TIWEST PTY LTD

DONGARA TENEMENTS

FLORA AND VEGETATION STUDIES
REGIONAL FCT ANALYSIS

October 2009

woodmanenvironmentalconsulting

A.C.N. 088 055 903

DOCUMENT REVISION HISTORY

Revision	Description	Originator	Reviewed	Date
A	Draft Report for Internal Review	BT	GW	4-08-2008
B	Draft Report for Client Review Incorporating additional regional conservation significance data	BT	GW	18-12-08
C	Draft Report for Client Review Incorporating additional wetland analysis, DEC changes to conservation significant flora and client comments	BT	GW/NS	22-04-09
0	Final Report	BT	CW	5-10-09

Reference: Tiwest 07-36

DISCLAIMER

This document is prepared in accordance with and subject to an agreement between Woodman Environmental Consulting Pty Ltd ("Woodman Environmental") and the client for whom it has been prepared ("Tiwest") and is restricted to those issues that have been raised by the Client in its engagement of Woodman Environmental and prepared using the standard of skill and care ordinarily exercised by Environmental Scientists in the preparation of such Documents.

Any organisation or person that relies on or uses this document for purposes or reasons other than those agreed by Woodman Environmental and the Client without first obtaining the prior written consent of Woodman Environmental, does so entirely at their own risk and Woodman Environmental denies all liability in tort, contract or otherwise for any loss, damage or injury of any kind whatsoever (whether in negligence or otherwise) that may be suffered as a consequence of relying on this document for any purpose other than that agreed with the Client.

CONTENTS

1 INTRODUCTION 1
2 AIMS 2
3 EXISTING ENVIRONMENT 2
3.1 REGIONAL SOILS AND LANDFORMS 2
3.2 REGIONAL FLORA AND VEGETATION 3
3.3 PREVIOUS STUDIES 7
4 METHODS 11
4.1 FIELD SURVEY 11
4.2 LICENSES 12
4.3 STATISTICAL ANALYSIS OF QUADRAT DATA AND REPORTING 12
5 LIMITATIONS OF THE STUDY 15
6 RESULTS 17
6.1 FLORA 17
6.2 FLORISTIC COMMUNITY TYPES 22
7 DISCUSSION 36
7.1 FLORA AND VEGETATION 36
7.2 REGIONAL SIGNIFICANCE AND CONSERVATION STATUS OF FLORA 37
7.3 REGIONAL SIGNIFICANCE & CONSERVATION STATUS OF FLORISTIC COMMUNITY TYPES 42
8 RECOMMENDATIONS 48
8.1 RECOMMENDATIONS FOR EXPLORATION DRILLING 48
9 REFERENCES 49

APPENDICES

Appendix A: Definitions for Categories of Threatened Ecological Communities and Declared Rare and Priority Flora (DEC 2008a,b)

Appendix B: Vascular Plant Species Recorded Within the Dongara Project Area during Studies Conducted by Woodman Environmental Consulting During 2006 and 2008

Appendix C: Vascular Plant Species Recorded in each Floristic Community Type Within the Dongara Project Area

Appendix D: Photographic Record of Floristic Community Types (FCTs) Recorded Within the Dongara Project Area

Appendix E: Summary Dendrogram of FCTs, Dongara Quadrat Data and Regional Dataset

Appendix F: Two-way Table, Ordination of Dongara Quadrat Data and Regional Dataset

Appendix G: Indicator Species Values (Monte Carlo Test) Dongara Quadrat Data and Regional Dataset

Appendix H: Declared Rare and Priority Flora Species Recorded in the Dongara Region (DEC 2007a)

FIGURES

Figure A: Monthly Rainfall Received at the Eneabba Minesite Between 2005 and 2008 Compared with the Long Term Cumulative Trend

Figure 1: Location Showing Mapping Areas

Figure 2: Dongara Project Area, Pre-european Vegetation

Figure 2.01: FCT Vegetation Legend

Figures 2.1 to 2.4: FCT Vegetation

Figures 3.01 to 3.04: Rare and Undescribed Flora and TEC Locations

Figures 3.11 to 3.14: Priority 1 Flora

Figures 3.21 to 3.24: Priority 2 Flora

Figures 3.31 to 3.34: Priority 3 Flora

Figures 3.41 to 3.44: Priority 4 Flora

TABLES

Table 1: Description, Pre-european Extent, Current Extent and Reservation Status of Vegetation Associations Related to Physiognomy in the Dongara Project Area (Shepherd *et al.* 2002)

Table 2: Significant Flora Species Recorded in the Dongara Project Area by Western Botanical (2005a,b, 2006) and Woodman Environmental Consulting (2007a)

Table 3: *Stylidium piliferum* species Identified in the Dongara Project Area by Western Botanical (2005a,b, 2006) and Woodman Environmental Consulting (2007a)

Table 4: Various Surveys Incorporated into the Northern Sandplains Study Area

Table 5: Priority Flora Species Recorded in the Dongara Project Area During Surveys Conducted by Woodman Environmental Consulting in 2006 (WEC 2007), 2007 and 2008 in Addition to Data Provided by Western Botanical (2005