department of Environmental Protection 2000a; Figure 4). It is contiguous with BushForever sites:

- BF site 388: Jandakot Airport, Jandakot;
- BF site 389: Acourt Rd Bushland, Banjup;
- BF site 472: Canning Vale Prison Bushland;
- BF site 253: Harrisdale swamp and Adjacent Bushland, Forrestdale/Wungong;

2.2.1.4 Vegetation linkages

Large consolidated areas are considered the best options for viable conservation of natural ecosystems and populations (Department of Environmental Protection, 2000b). In the Perth Metropolitan Region, there are few large areas available for conservation, with most areas being relatively small in size (less than 100 hectares)

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LEGEND

- Survey Area
- Lot 467

Vegetation Complex Boundary

- Bassendean Complex-Central And\South
- Southern River Complex

Bassendean Complex-Central And\South

Southern River Complex

VIRGILIA TCE
GLEN IRIS DR
HARTWELL PDE
DEAN RD
LAKES WY
BERRIGAN DR
BANKSIA CT
PAR CT
GLENDALE CR
VERNA CT
IMLAH CT
PRINSEP RD
MURIEL CT
CUTLER RD
NORTH LAKE RD
KENTUCKY CT
BEELIAR DR
POLETTI RD
LINKAGE AV
KNOCK PL
AVIOR AV
CHIRLEY BR
SOLOMON RD
ABAAYA ST
DOLLIER ST
BISCAYNE WY
FRASER RD
BOEING WY
SOLOMON RD
FALCON PL
CESSNA DR
BATTERSEA RD
FRASER RD
CLIFTON RD
WATERFOOT LOOP
ROEBUCK AV
ALTHAM WY
BURNSIDE TCE
GUNDARING TURN
NINAN WY
DRISCOLL DR
ACOURT RD
WARTON RD
CHARIOT TURN
SADDLE L
BAYSTONE PDE
HYBRID CT
HEBE RD
LOUISIANA GLEN
ACKWORTH RD
SKOTSCH RD
FRASER RD
COLUMBIA PWY
NICHOLSON RD
TURIN L
BROADWAY BYD
GRENOBLE ST
BORDEAUX PDE
DELFT L
PADUA RD
BARCLAY WY
TURTLEDOVE RD
RAVEN WY
MANDAKOT RD
MASON RD
WRIGHT RD
KEANE RD
ANSTEY RD
HEBBLE LOOP
GRANT PL
LIDDELOW RD
SCOFIELD PL
MUIR CT
BORONIA RD
TAYLOR RD
ARMADALE RD
ALLEN RD
WELD ST
DUMSDAY DR
LOFTIES ST
DEW ST
FORREST RD
LEAKE ST
BROOME ST
COMMERCIAL RD
LAKE RD
SWAMP RD
WRIGHT RD
SHEPHERD CT
RANFORD RD
BALFOUR
EDENCOURT
FURLEY RD
CHIARA AV
INGOT L
BENALLA DR
SOHO L
MINGARA AV
STILLS AV
REILLY RD
BALANNUP RD
HARRISDALE DR
WHITEHORSE DR
DELMAR AV
GLOBAL AV
KUDOS CCT
PARDALOTE RD
KULSARDI WY
BARN L
SKEET RD
LYDON BVD
ALABASTER DR
HAWKESBURY RTT
TAPPER RD
SCIANO AV
PEARSON DR
KWINANA FWY
WATERS AV
LOMBE GDNS
MYALL PL
GUTTERIDGE RD
MURDOCH WY
CARLSON PL
STEINER AV
GILLEN WY
REEVES ENT
KEW WY
FOLLAND PDE
TAPPER RD
HARPER RD
ARNO L
BARTRAM RD
AVON CR
BEENYUP RD
CALDER WY
BENDEE DR
MYSTIC ELB
VIVAL L
PAPERBARK L
SANGUINE WY
UTOPIA L
UNITY WY
CHIVALRY WY
WINDCHIMETCE
DUNLAP AV
RUTHERFORD ENT
ROSE L
HYGEIA BEND
LYON RD
LAUDERDALE DR
HARMONY AV
GOODWILL AV
MYRRH L

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Revision: 0
Drafted by: SC
Source: Cadastre & Orthophoto - Landgate 2010 Wetlands - DEC, 30.12.10 Vegetation - Heddle, 2002

0 187.5 375 750 1,125 1,500 metres

Figure 2

Swan Coastal Plain Vegetation Complex Map

and isolated from other conservation areas (Department of Environmental Protection, 2000b). Consequently, the consideration of proximity to other natural areas and connectivity with them is considered important by the DEC in assessing the significance of natural areas.

Linkages have been categorized by the DEC as follows (Department of Environmental Protection, 2000b):

- Regionally significant contiguous corridors of bushland/wetland areas;
- Regionally significant fragmented bushland/wetland areas;
- Regionally significant potential bushland/wetland areas.

A map of existing and potential bushland/wetland linkages in the Perth Metropolitan Area (Department of Environmental Protection, 2000b) shows that the Rocla survey area is part of a north-south linkage between Gibbs Rd and the Jandakot Airport/Canningvale bushlands. This linkage has been assigned the status 'Regionally Significant but not Contiguous Linkage of Bushland/Wetland Areas'.

2.2.2 Rare flora

Twenty three (23) DRF and Priority species were recorded on the DEC database as having been previously recorded in the locality of the Rocla Warton Rd survey area (within 5 kilometre radius of Rocla Warton Rd) (Figure 3; Table 1).

2.3 Wetlands

Western Australia's wetlands have been defined as 'areas of seasonally intermittently or permanently waterlogged soils or inundated land whether natural or otherwise, fresh or saline, e.g. waterlogged soils, ponds, billabongs, lakes, swamps, tidal flats, estuaries, rivers and their tributaries (Wetland Advisory Committee 1977, quoted in Department of Environmental Protection, 2000b).

There are over 9600 wetlands covering over 25% of the Swan CoastalPlain land area (Balla, 1994). Semeniuk proposed a classification of wetlands for south-western Australia based on landform and water longevity (Hill *et. al*., 1996; Table 2).

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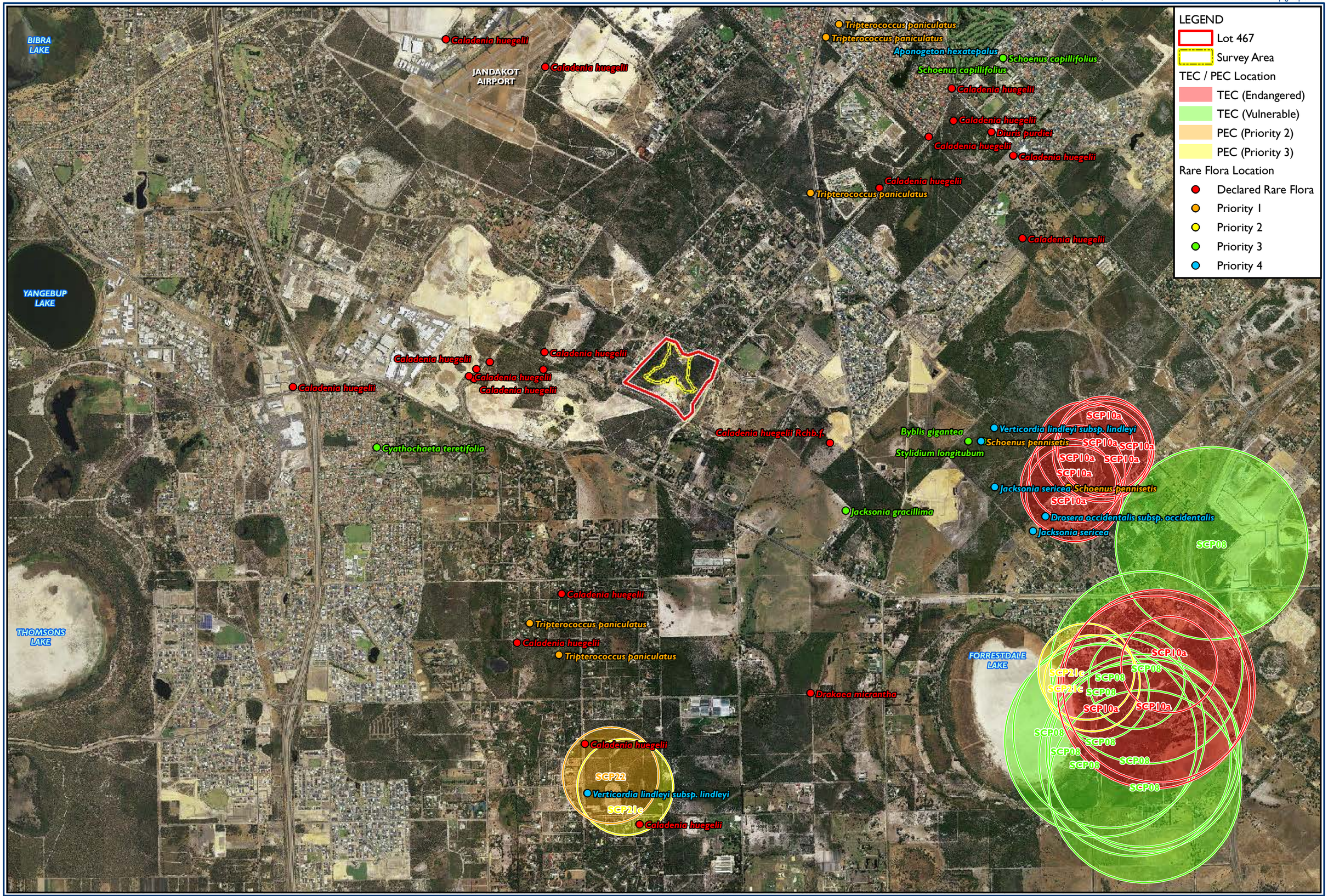

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Source: Cadastre & Orthophoto - Landgate 2010 DRF TEC/PEC - DEC

0 0.25 0.5 1 1.5 2 km

Figure 3

Location of DEC Records of Rare Flora and TECs/PECs

Table 1. Declared Rare and Priority Flora previously recorded within a 5 kilometre radius of the Rocla Warton Rd survey area (from DEC DEFL and WAHERB database searches, October 2010).

Taxon	Status[a]	Likelihood of occurrence in the survey area	Comments
Caladenia huegelii	DRF	Moderate	Banksia woodland on dune slopes is suitable habitat and *C. huegelii* recorded in the locality.
Diuris purdiei	DRF	Low to moderate	Grows under *Pericalymma* and *Melaleuca* spp. trees in winter-wet swamps and drainage lines (Brown *et. al*., 2008). The species only flowers in trhe season after a summer flower. This habitat type was limited in the survey area.
Drakaea elastica	DRF	Low to moderate	Found in low-lying situations adjoining winter-wet swamps (DEC Florabase, May 2011). This habitat type was limited in the survey area.
Drakaea micrantha	DRF	Low	Perth at northern end of range. Not expected on dune slopes.
Lepidosperma rostratum	DRF[b]	Low to moderate	Known from four populations in the east of the metropolitan area of Perth. Grows in sandy soil among low heath in a winter-wet swamp. Limited suitable habitat in the survey area.
Acacia lasiocarpa var. *bracteolata* long peduncle variant (G.J. Keighery 5026)	P1[b]	Low	Grey or black sand over clay. Swampy areas, winter wet lowlands. Limited suitable habitat in the survey area.
Ptilotus sericostachyus subsp. *roseus*	P1[b]		
Schoenus pennisetis	P1	Low to moderate	Grey or peaty sand, sandy clay. Swamps, winter-wet depressions. Limited suitable habitat in the survey area.
Acacia benthamii	P2	Low	Typically found on limestone breakaways. No suitable habitat in the survey area.
Byblis gigantea	P3	Low	Found in sandy-peat swamps. Seasonally wet areas. Limited suitable habitat in the survey area.
Cyathochaeta teretifolia	P3	Low to moderate	Prefers grey sand, sandy clay. Swamps, creek edges. Limited suitable habitat in the survey area.
Jacksonia gracillima	P3	Low to moderate	Found in areas adjacent to seasonal damplands. Limited suitable habitat in the survey area.
Schoenus capillifolius	P3	Low	Found on brown mud. Claypans. No suitable habitat in survey area.

Table 1 (cont). Declared Rare and Priority Flora previously recorded within a 5 kilometre radius of the Rocla Warton Rd survey area (from DEC DEFL and WAHERB database searches, October 2010).

Taxon	Status[a]	Likelihood of occurrence in the survey area	Comments
Stylidium longitubum	P3	Low to moderate	Sandy clay, clay. Seasonal wetlands. Limited suitable habitat in the survey area.
Aponogeton hexatepalus	P4	Low	Freshwater: ponds, rivers, claypans. No seasonally/perennially inundated areas in survey area.
Dodonaea hackettiana	P4[b]	Low	Occurs on sand and outcroping limestone. No limestone outcropping in survey area.
Drosera occidentalis subsp. *occidentalis*	P4	Low to moderate	Occurs on sandy & clayey soils and around swamps & wet depressions. Limited suitable habitat in the survey area.
Grevillea thelemanniana	P4[b]	Low to moderate	Prefers areas of sand, sandy clay, with winter-wet low-lying flats.
Jacksonia sericea	P4	Low	Found on calcareous and sandy soils. Soil in survey area not calcareous.
Microtis quadrata	P4[b]	Low to moderate	Grows around coastal swamps (Brown *et al*., 2008)
Ornduffia submersa (formerly Villarsia submerse)	P4[b]	Low	Prefers freshwater pools, lakes, swamps, winter-wet depressions, claypans. Does not appear to be inundation in survey area. (Paczkowska and Chapman, 2000).
Tripterococcus paniculatus	P4	Low to moderate	Prefers grey, black or peaty sand and winter-wet flats.
Verticordia lindleyi subsp. *lindleyi*	P4	Low to moderate	Occurs on sand, sandy clay in winter-wet depressions. Limited suitable habitat in the survey area.

a. The rare flora status classification definitions are set out in Appendix 1.

b. Exact locations were not known for these taxa. Rather, they were caught by a search of Herbarium records by suburb name within 5 kilometres of the survey area (DP List).

Table 2. Wetland classification based on permancy of water and a global geomorphic classification system (reproduced from Department of Environmental Protection, 2000b; after Semeniuk in Hill *et al*., 1996).

Water Longevity	Landform				
	Basin	**Channel**	**Flat**	**Slope**	**Highland**
Permanent inundation	lake	river	-	-	-
Seasonal inundation	sumpland	creek	floodplain	-	-
Intermittent inundation	playa#	wadi#	barlkarra#	-	-
Seasonal Waterlogging	dampland	trough#	palusplain	paluslope	palusmont#

Not used on the Swan Coastal Plain in the Perth Metropolitan Region.

Management categories for wetlands in Western Australia have been described by the Water and Rivers Commission (Department of Environmental Protection, 2000b). They are:

- Conservation wetlands: 95-100% vegetated; management objective of preserving their natural attributes and functions.;
- Resource enhancement: 10-94% vegetated; management for restoration and enhancement of natural attributes and functions.;
- Multiple Use: 0-9% vegetated; management for their use and development in the context of water, town and environmental planning.

Geomorphic wetlands have been mapped for the Swan Coastal Plain. Geomorphic wetlands and their management categories in the Rocla Warton Rd locality are shown in Figure 4.

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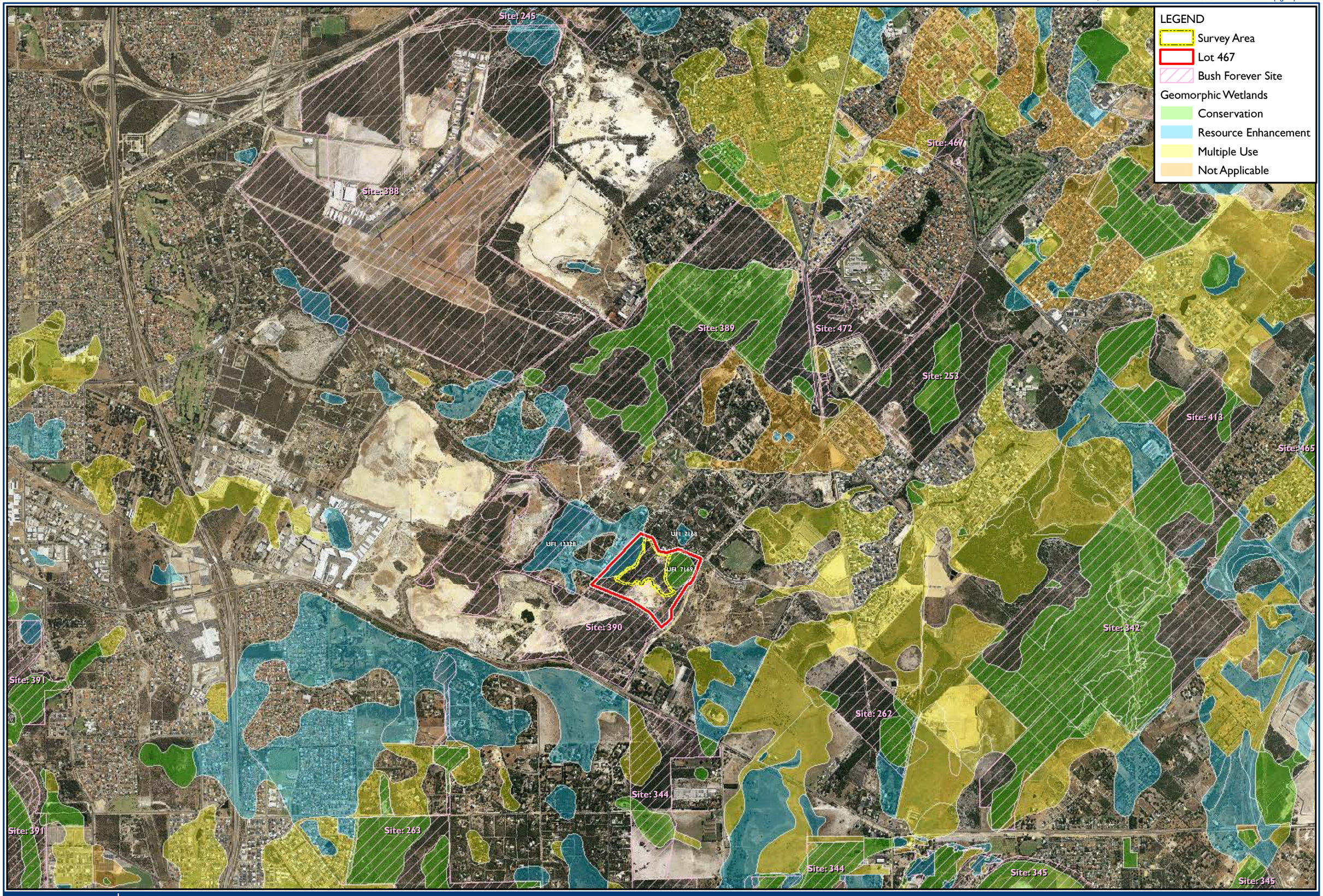

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Source: Cadastre & Orthophoto - Landgate 2010 Wetlands - DEC, 30.12.10 Bush Forever - DPI, 30.09.09

0 190 380 760 1,140 1,520 metres

Figure 4

Bush Forever and Geomorphic Wetlands Within Survey Locality

3.0 METHODS AND LIMITATIONS

3.1 Introduction to the field survey

The Rocla Warton Rd flora and vegetation fieldwork was conducted on the 6th and 7th of October 2010, with a site revisit to re-record quadrats and finalise other works on the 28th of October 2010.

3.2 Vegetation survey

3.2.1 Methods of the vegetation survey

Vegetation was described using quadrats, releves and mapping notes. Locations of sample sites were selected that were representative of observed variations in the vegetation and habitat. Suitable sites for the more detailed descriptions (quadrats) were limited to sites in Good or better condition, where a good suite of species representative of that vegetation type, were present.

Six (6) quadrats, WR1 to WR6, were recorded. Quadrats were 10 metres by 10 metres in size and were marked out with a field measuring tape between fence dropper stakes, which were driven into the ground at each corner. The 10 metre by 10 metre quadrat dimensions were used firstly because a 100m^2 sample area on the Swan Coastal Plain is considered to capture most species in a given plant community and secondly because that was the quadrat size used to collect data for the Gibson *et al*. (1994) Swan Coastal Plain study, with which the Rocla Warton Rd survey data set needed to be compatible.

Each quadrat was photographed. A description of the quadrat location, the habitat, surface soil texture and colour were recorded and the time since the site was last burnt was estimated. The vegetation structure was described using a modification of Specht's vegetation description table by Aplin (1979; Appendix 2). To obtain more representative data for the overstorey cover, the tree layer(s) cover was estimated over a larger area around the quadrats. The condition of vegetation in the quadrat was described using the Keighery classification outlined in Bush Forever (Department of Environmental Protection, 2000b; see Appendix 3). All plant species occurring in a quadrat were recorded, along with their height, percentage cover and specimen number if collected. Where a plant species was not well known, a specimen was collected and allocated a specimen number.

The specimens collected were pressed, dried and identified. The identifications were made by comparison to specimens in the reference and research collections of the

Western Australian Herbarium, by the use of keys in various papers and books and by relevant experts on various groups of flora that occur on the Swan Coastal Plain.

The Department of Environment and Conservation Declared Rare and Priority Flora List (Smith, 2010; definitions in Appendix 1) was consulted as required to confirm the status of plant species in the survey area.

The quadrats were revisited near the end of October to meet the Environmental Protection Authority's (2004) Guidance No 51 requirements. The two visits improved quadrat sampling by increasing the chances of recording, in at least one visit, early and later season flowering plants.

Two releves and three mapping notes were also recorded to describe the vegetation in the survey area. Releves are vegetation descriptions of an unbounded area around a point. Releve descriptions were similar to those for quadrats, but not all plant species were recorded, but rather some associated species were recorded. Mapping notes were an abbreviated form of releves descriptions.

3.2.2 Limitations of the vegetation survey

The cover estimate of each plant species recorded in the quadrats was based on estimating species projected canopy cover. The assumption was made that for most species, canopy cover and projected foliar cover are reasonably similar, or that the difference is less than the level of accuracy of the estimates.

There is a limit to the accuracy of the assignment of the different strata in the vegetation descriptions to structural units (for example, low open woodland, low woodland, low open forest, open shrubland, shrubland etc.). Referral of a stratum to a structural category depends on assessment of its cover. Such estimation is imprecise and it is not unusual for different observers to give quite different estimates of the cover of a species, or stratum in a stand. However, descriptive exercises such as that carried out for this report require only a moderate level of accuracy.

3.3 Flora survey

3.3.1 General flora survey methods

The flora in the study area was recorded while describing and sampling the vegetation (quadrats, releves and mapping notes), while walking between the vegetation recording sites, while mapping the vegetation units and when conducting rare flora searches.

Plant species were recorded elsewhere in the study area if they had not been recorded at a quadrat or releve sampling site or if they were of particular interest. Where a plant species was not well known, a specimen was collected and allocated a specimen number. GPS coordinates were recorded (using a Garmin 60CX hand held GPS unit) whenever it was considered there was a possibility that the plant species may be of special interest.

3.3.2 Rare flora searches

Grid searches for rare flora were conducted over the entire survey area on the 7th of October 2010. The main target was the giant spider orchid, *Caladenia huegelii* (Declared Rare Flora), because it had been recorded in the region and the Banksia woodland on dune slopes was considered to be suitable habitat for that taxon. Grid lines were spaced about 20 metres apart, with adjacent lines walked by one of three botanists. Despite a fairly early and dry Spring season, *Caladenia huegelii* plants were flowering at that time (Andrew Brown (DEC), *pers. comm*.). While searching for the *Caladenia huegelii*, other plants were also recorded if they were not well known, if there was some chance they may have been significant (DRF, Priority or Regionally Significant) or if they had not been recorded elsewhere in the survey area.

3.3.3 Limitations of the flora survey

The major limitation of the flora survey is that any such survey is a sampling procedure of a variable environment with plant populations of variable growth habit, life span and flowering season. Some species, including annuals, are only available for collection for part of the year. This means that to locate all species that grow in an area is a substantial task, the success of which is related to the time available and the size and diversity of habitat in the survey. Consequently, it is possible that there are species present in the survey area that were not recorded during this survey as they have only low abundance on the land, or were not flowering at the time of the survey. However, this limitation was minimised by surveying the site and then revisiting the quadrats during early and late Spring respectively, increasing the number of annual taxa that were in or near some stage of flowering at a survey time.

Given the limitations of the flora survey, it is likely that this survey recorded more than 85 to 90% of the vascular flora in the survey area. That is, while the flora survey was relatively thorough, it was possible that some species occurring in the survey area were not recorded.

3.4 Vegetation mapping

3.4.1 Methods for vegetation mapping

Vegetation units were recorded generally between plant community and plant association level. The vegetation unit boundaries were drawn on a computer generated aerial photograph while traversing the study area, using GPS coordinate readings to locate actual boundary positions. Orthocorrected aerial photography at 1:5000 was supplied by 360 Environmental PL.

The vegetation mapping unit descriptions were based on the quadrat, releve and mapping note descriptions. The vegetation descriptions recorded in the field were later synthesized into vegetation units, with some reference to the floristic similarity of quadrats determined by PATN analysis (see below).

3.4.2 Wetland vegetation mapping

The identification and delineation of a wetland is dependent on an areas hydrology, hydric soils and wetland vegetation (Hill *et al*., 1996). Obligate wetland species are considered reliable wetland indicators (Hill *et al*., 1996).

The vegetation units recorded at Rocla Warton Rd survey area were classified as wetland vegetation if a number of obligate wetland species were present in the units as dominants and if PATN analysis suggested an affinity with wetland Floristic Community Types (see below). Obligate wetland species were considered to be those that only occur in wetland sites and therefore appeared to require wetland conditions for growth. Table 3 shows a list of selected plant species that occur in the Perth Metropolitan area that were considered to be obligate wetland species after reference to the literature and from the experience of the author.

3.5 Floristic Community Types and PATN analysis of vegetation units

3.5.1 Introduction

The floristic analysis compared the similarity of species presence/absence data collected at the six (6) Rocla Warton Rd quadrats with the data for 509 sites recorded across the Swan Coastal Plain in a broad survey by Gibson *et al*. (1994).

3.5.2 Data storage and handling

The Rocla Warton Rd vegetation quadrat data was entered into a specially designed computer database developed by E. A. Griffin and M. Trudgen using Microsoft Access.

Table 3. List of a selection of plant species considered to be obligate wetland species in south-west Western Australia.

Wetland Species	Notes[a]
Astartea affinis	Found on seasonal wetlands, flats, creeklines, claypans.
Baumea juncea	Found in seasonally waterlogged or partially inundated areas which have fresh to brackish or seasonally saline water (Water and Rivers Commission, 1997).
Baumea vaginalis	In fresh and semi-saline waters at seasonally wet to permanently inundated sites such as swamp margins.
Baumea articulata	Can tolerate deep inundation for prolonged periods; normally fringes lakes, sumplands and watercourses.
Banksia littoralis (Swamp banksia)	Associated with winter-wet depressions. Frequently occurs in swampy areas, but is not tolerant of inundation and prefers areas subject to only short winter waterlogging or very shallow groundwater table (Water and Rivers Commission, 1997).
Cyathochaeta teretifolia	Usually found bordering swamps and along watercourse (Wheeler *et. al*., 2002).
Eucalyptus rudis subsp. *rudis* (Flooded gum)	Flooded gum is common fringing winter-wet depressions, lakes and watercourses on the SCP. It can tolerate prolonged periods of flooding and usually found in waterlogged areas (Water and Rivers Commission, 1997).
Euchilopsis linearis	Frequent in winter-wet depressions on Coastal Plain (Marchant *et al*.1987)
Lepidosperma longitudinale	Sandy and peaty soils in winter-wet depressions and along watercourses (Water and Rivers Commission, 1997).
Melaleuca lateritia	Fringes watercourses and in seasonally wet depressions (Water and Rivers Commission, 1997).
Melaleuca preissiana	In waterlogged soils fringing rivers and swamps. Less tolerant of prolonged inundation than *Melaleuca rhaphiophylla* (Water and Rivers Commission, 1997).
Melaleuca rhaphiophylla (Swamp paperbark)	Tolerates periodic inundation, but prefers waterlogged sites. Found near both fresh and saline water, but is less adapted for saline water conditions than Saltwater Paperbark (Water and Rivers Commission, 1997).
Melaleuca teretifolia	Associated with lakes or in winter-wet depressions on Coastal Plain; in sandy soils, sometimes with clay (Marchant *et al*., 1987).
Pericalymma ellipticum	occurs mainly in winter-wet depressions and along water courses (Marchant *et al*., 1987).
Pultenaea ochreata	Occurs on sandy soils of winter-wet depressions on the Swan Coastal Plain (Marchant *et al*., 1987).
Schoenus efoliatus	Occurs in swamps and winter-wet areas (Wheeler *et. al*., 2002).
Schoenus subfascicularis	Occurs in winter-wet depressions on Coastal Plain (Marchant *et al*., 1987).
Taxandria linearifolia (Swamp peppermint)	Fringes swamps and watercourses (Water and Rivers Commission, 1997).

a: Notes from DEC, 1997.

3.5.3 Data preparation and compatibility

To conduct the analysis on the Rocla Warton Rd quadrat data and the Gibson *et al*. (1994) dataset, it was first necessary to reconcile the names of the flora species. This step was necessary because of changes in the nomenclature over the last ten years and the potential for survey specific variations in the application of names. The reconciliation involved reducing some infra-specific names to the relevant species name, combining some taxa where confusion is known to have occurred in field observations and identifications and omitting some names (mostly where a taxon had only been identified to genus).

The Rocla Warton Rd data was compatible with the Gibson *et al*. (1994) data. Both datasets were based on data collected from quadrats of the same size (10 metres by 10 metres) and collected from two visits to each quadrat, at different times of season. Weed species were included in both the Gibson *et al*. (1994) and Rocla Warton Rd datasets.

3.5.4 PATN analysis

Mr Ted Griffin conducted the Rocla Warton Rd quadrat PATN analysis.

Following the reconciliation of species names between the Rocla Warton Rd survey and the Gibson *et al*. (1994) Swan Coastal Plain survey, the PATN analysis was conducted on the combined datasets. This analysis grouped the Rocla Warton Rd survey sites with the most floristically similar sites from the combined dataset. Each of the Rocla Warton Rd sites could then be allocated the Gibson *et al*. Floristic Community Type (FCT) of the most similar sites from the Gibson *et al*. dataset, with the degree of similarity indicated by 'dissimilarity coefficients'.

The methods of the PATN analysis are set out in more detail in a report prepared by Mr Ted Griffin that is included in full in Appendix 8.

3.5.5 Limitations of the floristic analysis

It has been found in other floristic analysis that the addition of new sites to the Gibson *et al*. (1994) data set to produce a combined classification, may disrupt the original classification of sites (Griffin and Trudgen, 2004). The more data that is added, the higher the level of disruption. If this occurs it can make it difficult to assign the new sites to the Gibson *et al*. Floristic Community Types (Griffin and Trudgen, 2004).

Another limitation in conducting a PATN floristic analysis using the above methods may arise depending on the degree of success in reconciling the two data sets. A further limitation may arise from any significant differences in data collection methods between the two surveys. However, this limitation was most likely inimportant in this PATN analysis, as the collection methods were similar between the two surveys (see above comments).

3.6 Identification of Threatened Ecological Communities (TEC's) and Priority Ecological Communities (PEC'S).

Once the Rocla Warton Rd quadrats were each assigned to a Floristic Community Type, a current table of Swan Coastal Plain TEC'c (DEC website, 2011) was consulted to determine if any of the Rocla Warton Rd vegetation sites (FCT's) were TEC's.

To determine if any of the Rocla Warton Rd FCT's were PEC's, a list of PEC's was consulted (DEC website, 2011).

3.7 Flora and vegetation and regional significance

Regional significance of the Rocla Warton Rd flora and vegetation was assessed against the criteria for the determination of regional significance of natural areas set out in Guidance Statement No. 10 (EPA, 2006).

4.0 FLORA OF THE SURVEY AREA

4.1. Flora list for the survey area

One hundred and fifty three (153) species of native flowering plants, one native fern and one native cycad (the Zamia Palm, *Macrozamia riedlei*) were recorded in the Rocla Warton Rd survey area. In addition, thirty eight (38) non-native species were recorded from the survey area. A list of species recorded in the Rocla Warton Rd survey area are shown in Appendix 4.

The flowering plant families that were well represented by native species in the survey area were the Myrtaceae (eucalypt family) with eighteen (18) native species, Fabaceae (pea and *Acacia* family) with fifteen (15) native species, Cyperaceae (sedge family) with eleven (11) native species, the Asteraceae (daisy family) with nine (9) native species, the Haemodoraceae family with nine (9) native species and the Proteaceae (Banksia family) with nine (9) native species.

The number of native species recorded in the Rocla Warton Rd survey area was probably a moderate number for the limited habitats in what was a small survey area (eleven hectares). The species richness (including weeds) of quadrats was greatest in the Banksia woodland and low in the dampland sites (Table 4). The higher number in dampland quadrat WR4 reflected its transitional nature, with many dryland species present.

Table 4. Number of species recorded in the Rocla Warton Rd survey quadrats.

Quadrat number	Number of species	Vegetation
WR1	68	Banksia woodland
WR2	55	Banksia woodland
WR3	46	Banksia woodland
WR4	50	*Melaleuca preissiana* woodland (dampland)
WR5	32	*Schoenus subfascicularis* sedgeland (dampland)
WR6	33	*Adenanthos cygnorum*, *Hypocalymma angustifolium* shrubland (dampland)

4.2 Significant flora and flora of interest in the survey area

4.2.1 Declared Rare Flora (DRF) recorded in the survey area

No Declared Rare Flora were recorded in the Rocla Warton Rd survey area.

4.2.2 Priority flora species recorded from the survey area

No Priority flora species were recorded in the survey area.

4.2.3 Other species of regional significance recorded in the survey area

Two plant species considered to have regional significance in the Rocla Warton Rd survey area, *Hensmania turbinata* and *Pultenaea ochreata*, were recorded.

4.2.3.1 *Hensmania turbinata*

Hensmania turbinata is a perennial herb about 20cm high (Paczkowska and Chapman, 2000). It is considered regionally significant in the Perth Metropolitan area because that is about the southern most extent of its range (Department of Environmental Protection, 2000b).

Hensmania turbinata was recorded from one location in the survey area, although its exact location was not recorded.

4.2.3.2 *Pultenaea ochreata*

Pultenaea ochreata is an erect shrub that grows to between 30 cm and 2 metres tall, has a pea flower and has been recorded on sandy soils in winter wet depressions (Paczkowska and Chapman, 2000; Plate 1). The Perth Metropolitan area appears to be at the northern limit of *Pultenaea ochreata's* range and it would therefore be of regional significance in the Perth area.

Plate 1. *Pultenaea ochreata*. (Photograph reproduced from FloraBase, Dept of Environment and Conservation website).

Pultenaea ochreata was recorded at three locations in the south-east corner of the survey area, near (and including) quadrat WR6.

4.2.4 Other species of interest recorded in the survey area

Two taxa recorded in the survey area, *Leucopogon* sp. Murdoch (M. Hislop 1037) and *Hibbertia huegelii sens. lat*., were also of interest.

Leucopogon sp. Murdoch (M. Hislop 1037) is an erect open shrub growing to a height of 70 to 80 centrimetres (DEC FloraBase website, May 2011; Plate 2). It grows on sand soils on winter wet sites, plains and swamps. Its range includes the Swan Coastal Plain and Geraldton sand plains between Eneaba in the north and Bunbury in the south (Mike Hislop, Western Australian Herbarium, *pers. comm*.). However, it is scattered sparsely within its range and generally only occurs in small numbers (Mike Hislop, *pers. comm*.). In its general appearance, without close scrutiny, *Leucopogon* sp. Murdoch (M. Hislop 1037) may be mistaken for *L. propinquus*.

Leucopogon sp. Murdoch (M. Hislop 1037) was recorded and collected once in the south west corner of the survey area.

Plate 2. *Leucopogon* sp. Murdoch (M. Hislop 1037). (Photograph reproduced from Flora Base, Dept of Environment and Conservation website).

Hibbertia huegelii sens. lat. refers to one collection of *Hibbertia huegelii* from the survey area that differed from the more common form of *H. huegelii* by having a dense covering of long hairs on the outer calyx surface as well as on the lower parts of the leaves. *Hibbertia huegelii sens. lat*. keyed to *Hibbertia huegelii* and matched some variations of *Hibbertia huegelii* in the Western Australian Herbarium's main collection (Mike Hislop, *per. comm*.). It was collected on the lower dune slopes on the eastern side of the survey area.

5.0 VEGETATION OF THE SURVEY AREA

5.1 Vegetation description

5.1.1 Introduction to the vegetation descriptions

The vegetation units described are considered to be mostly described at the vegetation association level.

The vegetation unit codes that discriminate the mapped vegetation units are derived from the generic and species names of the more abundant genera or species in the different strata present in each unit (see Table 5). For example, the vegetation unit 'MpAa' has its code derived from two of the dominant species in that unit: 'Mp' (*Melaleuca preissiana*) and 'Aa' (*Astartea affinis*).

Table 5. Abbreviations for species names that were used in vegetation unit codes.

Code	Species name	Code	Species name
Aa	*Astartea afinis*	Ha	*Hypocalymma angustifolium*
Ac	*Adenanthos cygnorum*	Mp	*Melaleuca preissiana*
Ba	*Banksia attenuata*	Pe	*Pericalymma ellipticum*
Bm	*Banksia menziesii*	Ss	*Schoenus subfascicularis*

5.1.2 Vegetation of the Rocla Warton Rd survey area

5.1.2.1 Overview

Six vegetation units were described and mapped in the remnant bushland in the Rocla Warton Rd survey area (Figure 5). These have been arranged into three vegetation groupings according to habitat in which they occurred:

- *Banksia attenuata-Banksia menziesii* low woodlands on dune slopes;
- *Melaleuca preissiana* mixed woodlands on gentle slopes and flats around the base of the dune (transitional vegetation);
- *Pericalymma* heaths and sedgelands on flats (dampland/palusplain).

Banksia attenuata-Banksia menziesii low woodlands covered the dune crest and slopes that occupy most of the survey area (Figure 5). *Eucalyptus todtiana* occurred in scattered patches across the dune, but occurred more consistently on the lower slopes. Transitional dryland vegetation of mixed woodlands with *Melaleuca preissiana* scattered low trees occurred along the base of the dune on the western and parts of the eastern edges of the survey area. Transitional wetland vegetation included *Melaleuca preissiana* low open forests and shrublands of *Adenanthos cygnorum* and *Hypocalymma angustifolium* on the flats (included wetland and dryland species).

Small areas of *Pericalymma ellipticum* heath and *Schoenus subfascicularis* sedgelands (seasonal damplands) occurred in the south-western and north-western corners of the survey area.

5.1.2.2 Vegetation units

(i) *Banksia attenuata-Banksia menziesii* low woodlands on dune slopes

BaBm

Banksia attenuata, Banksia menziesii, (*Allocasuarina fraserina*) low woodland over *Allocasuarina humilis* shrubland over *Hibbertia hypericoides, Astroloma xerophyllum* low shrubland over *Desmocladus flexuosus, Amphipogon turbinatus* open sedgeland/grassland.

Habitat and soil: Mid to upper slopes of dune. Pale grey sand over yellow sand.

Notes: This vegetation was recorded at quadrats WR1, WR2 and WR3 (Plate 3) (details in Appendix 5). *Eucalyptus todtiana* occurred occasionally on the upper slopes and scattered on the lower slopes.

(ii) *Melaleuca preissiana* mixed woodlands on gentle slopes and flats around the base of the dune

MpAa

Melaleuca preissiana, (*Allocasuarina fraseriana*) low open forest over *Xanthorrhoea preissii, Astartea affinis* open shrubland over *Hypocalymma angustifolium* scattered low shrubs over *Dasypogon bromeliifolius* open herbland to herbland.

Habitat and soil: North facing, very gently sloping to flat seasonal dampland. Grey sand.

Notes: This vegetation was recorded at quadrat WR4 (Plate 4) (details in Appendix 5). It occurred in the south-west corner of the survey area and included dryland species (eg *Allocasuarina fraseriana*) as well as dampland species (eg *Melaleuca preissiana, Baumea juncea*). It was considered to be transitional dampland vegetation.

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VEGETATION UNITS

(i) *Banksia attenuata-Banksia menziesii* low woodlands on dune slopes

BaBm *Banksia attenuata*, *Banksia menziesii*, (*Allocasuarina fraserina*) low woodland over *Allocasuarina humilis* shrubland over *Hibbertia hypericoides*, *Astroloma xerophyllum* low shrubland over *Desmocladus flexuosus*, *Amphipogon turbinatus* open sedgeland/grassland.

(ii) *Melaleuca preissiana* mixed woodlands on gentle slopes and flats around the base of the dune

MpAa *Melaleuca preissiana*, (*Allocasuarina fraseriana*) low open forest over *Xanthorrhoea preissii*, *Astartea affinis* open shrubland over *Hypocalymma angustifolium* scattered low shrubs over *Dasypogon bromeliifolius* open herbland to herbland.

MpBmBa *Melaleuca preissiana*, *Banksia menziesii*, *Banksia attenuata*, (*Nuytsia floribunda*, *Eucalyptus todtiana*) low woodland over *Xanthorrhoea preissii*, *Adenanthos cygnorum* subsp. *cygnorum* shrubland over *Hibbertia subvaginata* low open shrubland with *Dasypogon bromeliifolius* herbland.

(iii) *Pericalymma* heaths and sedgelands on flats (dampland/palusplain).

Pe *Pericalymma ellipticum* closed heath over *Daviesia incrassata* subsp. *incrassata*, *Euchilopsis linearis* scattered low shrubs (*Hypocalymma angustifolium* low shrubland in parts) over *Lyginia imberbis*, *Hypolaena exsulca* very open sedgeland.

Ss *Acacia pulchella* var. *goadbyi* scattered shrubs over *Hypocalymma angustifolium*, *Pericalymma ellipticum* scattered low shrubs over *Schoenus subfascicularis* closed sedgeland.

AcHa *Kunzea glabrescens* scattered tall shrubs over *Adenanthos cygnorum* shrubland over *Hypocalymma angustifolium* low open shrubland over *Hypolaena exsulca* very open sedgeland with *Dasypogon bromeliifolius*, *Phlebocarya ciliata* herbland.

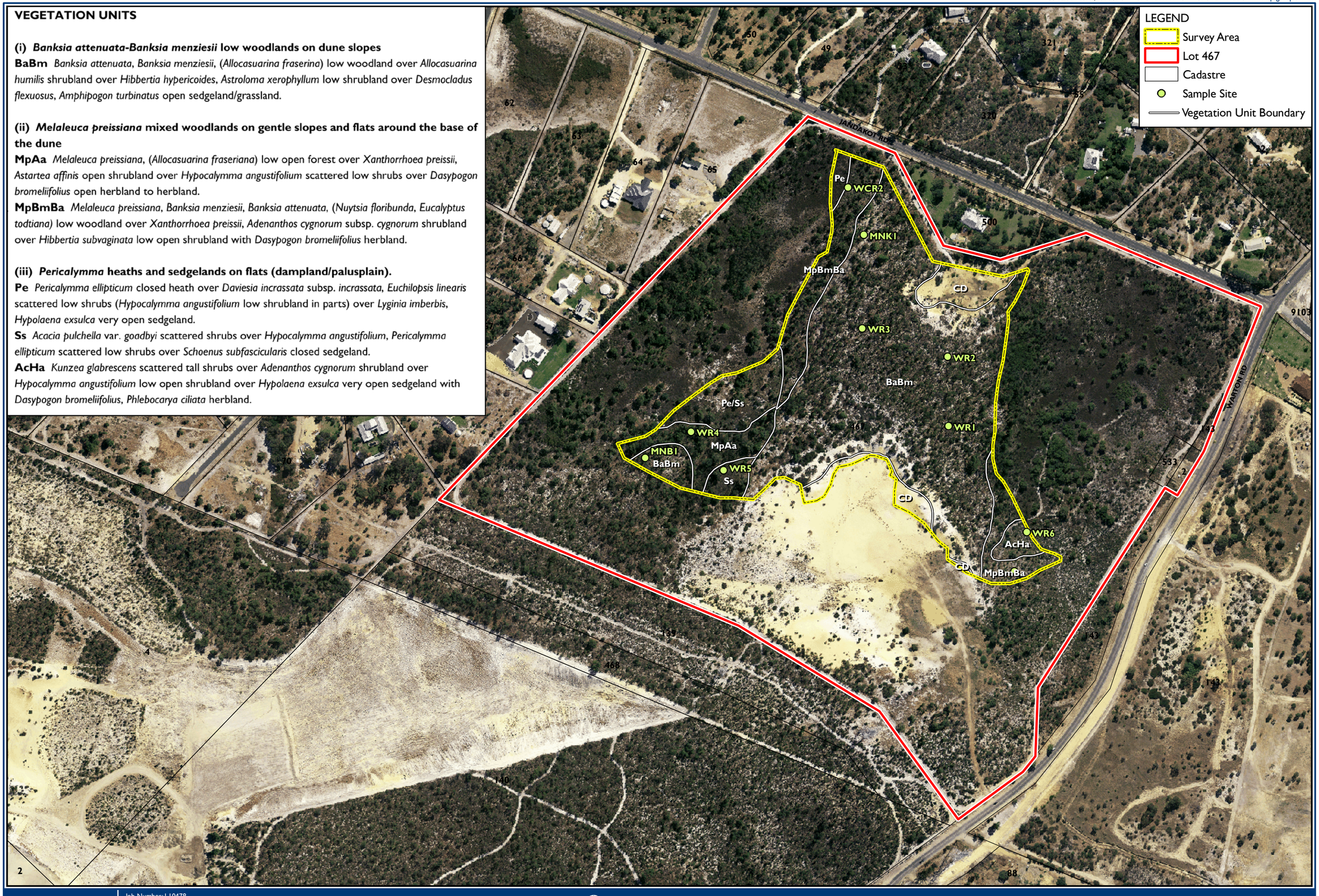

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Figure 5

Vegetation Units

Plate 3. ***Banksia attenuata-Banksia menziesii*** **low woodland unit 'BaBm' at quadrat WR3.**

Plate 4. Vegetation unit 'MpAa' at quadrat WR4.

MpBmBa

Melaleuca preissiana, *Banksia menziesii*, *Banksia attenuata*, (*Nuytsia floribunda, Eucalyptus todtiana)* low woodland over *Xanthorrhoea preissii*, *Adenanthos cygnorum* subsp. *cygnorum* shrubland over *Hibbertia subvaginata* low open shrubland with *Dasypogon bromeliifolius* herbland.

Habitat and soil: Flats adjacent to dune. Pale grey sand.

Notes: This vegetation was recorded at releve WCR1 (Plate 5) (details in Appendix 6). This transitional vegetation occurred between the *Banksia* low woodland on the dune slopes and the damplands/palusplain on the flats adjacent to the dune slopes. It included scattered *Melaleuca preissiana* amongst dryland tree and shrub species.

Plate 5. Vegetation unit 'MpBmBa' at releve site WCR1.

(iii) *Pericalymma* heaths and sedgelands on flats (dampland/palusplain).

Pe

Pericalymma ellipticum closed heath over *Daviesia incrassata* subsp. *incrassata, Euchilopsis linearis* scattered low shrubs (*Hypocalymma angustifolium* low shrubland in parts) over *Dasypogon bromeliifolius, Phlebocarya ciliata* open herbland (near edge of unit) and *Lyginia imberbis, Hypolaena exsulca* very open sedgeland.

Habitat and soil: Slight depression on flat (wetland). Sand.

Notes: This vegetation was recorded at releve WCR2 (Plate 6) (details in Appendix 6). It occurred in a small area in the north-west corner of the survey area. It occurred in a mosaic with sedgeland unit Ss in the south-western part of the survey area, where it was surrounded by transitional dampland vegetation that had an overstorey that included scattered *Melaleuca preissiana, Banksia littoralis* and *Banksia ilicifolia* and had patches of *Melaleuca teretifolia* open shrubland (see site description MNB2, Appendix 6)

Ss

Acacia pulchella var. *goadbyi* scattered shrubs over *Hypocalymma angustifolium, Pericalymma ellipticum* scattered low shrubs over *Schoenus subfascicularis* closed sedgeland.

Habitat and soil: Flat dampland. Grey sand.

Notes: This vegetation was recorded at quadrat WR5 (Plate 7) (details in Appendix 5). This vegetation occurred in a small area in the southwest corner of the survey area.

AcHa

Kunzea glabrescens scattered tall shrubs over *Adenanthos cygnorum* shrubland over *Hypocalymma angustifolium* low open shrubland over *Hypolaena exsulca* very open sedgeland with *Dasypogon bromeliifolius, Phlebocarya ciliata* herbland.

Habitat and soil: Flat at base of dune (wetland transition). Pale grey to white sand.

Notes: This vegetation was recorded at quadrat WR6 (Plate 8) (details in Appendix 5). It occurred in a small area in the south-east corner of the survey area.

Plate 6. ***Pericalymma ellipticum*** **heath vegetation, 'Pe', at releve site WCR2.**

Plate 7. ***Schoenus subfascicularis*** **sedgeland vegetation unit 'Ss' at quadrat WR5.**

Plate 8. Vegetation unit 'AcHa' at quadrat WR6.

5.2 Wetland vegetation

The vegetation units described in section 5.1 above are shown in Table 6, together with their wetland status. The location of the wetland vegetation and its boundaries can be seen in Figure 6.

The *Pericalymma ellipticum* heath ('Pe') and *Schoenus subfascicularis* sedgeland ('Ss') units were considered to be wetland vegetation (seasonal damplands). These wetlands units occurred on the eastern side of the survey area. Two transitional vegetation units on the flats at the baseof the dune ('MpAa' and 'AcHa'), were deemed to be transitional damplands. 'MpAa' was considered to be a transitional dampland because of its relationships with the wetland FCT5 evident in the PATN analysis dendrogram and because it included high cover of the wetland obligate *Melaleuca preissiana*. 'AcHa' was considered to be a transitional dampland because of its affinity to wetland FCT4, demonstrated in the PATN nearest neighbour analysis and because of the presence of some wetland obligate species. Conversely, the transitional vegetation unit 'MpBmBa', that occurred on the base of the dune slopes, had mostly dryland elements and was considered to be transitional dryland vegetation.

Table 6. Rocla Warton Rd vegetation units and their wetland status

Vegetation grouping	Vegetation unit	Wetland status	Comments
(i) *Banksia attenuata-Banksia menziesii* low woodlands on dune slopes	BaBm	Dryland	
(ii) *Melaleuca preissiana* mixed woodlands on gentle slopes and flats around the base of the dune (transitional vegetation)	MpAa	Transitional wetland (dampland)	Includes some obligate wetland species (*Melaleuca preissiana* (as a mixed low open forest), *Astartea affinis* and *Baumea juncea*) and came out close to FCT5 on the PATN dendrogram, although nearest neighbours found 'MpAa' most similar to dryland FCT's 23a and 28 (see Appendix 8).
" "	MpBmBa	Dryland (transitional)	Only scattered *Melaleuca preissiana* trees amongst predominantly dryland species.
" "	AcHa	Transitional wetland (dampland)	Includes some obligate wetland species, such as *Astartea affinis* and *Hypolaena exsulca* and is floristically similar to the dampland FCT4, as well as some dryland vegetation FCT's (see Appendix 8).
(iii) *Pericalymma* heaths and sedgelands on flats (dampland/palusplain).	Pe	Wetland (dampland)	Inferred as FCT5
" "	Ss	Wetland (dampland)	Affinity to wetland FCT5 demonstrated by PATN nearest neighbours analysis

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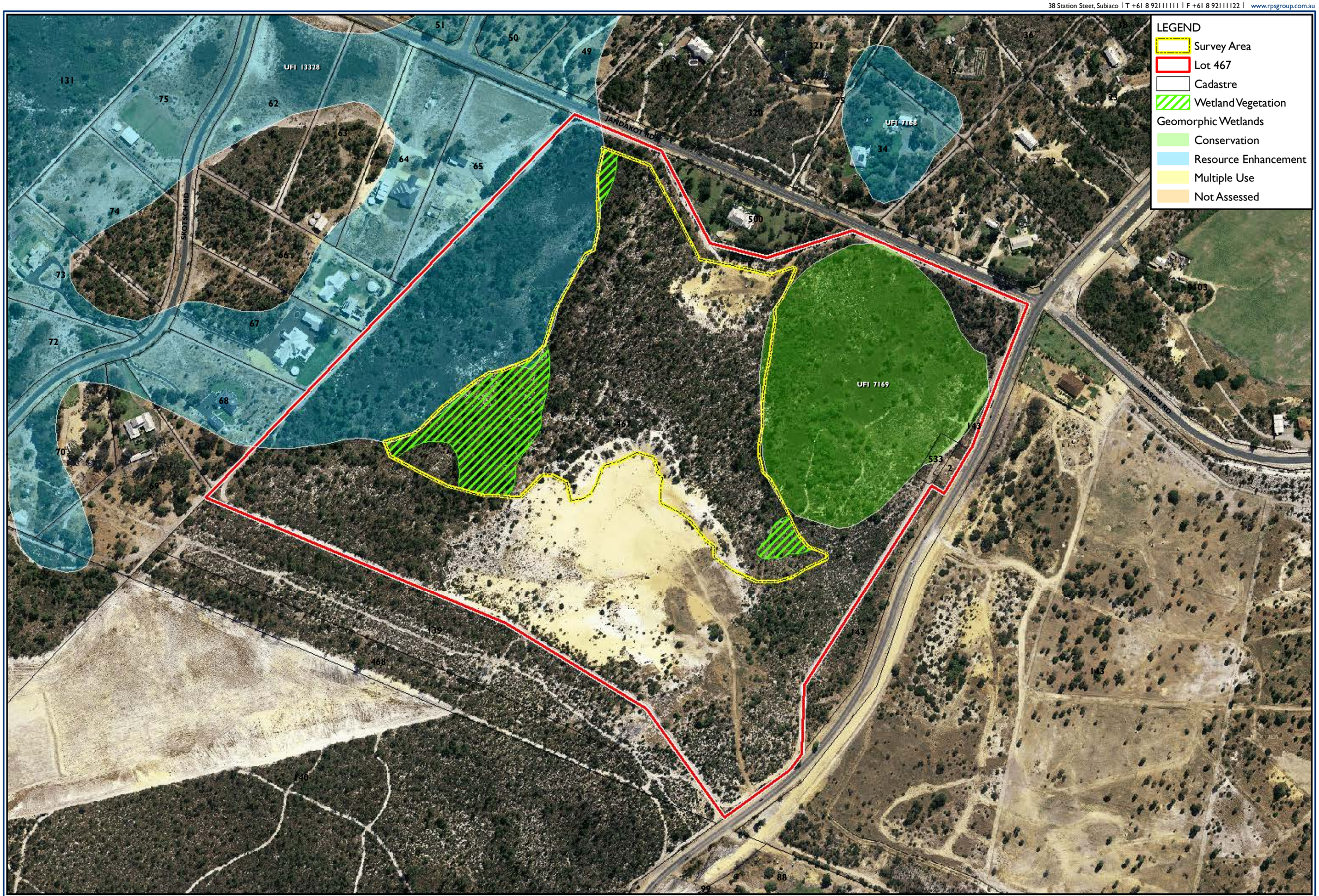

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Figure 6

Wetland Vegetation

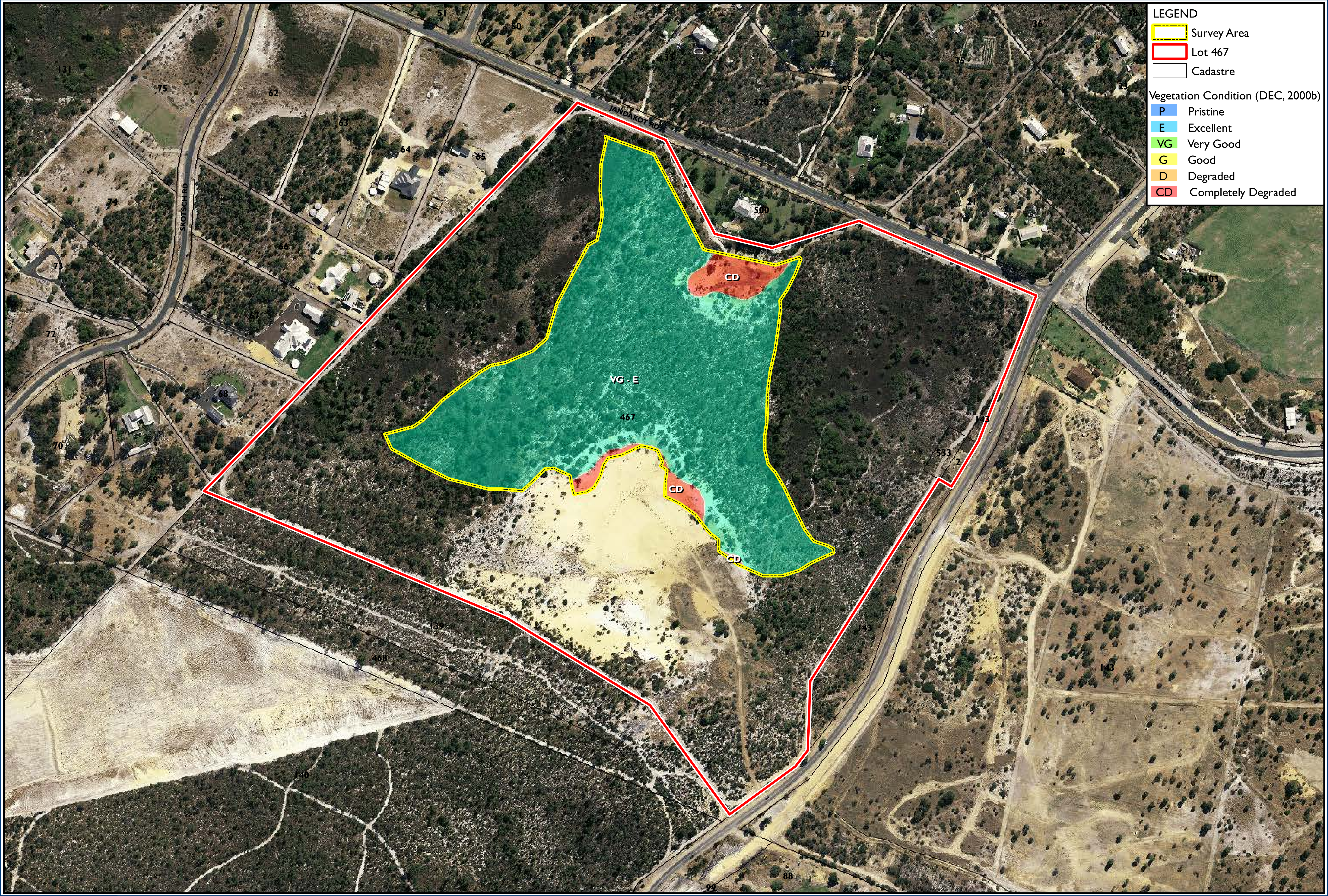
5.3 Vegetation condition

The vegetation in the survey area was mostly rated Very Good to Excellent, with the vegetation condition rated Excellent at a number of sample locations on the dunes and flats (Figure 7). The condition of the wetland vegetation was considered to be Very Good to Excellent. Completely Degraded areas in the northern and southern parts of the survey area were past sand mine areas (Plate 9).

Thirty eight weeds were recorded in the survey area (Appendix 4). However, weed cover was generally low throughout the remnant bushland in the survey area and were only abundant in the Completely Degraded areas.

Banksia spp. deaths, including recent deaths, were noted on the dune slopes in the survey area (Plates 10, 11). Locations of some of the observed areas of Banksia deaths are provided in Appendix 7. The deaths and decline of *Banksia* trees at this site probably indicate the presence of the Dieback fungus *Phytophthera cinnamomi*. However, other agents such as fire and drought (including falling water tables), as well as other pathogens, may also be responsible for Banksia tree deaths. To determine if Dieback is present and over what area, a dieback survey by accredited 'dieback interpreters' would be required.

Plate 9. Completely Degraded old sand mine area at the northern end of the survey area.



RPS

Job Number: L10478
Date: 20.05.11
Scale: 1:4000 @ A3
Revision: 0
Drafted by: SC
Source: Cadastre & Orthophoto - Landgate 2010

0 25 50 100 150 200 metres

Figure 7

Vegetation Condition

Plate 10. Banksia tree deaths in bushland just south of the old northern sand mine.

Plate 11. *Banksia attenuata* and *Banksia menziesii* deaths at the base of the dune on the east side of the survey area.

5.4 *Lomandra hermaphrodita* and *L. maritima* occurrence : host plants of the Graceful Sun Moth

The Graceful Sun Moth (*Synemon gratiosa*, Family Castniidae) is endemic to Western Australia, and is currently considered restricted to the Swan Coastal Plain between the Wanneroo area in northern Perth, south to Mandurah (approximately 60 km south of Perth). The Graceful Sun Moth is listed as under the *Environment Protection and Biodiversity Conservation Act 1999* and is also currently listed on Schedule 1 (fauna that is rare or is likely to become extinct) of the Western Australian *Wildlife Conservation Act 1950.*

The Graceful Sun Moth is thought to breed exclusively on *Lomandra* species, probably *L. hermaphrodita*. Two known food plants for the Graceful Sun Moth are *Lomandra hermaphrodita* and *L. maritima* (McNamara 2009, sited on Department of the Environment, Water, Heritage and the Arts website).

Lomandra maritima was not recorded in the Rocla Warton Rd survey area. However, *Lomandra hermaphrodita* plants were recorded at all three of the quadrats located on the dune slopes. While opportunisitic sightings of *Lomandra hermaphrodita* plants elsewhere in the site were not recorded during the survey, the fact that it occurred at all three sample points on the dune (less than 2% cover) suggests that it is probably scattered on the dune slopes in the survey area.

6.0 FLORISTIC COMMUNITY TYPES (FCT'S), THREATENED ECOLOGICAL COMMUNITIES (TEC'S) AND PRIORITY ECOLOGICAL COMMUNITIES (PEC'S)

This section outlines the results of the floristic analysis conducted by Mr Ted Griffin using the 2010 Rocla Warton Rd survey data and the Gibson *et al*. (1994) Swan Coastal Plain dataset. It is based on a detailed report prepared by Mr Ted Griffin, which is set out in full in Appendix 8.

6.1 Floristic analysis

6.1.1 Data Compatability

Mr Ted Griffin assessed that the Rocla Warton Rd survey sites appeared to have similar numbers of ephemeral species (such as Orchids) to those of the Gibson *et al*. (1994) sites. Further, he concluded that on the basis of richness and names that the datasets were probably sufficiently compatible to obtain reliable determinations (Appendix 8).

6.1.2 Determination of Floristic Community Types (FCT) by classification

The dendrogram results of the PATN analysis classification are shown in Appendix 8 and Table 7. This shows that the Rocla Warton Rd sites were divided between the dune sites that were most similar to FCT23a and sites on the flats that were similar to the wetland FCT's 4 and 5.

6.1.3 Determination of Floristic Community Types (FCT) using nearest neighbours method

Griffin found that the the nearest neighbour analysis also suggested that the Rocla Warton Rd dune slope sites belong to FCT23a, but suggested that two of the sites on the flats had affinities to both wetland and dryland FCT's (see Table 7; Appendix 8).

6.1.4 Combining the results: assignment of Floristic Community Types (FCT) to the Rocla Warton Rd quadrat sites

The overall result of the Rocla Warton Rd quadrat PATN analysis is shown in Table 7 below (reproduced from Griffin's report, see Appendix 8).

The dune Banksia woodland vegetation sites were all most similar to Floristic Community Type (FCT) 23a. The *Schoenus subfascicularis* sedgeland vegetation was consistently similar to FCT5 dampland sites. The *Adenanthos cygnorum-Hypocalymma angustifolium* shrubland site had mixed affinities, but had strong affinity to dampland FCT4 vegetation. The *Melaleuca preissiana* low open forest vegetation had some affinity with dampland vegetation FCT5. Both the

Melaleuca preissiana low open forest and *Adenanthos cygnorum-Hypocalymma angustifolium* shrubland vegetation were deemed to be wetland vegetation units because of their PATN floristic affinities and because of the presence and cover of obligate wetland species.

In interpreting the PATN analysis results, Griffin noted that "It is common for the classification '(dendrogram)' to indicate a simple result and the nearest neighbour analysis to be less conclusive. This is more a product of the classification process often suggesting an over simplified view than of inconsistency of the analyses" (see Appendix 8). Griffin (*pers. comm*.) has previously noted that the nearest neighbour analysis is more easily interpreted and reliable than the classification analysis and has given more weight to the nearest neighbour analysis assignment of vegetation sites to FCT's.

Table 7. Summary of Rocla Warton Rd PATN Analysis results. (Adapted from report by EA Griffin which is reproduced in full in Appendix 8).

Site	Dendrogram FCT	NNB FCT	Summary FCT
WR1	23a	23a	23a
WR 2	23a	23a	23a
WR 3	23a	23a	23a
WR 4	5	23a,28	23a/5
WR 5	5	5	5
WR 6	4	4,22,23a	4? (4/22)

6.2 Rocla Warton Rd vegetation units, their Floristic Community Types and assessment for Threatened Ecological Communities (TEC's) and Priority Ecological Communities (PEC's)

The vegetation units described and mapped in the Rocla Warton Rd survey area are listed in Table 8, together with the quadrats recorded in those units and the FCT's attributed by PATN analysis (and in some cases inferred) to those sites. FCT's were inferred to the vegetation units by comparison with other floristically similar Rocla Warton Rd vegetation units where quadrats had been recorded or by comparing species in site descriptions with species occurring in the Gibson *et al*. FCT's.

All of the FCT's with which Rocla Warton Rd vegetation units were found to have an affinity, are listed in Table 9, along with their descriptions, predominant landforms and status. Referrence to the current list of TEC's for Western Australia (DEC

website Aug 2010) showed that none of the FCT's occurring in the survey area were Threatened Ecological Community. One vegetation unit, 'AcHa', had some affinity with FCT22, which is a Priority 2 PEC (Tables 8 and 9).

Table 8. Summary of Rocla Warton Rd survey area vegetation units and FCT's.

Mapped Vegtn unit	Broad classification	Site	FCTz
AcHa	*Pericalymma* heaths and sedgelands on flats (dampland/palusplain).	WR6	4/22
BaBm	*Banksia attenuata-Banksia menziesii* low woodlands on dune slopes	WR1, WR2, WR3	23a
MpAa	*Melaleuca preissiana* mixed woodlands and mixed shrublands on gentle slopes and flats around the base of the dune (transitional vegetation)	WR4	23a/5
MpBmBa	*Melaleuca preissiana* mixed woodlands and mixed shrublands on gentle slopes and flats around the base of the dune (transitional vegetation)	WCR1, MNK1	$23a_z$
Pe	*Pericalymma* heaths and sedgelands on flats (dampland/palusplain).	WCR2, MNB2	5_z
Ss	*Pericalymma* heaths and sedgelands on flats (dampland/palusplain).	WR5	5

z FCTs inferred.

Table 9. Summary of Floristic Community Types occurring in the Rocla Warton Rd survey area.

FCT	Generalised description	Predominant landform	Status
FCT4	*Melaleuca preissiana* damplands	Bassendean	none
FCT5	Mixed shrub damplands	Bassendean/Pinjarra plain	none
FCT22	*Banksia ilicifolia* woodlands	Bassendean	PEC (Priority 2)
FCT23a	Central *Banksia attenuata-Banksia menziesii* woodlands	Bassendean	none

7.0 REGIONAL SIGNIFICANCE ASSESSMENT

Flora and vegetation values in the Rocla Warton Rd survey area were assessed for regional significance (Table 10) using the criteria for determination of regional significance of natural areas set out in the EPA Guidance Statement No. 10 (Environmental Protection Authority, 2006) and Bush Forever (Department of Environmental Protection, 2000a).

The Rocla Warton Rd survey area was assessed as regionally significant for flora and vegetation on the following grounds (see Table 10):

- Representation of ecological communities (less than 10% of Southern River Complex is protected (Department of Environmental Protection, 2000b)); and
- Maintaining linkages (part of a 'regionally significant but not contiguous linkage of bushland/wetland area') (Department of Environmental Protection, 2000b).

The vegetation in the Rocla Warton Rd survey area is Southern River Complex, of which 17% of its original extent in the Perth Metropolitan area remains, but about 6% of this original extent has some existing protection (Department of Environmental Protection, 2000a). The Department of Environment and Conservation has a modified objective for Constrained Areas being to seek to:

• retain at least 10% of the pre-clearing extent of the ecological community where >10% of the ecological community remains, or

• retain all remaining areas of each ecological community where <10% of this ecological community remains. (Environmental Protection Authority, 2006)

It was also noted that bushland in the survey area was part of an area of 'upland and wetland' ecological communities.

The Rocla Warton Rd survey area is part of a north-south orientated bushland corridor between Gibbs Rd and Jandakot Airport/Canningvale bushland that has been assigned the status of 'Regionally significant but not contiguous linkage of bushland/wetland areas' (Department of Environmental Protection, 2000b).

It is noted that the Rocla Warton Rd survey area includes a narrow strip along the edge of a Conservation Category Wetland along its eastern boundary (Figures 4 and 5). The vegetation in this part of Conservation Category Wetland has been checked and confirmed as dryland vegetation adjacent to wetland vegetation outside the survey area.

Table 10. Regional Significance Assessment: Rocla Warton Rd

Criterion	Comment
(i) Representation of ecological communities	
Vegetation complexes	BushForever (SCP part of PMA) (DEP, 2000a): Southern River Complex: 17%of original area remaining; 6% existing protection, 10% proposed BF protection. System6+part System 1 (EPA, 2006): Southern River Complex: 19.8% of pre-1750 extent; 1.5% in reserve
Floristic community types	Affinity to 4 FCTs
Size and shape	Fairly small area of remnant bushland within larger area of bushland.
Uplands and wetlands	Wetlands and adjacent upland vegetation is present in the survey area.
Vegetation condition	Remnants mostly in Very Good to Excellent condition. Dieback is most likely present in the survey area, but plant deaths do not appear to have been broad scale, with the exception of small areas of recent deaths that were observed.
Conclusion	• Southern River Complex have less than 10% of original extent in reserve = Regionally Significant.
(ii) Diversity	
Vegetation Complexes	One Complex (Southern River), although very close to the western edge of Bassendean Central and South Complex.
FCT's	Vegetation units mainly group with 4 FCT's.
Vegetation units	Six vegetation units (some wetland units only small area). One dryland unit, 1 dryland (transitional) unit, 1 wetland unit and 2 wetland (transitional) vegetation units and 2 wetland units.
Flora	155 native plant species recorded. Moderate number for size of area (11 hectares). Species richness: dampland quadrats had lower species richness (32 spp. incl. weeds); Banksia woodland had moderate to high species richness (46-68). Transitional dampland sites had higher species counts due to their transitional nature (dryland specie also found there.)
Conclusion	Moderate values for diversity
(iii) Rarity	
Flora	No DRF. No Priority species. Two other species of regional significance.
Vegetation :TEC's	No Tec's. One vegetation unit had mixed affinity that included a secondary affinity to PEC (FCT22). This vegetation units only covered a small area.
Conclusion:	Moderate values for rare vegetation.
(iv) Maintaining ecological processes	
Linkage	Rocla Warton Rd survey area lies in a north-south bushland corridor between Gibbs Rd and Jandakot airport/Canningvale bushlands that has been deemed 'Regionally significant but not contiguous linkage of bushland/wetland areas' (DEP, 2000b).
Size of areas in natural condition	Remnant area covers most of survey area, which is a little greater than 10 hectares in size.
Conclusion:	Regionally significant for maintaining linkages.
(v) Scientific or evolutionary importance	No known scientific or evolutionary importance.
(vi) General criteria for protection of wetland, streamline, estuarine	Wetland vegetation was recorded in the survey area (Very Good to Excellent condition), but is not classified as 'conservation category wetland' A small strip of a conservation wetland along the eastern boundary was inside the survey area. However, the actual vegetation inside the boundary was 'dryland vegetation'.
Conclusion:	
Summary:	Regionally significant for: • representation of ecological communities and • for maintaining linkages

8.0 ACKNOWLEDGEMENTS

Field work was coordinated by Carrie Gill (RPS). Quadrat recording and rare flora searching was undertaken by Carrie Gill, Kelli McCreery and Brian Morgan. Carrie Gill did the vegetation unit and vegetation condition mapping in the field.

Plant identifications were mostly undertaken by Brian Morgan and Chris Hancock, with some assistance from Cate Tauss. Mike Hislop (Western Australian Herbarium) undertook a few difficult identifications, Allen Lowrie identified some of the Drosera and Stylidium specimens and Russell Barrett identified the Lepidosperm's.

Mr Ted Griffin ran the PATN analysis and gave advice on the interpretation of the results. His report is included in full in Appendix 8.

Simon Croft (RPS) prepared the GIS mapping for the report.

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APPENDIX ONE. The Department of Environment and Conservation Declared Rare Flora and Priority Flora Categories (from Smith, 2010)

Declared Rare 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.

Declared Rare Flora - Presumed Extinct Flora

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.

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.

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 (ie. not currently endangered). Such taxa are under consideration for declaration as "rare flora", but are in urgent need of further survey.

Priority Three - Poorly Known Taxa.

Taxa which are known from several populations, and the taxa are not believed to 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 are in need of further study.

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.

APPENDIX TWO. Vegetation structural table of Trudgen based on Aplin's (1979) modification of Specht's classification

Life form and height of tallest stratum	Projective foliage cover of tallest stratum as %	Description
Trees over 30 metres	70 -100	High closed forest
	30 -70	High open forest
	10 - 30	high woodland
	2 -10	high open woodland
	under 2	Scattered tall trees
Trees 10 - 30 metres	70 -100	Closed forest
	30 -70	Open forest
	10 - 30	Woodland
	2 -10	Open woodland
	under 2	Scattered trees
Trees under 10 metres	70 -100	Low closed forest
	30 - 70	Low open forest
	10 - 30	Low woodland
	2 -10	Low open woodland
	under 2	Scattered low trees
Shrubs over 2 metres	70 - 100	Closed scrub
	30 - 70	Open scrub
	10 - 30	High shrubland
	2 -10	High open shrubland
	under 2	Scattered tall shrubs
Shrubs 1 - 2 metres	70 - 100	Closed heath
	30 - 70	Open heath
	10 - 30	Shrubland
	2 -10	Open shrubland
	under 2	Scattered shrubs
Shrubs under 1 metre	70 - 100	low closed heath
	30 - 70	low open heath
	10 - 30	low shrubland
	2 -10	Low open shrubland
	under 2	Low scattered shrubs
Herbs/Sedges/Grasses	70 - 100	Closed herb, sedge, grassland
	30 - 70	Herb, sedge, grassland
	10 - 30	Open herb, sedge, grassland
	2 -10	Very open herb, sedge, g'land
	under 2	Scattered herbs sedges, grasses

Grasslands then divided into:
Tussock grasslands (perennial tussock species, e.g. Eragrostis species);
Hummock grasslands (Triodia and Plectrachne species that form hummocks)
Curly spinifex grassland (Plectrachne pungens, which does not form hummocks) (follows J.S. Beard).
Annual tussock grassland (e.g. annual Sorghum species).

APPENDIX THREE. Vegetation condition scale and descriptions

(from Keighery 1994, reproduced in Department of Environmental Protection 2000b)

Pristine (1) : Pristine or nearly so, no obvious signs of disturbance

Excellent (2) : Vegetation structure intact, disturbance affecting individual species and weeds are non-aggressive species.

Very Good (3) : 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 (4) : Vegetation structure significantly altered by very obvious signs of multiple disturbance. 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 (5) : 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 (6) : 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.

APPENDIX FOUR Flora list for the Rocla Warton Rd survey area

Notes:
1. Plant families are listed in alphabetical order within the main classification groups.
2. An asterisk (*) beside the taxon name indicates an introduced species not native to the survey area..
4. The 'status' column shows the conservation status of significant flora species on the list.
DRF = Declared Rare Flora; P1 to P4 = Priority 1 to Priority 4 (see definitions in Appendix 1); RS = other regionally significant flora

FAMILY/TAXA	COMMON NAMES	PRIORITY STATUS
PTERIDOPHYTA (ferns and fern allies)		
CLASS LYCOPSIDA (fern allies)		
SELAGINELLACEAE		
Selaginella gracillima		
GYMNOSPERMAE		
CLASS CYCADOPSIDA (Cycads)		
ZAMIACEAE		
Macrozamia riedlei	Zamia	
ANGIOSPERMAE (flowering plants)		
AIZOACEAE		
*Carpobrotus edulis	pigface	
APIACEAE		
Trachymene pilosa		
Xanthosia huegelii		
ARACEAE		
*Zantedeschia aethiopica	Arum lily	
ASPARAGACEAE		
*Asparagus asparagoides	Bridle creeper	
Chamaescilla corymbosa		
Laxmannia ramosa subsp. ramosa		
Laxmannia squarrosa		
Thysanotus manglesianus/patersonii		
Thysanotus tenellus		
ASTERACEAE		
*Arctotheca calendula	Capeweed	
Brachyscome iberidifolia		
*Hedypnois rhagadioloides subsp. cretica		
Hyalosperma cotula		

FAMILY/TAXA	COMMON NAMES	PRIORITY STATUS
ASTERACEAE (cont)		
*Hypochaeris glabra		
Lagenophora huegelii		
Podotheca angustifolia		
Podotheca chrysantha		
Podotheca gnaphalioides		
Quinetia urvillei		
Rhodanthe citrina		
Siloxerus humifusus		
*Sonchus oleraceus		
*Ursinia anthemoides		
BORAGINACEAE		
*Echium plantagineum		
CACTACEAE		
*Opuntia stricta	Prickly pear	
CAMPANULACEAE		
*Wahlenbergia capensis		
Wahlenbergia preissii		
CASUARINACEAE		
Allocasuarina fraseriana	Sheoak	
Allocasuarina humilis		
CENTROLEPIDACEAE		
Centrolepis drummondiana		
COLCHICACEAE		
Burchardia congesta		
Wurmbea sp.		
CRASSULACEAE		
Crassula colorata var. colorata		
CYPERACEAE		
Baumea juncea		
Baumea vaginalis		
*Isolepis marginata		
Lepidosperma longitudinale		
Lepidosperma scabrum (Inland form)		
Lepidosperma sp.	(formerly L. pubisquameum)	
Lepidosperma sp. Coastal Dunes	(formerly L. pubisquameum)	
Lepidosperma sp. K Boorabbin (K.L. Wilson 2579)	(formerly L. pubisquameum)	

FAMILY/TAXA	COMMON NAMES	PRIORITY STATUS
CYPERACEAE (cont)		
Mesomelaena pseudostygia		
Schoenus clandestinus		
Schoenus curvifolius		
Schoenus subfascicularis		
DASYPOGONACEAE		
Calectasia narragara		
Dasypogon bromeliifolius		
Lomandra caespitosa		
Lomandra hermaphrodita		
Lomandra preissii		
Lomandra suaveolens		
DILLENIACEAE		
Hibbertia aurea		
Hibbertia huegelii		
Hibbertia huegelii sens. lat.		
Hibbertia hypericoides		
Hibbertia racemosa		
Hibbertia subvaginata		
Hibbertia vaginata		
DROSERACEAE		
Drosera erythrorhiza subsp. erythrorhiza		
Drosera glanduligera		
Drosera menziesii subsp. penicillaris		
Drosera paleacea		
Drosera pallida		
ERICACEAE		
Astroloma xerophyllum		
Conostephium pendulum		
Leucopogon conostephioides		
Leucopogon sp. Murdoch (M. Hislop 1037)		
EUPHORBIACEAE		
*Euphorbia peplus		
Monotaxis occidentalis		
Poranthera microphylla		

FAMILY/TAXA	COMMON NAMES	PRIORITY STATUS
FABACEAE		
Acacia applanata		
Acacia huegelii		
*Acacia longifolia	Sydney Golden wattle	
Acacia pulchella var. goadbyi		
Acacia stenoptera		
Bossiaea eriocarpa		
Daviesia incrassata subsp. incrassata		
Daviesia triflora		
Euchilopsis linearis		
Gastrolobium capitatum		
Gompholobium tomentosum		
Hardenbergia comptoniana		
Hovea trisperma		
Jacksonia furcellata		
Kennedia prostrata		
Pultenaea ochreata		
*Trifolium arvense		
GERANIACEAE		
*Erodium botrys		
*Pelargonium capitatum		
GOODENIACEAE		
Dampiera linearis		
Lechenaultia floribunda		
Scaevola repens var. repens		
HAEMODORACEAE		
Anigozanthos humilis		
Anigozanthos manglesii subsp. manglesii	Red and Green kangaroo paw	
Conostylis aculeata subsp. aculeata		
Conostylis aculeata subsp. preissii		
Conostylis aurea		
Conostylis juncea		
Haemodorum spicatum		
Phlebocarya ciliata		
Phlebocarya filifolia		
HALORAGACEAE		
Gonocarpus pithyoides		

FAMILY/TAXA	COMMON NAMES	PRIORITY STATUS
HEMEROCALLIDACEAE		
Arnocrinum preissii		
Dianella revoluta var. divaricata		
Hensmania turbinata		
Tricoryne elatior		
IRIDACEAE		
*Gladiolus caryophyllaceus		
Patersonia occidentalis var. angustifolia		
*Watsonia meriana var. bulbillifera		
LAMIACEAE		
Hemiandra pungens		
LAURACEAE		
Cassytha racemosa forma racemosa		
LOGANIACEAE		
Phyllangium divergens		
LORANTHACEAE		
Nuytsia floribunda	Christmas tree	
MOLLUGINACEAE		
Macarthuria australis		
MYRTACEAE		
Astartea affinis		
Calothamnus hirsutus		
Calytrix angulata		
Calytrix flavescens		
*Chamelaucium uncinatum	Geraldton wax	
Darwinia citriodora		
Eremaea pauciflora var. pauciflora		
Eucalyptus marginata subsp. marginata	Jarrah	
Eucalyptus rudis	Flooded gum	
Eucalyptus todtiana	Prickly bark	
Hypocalymma angustifolium		
Kunzea glabrescens		
Melaleuca preissiana	Moonah	
Melaleuca seriata		
Melaleuca teretifolia		
Melaleuca thymoides		
Pericalymma ellipticum		
Regelia inops		
Scholtzia involucrata		

FAMILY/TAXA	COMMON NAMES	PRIORITY STATUS
ORCHIDACEAE		
Caladenia discoidea		
Caladenia flava subsp. flava	Cowslip orchid	
Eriochilus dilatatus subsp. multiflorus	White bunny orchid	
Pterostylis sanguinea	Dark banded greenhood orchid	
Pterostylis sp.		
Pyrorchis nigricans		
Thelymitra sp.		
OXALIDACEAE		
*Oxalis pes-caprae	Sour sob	
PAPAVERACEAE		
*Fumaria capreolata		
POACEAE		
*Aira caryophyllea		
Amphipogon turbinatus		
Aristida contorta		
Austrostipa elegantissima		
Austrodanthonia occidentalis		
Austrostipa flavescens		
Austrostipa camplachne		
*Avena barbata		
*Brachypodium distachyon		
*Briza maxima		
*Briza minor		
*Cynodon dactylon	couch	
*Ehrharta calycina	Perennial veldt grass	
*Ehrharta longiflora	Annual veldt grass	
*Eragrostis curvula	Love grass	
*Holcus lanatus		
*Lagurus ovatus		
Microlaena stipoides var. stipoides		
*Pentaschistis airoides subsp. airoides		
*Vulpia bromoides		
*Vulpia myuros forma myuros		
PORTULACACEAE		
Calandrinia corrigioloides		
PRIMULACEAE		
* Lysimachia arvensis	formerly Anagalis arvensis	

FAMILY/TAXA	COMMON NAMES	PRIORITY STATUS
PROTEACEAE		
Adenanthos cygnorum subsp. cygnorum		
Banksia attenuata		
Banksia ilicifolia		
Banksia littoralis	Swamp Banksia	
Banksia menziesii		
Persoonia saccata		
Petrophile linearis		
Stirlingia latifolia		
Synaphea spinulosa subsp. spinulosa		
RESTIONACEAE		
Desmocladus flexuosus		
Hypolaena exsulca		
Lyginia barbata		
Lyginia imberbis		
RUTACEAE		
Boronia crenulata		
Boronia dichotoma		
Boronia ramosa subsp. anethifolia		
Philotheca spicata		
SOLANACEAE		
*Solanum nigrum		
STYLIDIACEAE		
Stylidium brunonianum		
Stylidium repens var. repens		
Stylidium saxifragoides		
Stylidium schoenoides		
THYMELAEACEAE		
Pimelea imbricata		
XANTHORRHOEACEAE		
Xanthorrhoea preissii		

APPENDIX FIVE. Quadrat descriptions and species lists for the Rocla Warton Rd survey area

Warton Rd RPS **Site** WR1
Described CG **Date** 6/10/2010 **Type** Q 10x10
Season E **Uniformit**
Location
MGA Zone 50 396281 **mE** 6444986 **mN**
Habitat South-west facing, upper slope of dune.
Soil Pale grey sand over yellow sand.
Rock Type None
Vegetation Banksia attenuata, Banksia menziesii, (Allocasuarina fraserina) low woodland over Allocasuarina humilis shrubland over Hibbertia hypericoides, Astroloma xerophyllum low shrubland over Desmocladus flexuosus, Amphipogon turbinatus open sedgeland/grassland.
Veg Condition (BF). Excellent. Low to medium disturbance; recent Banksia deaths nearby.
Fire More than 5 years since fire.
Notes Bareground 20%. Litter 40%.
SPECIES LIST:

Quad Name	Cove	C	Heigh	Specime	Notes
Acacia applanata	+		35	WR1-33	Acacia ? wind/app
Acacia stenoptera	+		45	WR1-21	Acacia ? stenop
Aira caryophyllea	+		4	WR1-38	Aira
Allocasuarina humilis	23		160		Allocasuarina humilis
Amphipogon turbinatus	7		35	WR1-4	Amphipogon
Anigozanthos humilis	+		10		Anigozanthos humilis
Astroloma xerophyllum	+		30	WR1-1,1-41	Epacrid
Austrodanthonia occidentalis	+		30	WR1-27,1-46	Austrodanth
Austrostipa flavescens	+		20	WR1-10,44.51	Austrostipa flavescens
Banksia attenuata	15		600cm		Banksia attenuata (2% dead)
Banksia menziesii	6		500		Banksia menziessii
Boronia ramosa subsp. anethifolia	+		25	WR1-47	Boronia
Bossiaea eriocarpa	+		12	WR1-22	Bossiaea eriocarpa
Briza maxima	+		40		Briza maxima
Burchardia congesta	+		40		Burchardia congesta
Caladenia flava subsp. flava	+		20	WR1-13	Caladenia flava
Calandrinia corrigioloides				WR1-39	Calandrinia
Calytrix flavescens	2		20		Calytrix flavescens
Chamaescilla corymbosa	+		10		Chamaescilla
Conostephium pendulum	+		20	WR1-35	Epacrid
Conostylis aculeata subsp. aculeata	+		20	WR1-7	Conostylis aculeata
Conostylis aurea	+		15	WR1-6	Conostylis
Conostylis juncea	+		15	WR1-8	Conostylis g/y ???
Dampiera linearis	+		15		Dampiera linearis
Dasypogon bromeliifolius	+		15		Dasypogon brom
Desmocladus flexuosus	3		15	WR1-3	Desmocladus
Drosera pallida	+		10	WR1-9	Drosera ? macrantha
Ehrharta calycina	+		50		Ehrharta calycina
Eremaea pauciflora	2		70	WR1-2	Eremaea pauc
Gastrolobium capitatum	+		30	WR1-32	Gastrolobium
Gladiolus caryophyllaceus	+		90		Gladiolus caryoph
Gompholobium tomentosum	+		60		Gompholobium toment
Hibbertia huegelii	+		40	WR1-5	Hibbertia huegelii
Hibbertia hypericoides	23		70		Hibbertia hyp
Hibbertia racemosa	+		30	WR1-26	Hibbertia subvag
Hyalosperma cotula	+		5	WR1-11	Hyalosperma cot
Hypochaeris glabra	+		10		Hypochaeris glabra
Laxmannia ramosa subsp. ramosa	+		15	WR1-28	Laxmannia
Laxmannia squarrosa	+		10	WR1-19	Laxmannia on stilts
Lepidosperma sp.	+		35	WR1-15	Lepidosp pubisq

Leucopogon conostephioides	+	30	WR1-30	Leucopogon
Lomandra hermaphrodita	+	20	WR1-18	Lomandra hermaph
Lomandra preissii	+	30	WR1-50	Lomandra
Lomandra suaveolens	+	25	WR1-12,1-48	Lomandra
Lyginia barbata	+	40	WR1-24	Lyginia imberbis
Nuytsia floribunda	+ (<1%)	400		Nuytsia floribunda
Oxalis pes-caprae	+	5		Oxalis pes-caprae
Patersonia occidentalis var. angustifolia	+	30	WR1-17	Patersonia occid
Pelargonium capitatum	+	2		Pelar capit
Petrophile linearis	+	20		Petrophile linearis
Philotheca spicata	+	30		Philotheca spicata
Phlebocarya filifolia	+	25	WR1-45	Phleb ? pilos
Phyllangium divergens	+	5	WR1-40	Phyllangium
Poranthera sp.	+	2	WR1-36	herb
Pterostylis sp.	+	4		Pterostylis (sterile, grazed)
Quinetia urvillei	+	3	WR1-31	Quinettia urv
Schoenus curvifolius	+	30	WR1-34	Schoenus curv
Scholtzia involucrata	1	35		Scholtzia involucr
Siloxerus humifusus	+	2	WR1-37	? Siloxerus
Stirlingia latifolia	2	35		Stirlingia latif
Stylidium brunonianum	+	35	WR1-29	Stylid pnk grey/blue lin rosette
Stylidium repens	+	10	WR1-14	Stylidium repens
Stylidium saxifragoides	+	20	WR1-16	Stylidium ? cil
Thysanotus manglesianus/patersonii	+	40	WR1-42	Thysanotus ????????
Trachymene pilosa	+	3	WR1-25	Trachymene pilosa
Ursinia anthemoides	+	10		Ursinia art
Wahlenbergia capensis	+	3	WR1-23	Wahlenbergia capensis
Xanthosia huegelii	+	10	WR1-52	Xanth hueg

Warton Rd RPS **Site** WR2
Described KM **Date** 6/10/2010 **Type** Q 10x10
Season E **Uniformit**
Location
MGA Zone 50 396280 **mE** 6445069 **mN**
Habitat South-east facing, upper slope of dune.
Soil Pale grey sand over yellow sand.
Rock Type
Vegetation Banksia menziesii, Banksia attenuata (Nuytsia floribunda, Allocasuarina fraseriana) low woodland over Allocasuarina humilis shrubland over Hibbertia hypericoides low shrubland over Amphipogon turbinatus, Desmocladus flexuosus very open grassland/sedgeland.
Veg Condition (BF) Very Good to Excellent. (Low disturbance; some weeds (<5%); some dead Banksia).
Fire More than 5 years since fire.
Notes Bareground 15%. Litter 65%
SPECIES LIST:

Quad Name	Cove C	Heigh	Specime	Notes
Acacia applanata	+	40	WR2-07	Acac
Acacia stenoptera	+	40	WR2-08	Acac
Allocasuarina humilis	25	120		Allo humi humi
Amphipogon turbinatus	6	20		Amphi turbi
Anigozanthos humilis	+	10		Anigo humil
Astroloma xerophyllum	2	60	WR2-04	Astroloma sp
Austrodanthonia occidentalis	+	25	WR2-25	Austrodant
Austrostipa flavescens	+	25	WR2-12,24	Austrostip
Banksia attenuata	15	600		Bank atte (1% dead)
Banksia menziesii	6	500		Bank menz
Bossiaea eriocarpa	+	20		Bossi erioc
Briza maxima	+	20		Briza maxim
Burchardia congesta	+	30		Burch conge

Calytrix flavescens	2	30		Caly flav
Conostylis aurea	+	20	WR2-15	Conos ? aurea
Crassula colorata var. colorata	+	1	WR2-23	Crassula
Dasypogon bromeliifolius	+	20		Dasyp brome
Daviesia triflora	+	60	WR2-06	Davi ? tris
Desmocladus flexuosus	3	30	WR2-09	Desmo
Drosera erythrorhiza subsp. erythrorhiza	+	1		Dros eryth
Drosera menziesii subsp. penicillaris	+	20	WR2-16	Drose ? menz
Drosera pallida		60	WR2-28	Dros mac/pal (+ dead)
Ehrharta calycina	+	60		Ehrha calyc
Gastrolobium capitatum	+	30	WR2-03	Gast sp
Gladiolus caryophyllaceus	+	60		Gladi caryo
Gompholobium tomentosum	+	50		Gomph tome
Hibbertia huegelii	1	20	WR2-05	Hibb hueg
Hibbertia hypericoides	12	60		Hibb hype
Hypochaeris glabra	+	10		Hypo glab
Kunzea glabrescens	1	170	WR2-01	Kunz glab
Laxmannia squarrosa	+	10	WR2-11	Laxma squar
Lepidosperma pubisquameum	+	30		Lepid pubisquameumq
Leucopogon conostephioides	2	50	WR2-02	Leuc ? cono
Lomandra hermaphrodita	+	15	WR2-14	Loman (curly)
Lomandra preissii	+	60	WR2-18	Loman (spike)
Lomandra suaveolens	+	20	WR2-26	Lomandra
Lyginia imberbis	1	35		Lygin imber
Patersonia occidentalis var. angustifolia	+	30		Pater occid
Petrophile linearis	+	20		Petr line
Philotheca spicata	+	60		Philo spica
Podotheca angustifolia	+	2	WR2-17	P sp.
Quinetia urvillei	+	2		Quine urvil
Schoenus curvifolius	+	15	WR2-13	Loman ? caesp
Scholtzia involucrata	2	35		Scho invol
Stirlingia latifolia	1	40		Stir lati
Stylidium brunonianum	+	25	WR2-30	Styl 'brun'
Stylidium repens	2	10	WR2-27	Styli repe
Stylidium saxifragoides	+	2	WR2-21	Styli 'pilif'
Thysanotus manglesianus/patersonii	+	40	WR2-19	Thysa pat/man
Trachymene pilosa	+	5		Trach pilosa
Tricoryne elatior	+	30	WR2-10,29	Lily
Ursinia anthemoides	+	10		Ursin anth
Wahlenbergia capensis	+	10		Wahl capen
Wahlenbergia preissii	+	10	WR2-20	Wahle ? graci
Wurmbea sp.	+	2	WR2-22	Wurmbea ?

Warton Rd RPS **Site** WR3
Described CG **Date** 6/10/2010 **Type** Q 10mx10m
Season E **Uniformit**
Location
MGA Zone 50 396178 **mE** 6445103 **mN**
Habitat West-facing, mid to upper slope of dune
Soil Pale grey sand over yellow sand.
Rock Type None
Vegetation Banksia attenuata, Banksia menziesii, (Eucalyptus todtiana, Allocasuarina fraseriana) low woodland over Hibbertia hypercoides low open heath over Amphipogon turbinatus, Desmocladus flexuosus very open grassland/sedgeland.
Veg Condition (BF) Excellent. (Low disturbance).
Fire More than 5 years since fire.
Notes Bareground 30%. Litter 50%.

SPECIES LIST:

Quad	Name	Cove	C	Heigh	Specime	Notes
	Allocasuarina humilis	+		100		A. humilis
	Amphipogon turbinatus	3		25	WR3-1	Amphipogon
	Anigozanthos humilis	+		20		Anigozanthos humlis
	Austrodanthonia occidentalis	+		40	WR3-28	Poaceae sp (slender)
	Austrostipa flavescens	+		25	WR3-26	? Austrostipa
	Austrostipa variabilis	+		60	WR3-27	Tall native grass
	Banksia attenuata	6		550		Banksia attenuata (1% dead)
	Banksia menziesii	5		400		B. menziezii (2% dead)
	Bossiaea eriocarpa	+		20	WR3-21	Bossiaea eriocarpa
	Briza maxima	+		20		Briza maxima
	Burchardia congesta	+		30		Burchardia cong
	Calytrix flavescens	2		20	WR3-6	?Calytrix flavescens
	Conostylis aculeata subsp. preissii	+		20	WR3-18	Conostylis ? aurea
	Crassula colorata var. colorata	+		2	WR3-25	? Crassula
	Dampiera linearis	+		20		Dampiera linearis
	Dasypogon bromeliifolius	+		20		Dasypogon brom
	Daviesia triflora	+		40	WR3-16	Daviesia
	Desmocladus flexuosus	1		25	WR3-3	Desmocladus sp
	Drosera menziesii subsp. penicillaris	+		60	WR3-10	Drosera pink
	Drosera pallida/menziesii	+		5	WR3-24	Drosera
	Ehrharta calycina	+		50		Ehrharta calycina
	Eucalyptus todtiana	5		600		Eucalyptus todtiana
	Gladiolus caryophyllaceus	+		80		Gladiolus caryo
	Gompholobium tomentosum	1		40		Gompholobium toment
	Hibbertia huegelii	+		30	WR3-13	Hibbertia hueg
	Hibbertia hypericoides	40		60		Hibbertia hyp
	Laxmannia ramosa subsp. ramosa	+		10	WR3-12	Laxmannia
	Laxmannia squarrosa	+		20	WR3-14	Laxmannia on stilts
	Lepidosperma scabrum (Inland form)	+		40	WR3-20	Lepidosperma tevete
	Lepidosperma sp. Coastal Dunes	+		60	WR3-8	Lepidosperma ? pubisqu
	Leucopogon conostephioides	+		50	WR3-19	Epacrid small fwrs
	Lomandra caespitosa	+		25	WR3-5,30	Lomandra (narrow lf)
	Lomandra hermaphrodita	+		30	WR3-11,23	Lomandra bluish
	Lyginia barbata	+		50	(=WR1-24)	Lyginia imberbis
	Patersonia occidentalis var. angustifolia	+		30		Patersonia occident
	Petrophile linearis	+		30		Petrophile linearis
	Philotheca spicata	1		50		Philotheca spicata
	Podotheca angustifolia	+		3	WR3-22	Podotheca
	Schoenus curvifolius	+		25	WR3-29	? Schoenus
	Stirlingia latifolia	2		50		Stirlingia latifolia
	Stylidium brunonianum	+		25	WR3-9	Stilidium linear fleshy
	Stylidium repens	4		10	WR3-2	Stylidium repens
	Stylidium saxifragoides	+		15	WR3-15	Stylidium smll yellow
	Trachymene pilosa	+		5	(=WR1-25)	Trachymene pilosa
	Tricoryne elatior					Tricoryne elatior
	Ursinia anthemoides	+		15		Ursinia anthemoides

Warton Rd RPS **Site** WR4
Described BRM **Date** 6/10/2010 **Type** Q 10x10
Season E **Uniformit**
Location
MGA Zone 50 395973 **mE** 6444979 **mN**
Habitat North facing, very gently sloping to flat seasonal dampland.
Soil Grey sand.
Rock Type None
Vegetation Melaleuca preissiana, (Allocasuarina fraseriana) low open forest over Xanthorrhoea preissii, Astartea affinis open shrubland over Hypocalymma angustifolium scattered low shrubs over Dasypogon bromeliifolius open herbland to herbland and Chamaescilla corymbosa open annual herbland.
Veg Condition (BF) Excellent. (Low disturbance; some weeds (<5%))
Fire More than 5 years since last fire.
Notes Litter >90%.
SPECIES LIST:

Quad	Name	Cove	C	Heigh	Specime	Notes
	Acacia pulchella var. goadbyi	+		100	WR4-34	Acac pulc (o/hang + seedling)
	Aira caryophyllea	+		4	WR4-23	Aira
	Allocasuarina fraseriana	8		800		Allocasuarina
	Astartea affinis	4		190	WR4-2	Astartea
	Austrostipa flavescens	+		20	WR4-30	Austrost
	Avena barbata	+		25	WR4-21	Grass
	Baumea juncea	+		50	WR4-6	Baumea juncea (not collected!)
	Boronia ramosa subsp. anethifolia	+		20	WR4-27	Boronia
	Bossiaea eriocarpa	+		30		Bossiaea eriocarpa
	Briza maxima	+		30		Briza max
	Briza minor	+		10		Briza minor
	Burchardia congesta	+		30		Burch conge
	Caladenia flava subsp. flava	+		15		Caladenia flava var. flava
	Calandrinia corrigioloides	+		3	WR4-8,10	Calandrinia
	Centrolepis drummondiana	+		2	WR4-24	Centrolepis
	Chamaescilla corymbosa	15		20	WR4-3	Chamaescilla corym
	Conostephium pendulum	+		15		Conostep peno
	Conostylis juncea	+		20	WR4-13,33	Conostylis
	Crassula colorata var. colorata	+		1	WR4-22	Crassula
	Dasypogon bromeliifolius	25		40		Dasypogon brom
	Dianella revoluta var. divaricata	+		35		Dianella rev
	Drosera pallida	+		45	WR4-5	Drosera climber
	Eriochilus dilatatus subsp. multiflorus	+		15	WR4-14	Orchid spade lf
	Fumaria capreolata	+		10		Fumaria weed (white
	Gladiolus caryophyllaceus	+		70		Gladiolus caryo
	Hibbertia hypericoides	+		40		Hibbertia hypercoides
	Hibbertia subvaginata	+		25	WR4-20	Hibbertia vag
	Hovea trisperma	+		20		Hovea elliptica
	Hyalosperma cotula	+		4	WR4-7	daisy wte
	Hypocalymma angustifolium	+		50		Hypocalymma angust
	Hypochaeris glabra	+		1		Hypochaeris glabra
	Isolepis marginata	+		2	WR4-11	Isolepis ? mag
	Lagenophora huegelii	+		12		Lagenophora huegelii
	Lepidosperma sp.	+		45	WR4-15,29	Sedge
	Lepidosperma sp. K Boorabbin (K.L. Wilson	+		45	WR4-16	Sedge
	Lomandra caespitosa	+		20	WR4-19	Lomandra caespitosa
	Lomandra preissii	+		40	WR4-4	Lomandra preissii
	Melaleuca preissiana	60		700	WR4-1	Melaleuca preissiana
	Oxalis pes-caprae	+		30		Oxalis pes-caprae
	Phlebocarya ciliata	+		30	WR4-17,32	Conost acul
	Podotheca gnaphalioides	+		15	WR4-26	Podotheca ?grac /chrys
	Poranthera microphylla	+		3	WR4-18	? Poranthera micro
	Quinetia urvillei	+		2		Quinetia urvillei

Siloxerus humifusus	+	1	WR4-31	Siloxeros
Sonchus oleraceus	+	2		Sonchus oleraceus
Thelymitra sp.	+	20	WR4-25	Thelymitra orchid
Thysanotus manglesianus/patersonii	+	20		Thysanotus mang/pat
Trachymene pilosa	+	5		Trachymene pilosa
Wahlenbergia preissii	+	20	WR4-9,12,28	Wahlenb (native)
Xanthorrhoea preissii	7	180		Xanth preissii

Warton Rd RPS **Site** WR5
Described BRM **Date** 6/10/2010 **Type** Q 10mx10m
Season E **Uniformit**
Location
MGA Zone 50 396012 **mE** 6444933 **mN**
Habitat Flat dampland.
Soil Grey sand.
Rock Type None
Vegetation Acacia pulchella var. goadbyi scattered shrubs over Hypocalymma angustifolium, Pericalymma ellipticum scattered low shrubs over Baumea juncea, Schoenus subfascicularis closed sedgeland.
Veg Condition (BF) Excellent. (Low disturbance; some weeds, rabbits).
Fire More than 5 years since fire.
Notes Bareground 3%. Litter 30%.
SPECIES LIST:

Quad	Name	Cove	C	Heigh	Specime	Notes
	Acacia pulchella var. goadbyi	1		140	WR5-2	Acacia pulchella
	Aira caryophyllea	+		12	WR5-4	grass
	Anagallis arvensis	+		12		Anagallis arvensis (sterile)
	Astartea affinis	+		10	WR5-7	Astartea (juv)
	Austrostipa flavescens	+			WR5-17	?Austrostipa
	Baumea juncea					
	Boronia ramosa subsp. anethifolia	+		35	WR5-11,20	Boronia ?racemosa
	Briza maxima	+		20		Briza max
	Carpobrotus edulis	+		3		Carpobrotus (pigface)
	Chamaescilla corymbosa	+		5	??(=WR4-3)	Chamaescilla (?grazed; finished flrg)
	Dasypogon bromeliifolius	+		50		Dasypogon brom
	Ehrharta calycina	+		45		Ehrhata calyc
	Euchilopsis linearis	2		40	WR5-6	pea orange flr
	Gladiolus caryophyllaceus	+		70		Gladiolus car (pk flr)
	Hyalosperma cotula	+		5	(=WR4-7)	daisy
	Hypocalymma angustifolium	+		80		Hypocalymma angust
	Hypochaeris glabra	3		3		Hypochaeris glabra (cats tongue)
	Pericalymma ellipticum	+		70	WR5-1	Pericalymma/ Leptosperm
	Phlebocarya ciliata	+				WR5-18 ? Phlebocarya
	Phyllangium divergens	+		4	WR5-14	Phyllangium
	Quinetia urvillei	+		3		Quinetia urvillei
	Rhodanthe citrina	+		5	WR5-12	? Waitzia
	Schoenus subfascicularis	90		60	WR5-3	Schoenus
	Selaginella gracillima	+		2	WR5-15	Herb
	Siloxerus humifusus	+		2	WR5-16	Herb? Siloxerus
	Sonchus oleraceus	+				Sonchus oleracaceus
	Stylidium brunonianum	+			WR5-19	Stylidium
	Thysanotus manglesianus/patersonii	+		40		Thysanotus mang/pat
	Trachymene pilosa	+		3		Trachymene pilosa
	Ursinia anthemoides	+		5		Ursinia art
	Vulpia myuros forma myuros	+		40	WR5-10	Grass (?Vulpia)
	Wahlenbergia preissii	+		4	WR5-13	Whalenbergia

Warton Rd RPS **Site** WR6
Described CG **Date** 6/10/2010 **Type** Q 10mx10m
Season E **Uniformit**
Location
MGA Zone 50 396375 **mE** 6444859 **mN**
Habitat Flat at base of dune (wetland transition)
Soil Pale grey to white sand.
Rock Type None
Vegetation Kunzea glabrescens scattered tall shrubs over Adenanthos cygnorum shrubland over Hypocalymma angustifolium low open shrubland over Hypolaena exsulca very open sedgeland with Dasypogon bromeliifolius and Phlebocarya ciliata herbland.
Veg Condition (BF) Very Good to Excellent. (Low disturbance).
Fire More than 5 years since last fire.
Notes Bareground 20%. Litter 5%.
SPECIES LIST:

Quad Name	Cove	C	Heigh	Specime	Notes
Adenanthos cygnorum	7		200		Adenanthos cygnorum
Astartea affinis	2		80	WR6-3	Astartea affinis
Calandrinia corrigioloides	+		1	WR6-1	Calandrinia
Crassula colorata var. colorata	+		1	WR6-10	Crassula
Dasypogon bromeliifolius	20		40		Dasypogon brom
Ehrharta calycina	+		70		Ehrharta caly
Ehrharta longiflora	+			WR6-16	Poaceae (mini)
Gladiolus caryophyllaceus	+		80		Glady caryo
Gonocarpus pithyoides	+			WR6-5,12	Small linear leaf shrub
Hibbertia huegelii			25		Hibbertia hueg (nealry dead)
Hibbertia subvaginata	+		20	WR6-8	Hibbertia ? subvag
Hibbertia vaginata	+		30	WR6-4	Hibbertia vaginata
Hyalosperma cotula	+		7	WR6-2	? Hyalosperma
Hypocalymma angustifolium	5		60		Hypocalymma
Hypochaeris glabra	+		10		Hypochaeris glabra
Hypolaena exsulca	+			WR6-13	Restio (?Hyplaena)
Jacksonia furcellata	+		100		Jacksonia furc
Kunzea glabrescens	1		250		Kunzea glabrescens
Laxmannia squarrosa	+		10	WR6-7	Laxmannia
Lechenaultia floribunda	2		30	(=WB12)	Lechenaultia
Lomandra caespitosa	+		30	WR6-6	Lomandra
Lyginia imberbis	4		40	(=WC opp)	Lyginia ? barbata
Monotaxis occidentalis	+		10	WR6-11	Herb to 10cm
Pentaschistis airoides subsp. airoides	+		10	WR6-9	Aira
Pericalymma ellipticum	+		70		Pericalymma
Phlebocarya ciliata	15		30		Phlebocarya
Pultenaea ochreata	+		60	(=WK22)	Pea
Siloxerus humifusus	+		2	(=WB21)	Siloxerus
Stylidium repens	1		5	(=WR1-14)	Stylidium repens
Trachymene pilosa	+		4		Trachymene pilosa
Tricoryne elatior	+		25		Tricoryne elator
Ursinia anthemoides	+		10		Ursinia anthem
Xanthorrhoea preissii	+				Xanthorrhoea preissii

APPENDIX SIX. Releve and mapping note descriptions and species lists for the Rocla Warton Rd survey area

Note: these site descriptions do not have a complete species list, but list representative species under 'Associated species'.

RELEVES
Rocla Warton Rd - Site WCR1
Described by CG Date 7/10/2010
Location:
Photo: CG12-14
AMG: Zone50 396360mE, 6444812mN (WGS84)
Habitat: Flats adjacent to dune.
Soil: Pale grey sand.
Rock Type:
Vegetation: *Melaleuca preissiana, Banksia menziesii, Banksia attenuata,* (*Nuytsia floribunda, Eucalyptus todtiana)* low woodland over *Xanthorrhoea preissii, Adenanthos cygnorum* subsp. *cygnorum* shrubland over *Hibbertia subvaginata* low open shrubland with *Dasypogon bromeliifolius* herbland.
Assoc. species: *Banksia ilicifolia, Jacksonia furcellata, *Gladiolus caryophyllaceus, Allocasuarina humilis, Hypocalymma angustifolium, Acacia pulchella*.
Veg Condition (BF): Very Good.
Fire Age: More than 5 years since last fire.
Notes: Transitional vegetation along the edge of the lower dune slopes.

Rocla Warton Rd - Site WCR2
Described by CG Date 7/10/2010
Location: North-west corner of survey area.
Photo: CG20,21.
AMG: Zone50 396161mE, 6445272mN (WGS84)
Habitat: Slight depression on flat (wetland).
Soil: Sand.
Rock Type:
Vegetation: *Pericalymma ellipticum* closed heath over *Daviesia incrassata* subsp. *incrassata, Euchilopsis linearis, Acacia pulchella* scattered low shrubs (*Hypocalymma angustifolium* low shrubland in outer parts of vegetation unit) over *Dasypogon bromeliifolius* open herbland, *Phlebocarya ciliata* open herbland (near edge of unit) and *Lyginia imberbis, Hypolaena exsulca* very open sedgeland.
Assoc. species: *Jacksonia furcellata, Adenanthos cygnorum* subsp. *cygnorum, Regelia inops*.
Veg Condition (BF): Excellent.

MAPPING NOTES
Rocla Warton Rd - Site MNB1
Described by BRM Date 7/10/2010
Location: South-west corner of survey area.
Photo: KM26-28.
AMG: Zone50 395918mE, 6444948mN (WGS84)
Habitat: Flats beside sand dune.
Soil: Grey sand.
Vegetation: *Eucalyptus marginata, Melaleuca preissiana* woodland over *Allocasuarina fraseriana* low open woodland over *Xanthorrhoea preissii* scattered shrubs to open shrubland over *Hibbertia hypericoides* low open shrubland over *Dasypogon bromeliifolius* very open herbland.
Assoc. species:
Veg Condition (BF): Very Good.

Rocla Warton Rd - Site MNB2
Described by BRM Date
Location: South-west corner of survey area.
Photo: BM1,2.
AMG: Zone50 395946mE, 6445014mN (WGS84)
Habitat: Flats (seasonal damplands).
Soil: Grey sand.
Vegetation: *Melaleuca preissiana, Banksia littoralis, Banksia ilicifolia* scattered low trees over *Adenanthos cygnorum* subsp. *cygnorum* scattered tall shrubs over *Pericalymma ellipticum* closed heath (80-90%) over *Lyginia imberbis* scattered sedges with areas of *Scheonus subfascicularis* sedgeland.
Assoc. species: *Acacia pulchella, Jacksonia furcellata, Hypolaena exsulca, Hypocalymma angustifolium, Regelia inops, Melaleuca teretifolia* (patches of open shrubland).
Veg Condition (BF): Very Good to Excellent (very little weed).
Note: This transitional vegetation grew around the perimeter of areas *Pericalymma ellipticum* heath and *Scheonus subfascicularis* sedgeland.

Rocla Warton Rd - Site MNK1
Described by KM Date 7/10/2010
Location: North-west corner of survey area.
Photo: KM013.
AMG: Zone50 396180mE, 6445215mN (WGS84)
Habitat: Very gentle lower slope at base of dune.
Soil: Sand.
Vegetation: *Melaleuca preissiana, Banksia ilicifolia, Nuytsia floribunda, Eucalyptus todtiana, Banksia menziesii* low woodland over *Xanthorrhoea preissii, Adenanthos cygnorum* subsp. *cygnorum* shrubland over *Dasypogon bromeliifolius* open herbland.
Assoc. species: *Melaleuca thymoides, Chamaescilla corymbosa* var. *corymbosa, Jacksonia furcellata, Calytrix flavescens, Scholtzia involucrata*.
Veg Condition (BF): Very Good (weeds present).
Notes: Transitional vegetation along the edge of the lower dune slopes.

APPENDIX SEVEN. Banksia tree death locations noted in the survey area.

Site	Location		Comments
	Easting	**Northing**	
WR1	396281	6444986	recent Banksia deaths
WR2	396280	6445069	some dead Banksia's
SW corner, lower slopes	395954	6444943	Extensive recent deaths, incl. Banksia, Allocasuarina fraseriana and Jarrah deaths.
Eastern side	396334	6445037	*B. attenuata*, *B. menziesii* recent deaths. Also *Dasypogon brom*. and *A. fraseriana* deaths.

APPENDIX EIGHT Reproduction of a report 'FCT Analysis Warton Rd Sites' by Mr Ted Griffin

1.0 INTRODUCTION

1.1 Purpose of this report

The current report is intended to help clarify the assignment of Floristic Community type (FCT) designation to vegetation community (site) data. FCTs were defined by Gibson et al (1994) based on site data collected from vegetation on the Swan Coastal Plain. In particular, the potential that a Threatened Ecological Community (English and Blyth 1997) is represented by the data collected needs to be clarified.

1.2 Location of Warton Sites

The sites were apparently from the Warton Rd area.

1.3 Brief background to floristic analysis of vegetation on the Swan Coastal Plain

Floristic analysis (ie., analysis of variation in vegetation based on the species present, rather than description of structural variation and dominance) as a significant component of the understanding of the variation present in the native vegetation of the Swan Coastal Plain dates to Gibson *et al* (1994 – all references to the SCP survey in the current report refer to this publication), the first publication to document the floristics of the vegetation of a large part of the Swan Coastal Plain. While the SCP survey is based on a very significant amount of work, it must be viewed as a "first pass" survey, limited, in the context of the great variety of vegetation present in the very large area surveyed, by the relatively limited number (509) of sites (quadrats) it is based on. To a limited degree, this limitation has subsequently been addressed in an "update" to the work of the SCP survey (which describes additional units). However, there is no detailed publication of the results of this update available and the additional data used are not readily available in an appropriate form (ie., one that would enable ready comparison of new data to the overall data set).

The units described by the SCP survey are a series of "floristic community types", a "unit" whose rank is defined by the use within a study. The SCP survey surveyed a very large survey area and defined a relatively small number of floristic community types. Consequently, the floristic community types they have described are of a very high order (see Trudgen 1999, volume 1, for further discussion of this point). This is an extremely important point to fully grasp in interpreting the analysis presented by the SCP survey and in understanding the meaning of analysis of other data sets when they are compared to the floristic community types of the SCP survey.

The important effects of the limited size data set used by the SCP survey and of the relatively small number of floristic community types defined by them, can be summarised by the following points:

1. the definition of all but two of the Threatened Ecological Communities for vegetation on the Swan Coastal Plain (English and Blyth 1997) has been based on the floristic community types of the SCP survey. It therefore follows, that with two exceptions, only vegetation units from one study that are different at a very high order of floristics are treated as rare by Government. No account is taken of other important differences, such as differences in structure and dominance;

2. for the definition of floristic community types to be robust, a sufficient sized database is needed to give adequate precision in their definition. About half of the floristics community types (or sub types) of the SCP survey are based on less than 10 sites. It is likely that with a larger data set there would be significant alteration in the classification of those floristic community types from the SCP survey based on small numbers of sites.

3. as noted above, many (if not most) of the floristic community types defined by the SCP survey are very broad. They contain very significant variation in floristics, structure and dominance. Some (or in more highly cleared parts of the Swan Coastal Plain much) of this variation may be rare by any reasonable definition, but it is currently "buried" within larger groups;
4. there is likely to be significant variation not sampled by the SCP survey. This includes some variation at a high level of floristic difference (see Trudgen 1999, volume 1, for an example of this) and undoubtedly quite significant (large!) amounts of variation at "medium" and "low" levels.

5. the document, and its use by Government, has focussed attention in the environmental impact assessment process on the high level of units described, deflecting attention from the layers of variation beneath these units that also have significant conservation value.

From these points it is obvious that there is a need for a major "upgrade" to the floristic analysis of the vegetation of the Swan Coastal Plain to provide a more detailed floristic classification that considers not only more of the variation present, but explicitly recognises more of the variation present in formally described units.

Obviously, such a reworking would have some effect on what vegetation is considered rare on the Swan Coastal Plain. It needs to be stressed that it would be very unlikely to find that any of the vegetation currently considered to be rare on the basis of the SCP survey*'s* classification was not rare. On the other hand, it is likely that such a review would very probably consider to be rare some vegetation which is not currently considered rare.

1.4 Data provided

It is very important in comparing different sets of floristic data that they are comparable in the application of names, in the intensity of the survey (ie., the effort of searching resulting in similar proportion of the flora at sites being recorded) and in the size of the site recorded. If the data from different data sets is not comparable in these ways, it reduces the clarity of the results of the analyses carried out. If the discrepancy in the comparability of the data sets is large, the results may become meaningless.

A brief observation suggest that these Warton sites appears to have similar number of species from groups such as Orchids.

2.0 METHODS

2.1 Data Preparation

The data from the Warton sites were provided into a standard MS Access based database designed for this type of data. One virtue of the database is that the species recorded at each site are stored against standard codes (numbers, those used by the Western Australian Herbarium) for each species. This facilitates ready comparison of data from different surveys stored in the same system.

After the data were incorporated into the database (containing the data from other projects), a process of reconciliation of flora species names with those used in the SCP survey was undertaken. This step was necessary at least because of changes in nomenclature over the last ten years and the potential of survey specific variations in the application of names. The reconciliation involved:

- reducing some infra-specific names to the relevant species name,
- combining some taxa where confusion is known to have occurred in field observations and identifications, and
- omitting some names (mostly, where a species had only been identified to genus).

The reconciliation process was relatively straight forward as most of the names had already been standardised. Most reconciliation was to conform with the methods that the SCP survey used to manage confusing taxa plus some nomenclatural changes (see Appendix).

2.2 Comparability of datasets

It was concluded that the datasets were probably compatible to obtain reliable determinations.

2.3 Comparisons made

The data from the 6 sites plus the 509 sites from the SCP survey of the southern part of the Swan Coastal Plain (south of Gingin) were combined. This enabled various analyses to be performed.

The main purpose was intended to assign the individual sites to the Floristic Community Types (FCTs) defined in the SCP survey.

These data are provided in BM_Warton.mdb.)

2.4 Analyses carried out

The approach was the use of numerical classification techniques (PATN) based on the similarity of the floristic composition of the Warton sites to sites in the SCP survey data set.

2.4.1 PATN

Several modules of the numerical classification package PATN (Belbin 1987) were used for the analyses. The parameter values were the same as used by the SCP survey used to ensure consistency of analysis with that study.

The PATN modules used were ASO (calculation of similarity matrix), FUSE (classification based on the results of ASO), DEND (representation of classification) and NNB (determination of sites most similar to each site – nearest neighbours). The results of the analyses were imported into a database (BM_Eglington.mdb) so that site characteristics and previous classifications (eg., Floristic Community Types derived in earlier classifications) could be associated and various analyses based on these data could be performed.

The assignment of floristic community types to the Warton sites was made by summarising the results of two different methods:

- the classification, and
- the ten nearest neighbours.

Experience demonstrates that the results of these are likely to vary, but that from nearest neighbours is likely to make more sense.

To the classification dendrogram of the combined dataset the FCT assigned by the SCP survey was associated with the SCP survey sites. The apparent FCTs were assigned to the Warton sites by interpreting the position of these sites in the dendrogram (particularly by the way they joined to the SCP sites.

The 10 sites in the combined data set that were most similar to each of the Warton sites were obtained from the nearest neighbour method (NNB). By associating those nearest neighbours from the SCP survey, the most likely FCTs for each of the Warton sites were determined.

An attempt was then made to reconcile these different assignments of a Floristic Community Type.

3.0 LIMITATIONS

It has been found in earlier projects that the addition of new sites to the SCP survey data set to produce a combined classification disrupts the original classification. The more data added, the higher the level of the disruption. This problem can make it difficult to assign Floristic Community Types to new sites using this method.

Secondly, it is common for new data to group to their cohorts. In some cases this has proven to result from common deficiencies in the data, ie. whole groups of species missing. This absence tends to draw them together. The more sites in the added batch, the tighter they draw together.

The analyses are conducted without personal knowledge of the sites and no photographs were provided.

4.0 RESULTS

4.1 Determination of floristic community type by classification

The classifications suggested that the sites appeared to belong to several FCTs: 4, 5 and 23a (Figure 1).

Figure 1. Relevant portions of Dendrogram

site	FCT	#sp	dendrogram
			05/10/11 06:42:15.30 dend BRM Warton with SCP May 2011
			0.2050 0.3656 0.5261 0.6867 0.8472
KOOLJ-1	4	20	
MELA-1	4	23	
PLINE-4	4	22	
WHITE-2	4	37	
WR6		33	
AUSTB-4	5	28	
AUSTB-6	5	32	
GUTHR-2	5	39	
GUTHR-4	5	36	
HARRY-3	5	25	
MILT-1	5	37	
WR4		50	
WR5		32	
PLINE-5	5	23	
BANK-2	23a	61	
hurst03	23a	67	
MODO-4	23a	62	
low13b	23a	66	
BULL-3	23a	70	
WHITE-1	23a	58	
YULE-1	23a	56	
YULE-2	23a	57	
WR1		68	
WR2		54	
WR3		46	

Warton Road Sites WR

Table 2 provides a summary of the “most likely” FCT for this classification.

4.2 Determination of floristic community type using Nearest Neighbour method

The nearest neighbour analysis suggests that the sites also belong to a number of communities but principally FCT 23a, 5, 28 and 22.

Table 1. Results of Nearest Neighbour analysis

s	s1	fct1	v1	s2	fct2	v2	s3	fct3	v3	s4	fct4	v4	s5	fct5	v5
WR1	WR2		0.2333	WR3		0.3514	hurst03	23a	0.3534	WARB-3	23a	0.4101	YULE-2	23a	0.4146
WR2	WR3		0.2323	WR1		0.2333	hurst03	23a	0.3719	WIRR-1	23a	0.4154	YULE-2	23a	0.4234
WR3	WR2		0.2323	WR1		0.3514	hurst03	23a	0.375	WAND-1	23a	0.4314	YULE-2	23a	0.4314
WR4	WR5		0.4937	hurst03	23a	0.5652	NEER-5	28	0.5682	HARRY-1	28	0.5745	hurst02	23a	0.5789
WR5	WR4		0.4937	GUTHR-2	5	0.5714	HARRY-3	5	0.6071	MILT-1	5	0.6176	WR6		0.625
WR6	WHITE-2	4	0.6	WR5		0.625	MELA-5	22	0.6338	BANK-1	22	0.6364	hurst03	23a	0.64

Table 1 (cont)

s	s6	fct6	v6	s7	fct7	v7	s8	fct8	v8	s9	fct9	v9	s10	fct10	v10
WR1	WIRR-2	23a	0.4307	YULE-1	23a	0.4426	NINE-2	21a	0.45	WIRR-1	23a	0.4507	MODO-4	23a	0.4531
WR2	WHITE-1	23a	0.4464	YULE-1	23a	0.4545	WARB-3	23a	0.4646	MODO-4	23a	0.4655	BULL-3	23a	0.4677
WR3	WHITE-1	23a	0.4369	BULL-3	23a	0.4609	DEJONG-c	21c	0.4651	WIRR-1	23a	0.4711	MODO-4	23a	0.4766
WR4	WR1		0.5789	hurst01	23a	0.5789	BULLER-3	21c	0.5842	CORON-1	21a	0.5842	GUTHR-3	21a	0.6
WR5	GUTHR-1	4	0.6429	WR1		0.6495	AUSTB-6	5	0.6508	low08	5	0.6571	MODO-6	4	0.661
WR6	MODO-2	21c	0.6471	WR4		0.6543	GUTHR-2	5	0.6667	MODO-1	4	0.6716	MODO-6	4	0.6721

s – the site being compared
s1 to s10 – the 1st to 10th most similar sites
f1 to f10 – the FCT of the similar sites (only for SCP sites)
v1 to v10 – the dissimilarity value between the site and the similar sites (values above 0.6 tend to indicate low similarity)

4.3 Combining the results

It is common for the classification to indicate a simple result and the nearest neighbour analysis to be less conclusive. This is more a product of the classification process often suggesting an over simplified view than of inconsistency of the analyses.

There appeared to be reasonable accord in that both methods suggested the same FCT for 4 of the 6 sites.

Table 2 Summary of results

Site	Dendrogram FCT	NNB FCT	Summary FCT
WR1	23a	23a	23a
WR2	23a	23a	23a
WR3	23a	23a	23a
WR4	5	23a/28	23a/5
WR5	5	5	5
WR6	4	4/22/23a	4?

4.0 REFERENCES

Belbin, L. (1987) *PATN Reference Manual* (313p), *Users Guide* (79p), *Command Manual* (47p), and *Example Manual* (108p). CSIRO Division of Wildlife and Ecology, Lynham, ACT.

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5.0 APPENDIX

Appendix 1 Species combinations made to assist in reconciling taxonomic changes and identification difficulties between this survey and SCP data.

FCODE	Species_LUP.name	Species_LUP_1.name
031	Aira caryophyllea	Aira caryophyllea/cupaniana group
031	Austrostipa variabilis	Austrostipa semibarbata/campylachne
031	Avena barbata	Avena barbata/fatua
031	Pentaschistis airoides subsp. airoides	Pentaschistis airoides/pallida
031	Vulpia myuros forma myuros	Vulpia myuros
032	Lepidosperma pubisquameum	Lepidosperma angustatum/squamatum
032	Lepidosperma scabrum (Inland form)	Lepidosperma scabrum
032	Lepidosperma sp.	Lepidosperma angustatum/squamatum
032	Lepidosperma sp. Coastal Dunes	Lepidosperma angustatum/squamatum
032	Lepidosperma sp. K Boorabbin (K.L. Wilson 2579)	Lepidosperma angustatum/squamatum
032	Lepidosperma squamatum	Lepidosperma angustatum/squamatum
032	Schoenus subfascicularis	Baumea juncea
039	Lyginia imberbis	Lyginia barbata
054E	Dianella revoluta var. divaricata	Dianella revoluta
054F	Chamaescilla corymbosa	Chamaescilla spiralis/corymbosa
054F	Laxmannia ramosa subsp. ramosa	Laxmannia ramosa
054F	Thysanotus manglesianus/patersonii	Thysanotus patersonii/manglesianus
054J	Burchardia congesta	Burchardia umbellata/congesta
055	Conostylis aculeata subsp. aculeata	Conostylis aculeata
055	Conostylis aculeata subsp. preissii	Conostylis aculeata
060	Patersonia occidentalis var. angustifolia	Patersonia occidentalis
066	Caladenia flava subsp. flava	Caladenia flava
066	Eriochilus dilatatus subsp. multiflorus	Eriochilus dilatatus
066	Pterostylis sp.	
066	Thelymitra sp.	
143	Drosera pallida/menziesii	
149	Crassula colorata var. colorata	Crassula colorata
163	Acacia applanata	Acacia willdenowiana
163	Acacia pulchella var. goadbyi	Acacia pulchella
165	Gastrolobium capitatum	Nemcia capitata
165	Hovea trisperma	Hovea trisperma var. trisperma
175	Boronia ramosa subsp. anethifolia	Boronia ramosa
273	Astartea affinis	Astartea aff. fascicularis
273	Hypocalymma sp.	
273	Kunzea glabrescens	Kunzea ericifolia
302	Phyllangium divergens	Phyllangium paradoxum
343	Stylidium saxifragoides	Stylidium piliferum
345	Lagenophora huegelii	Lagenifera huegelii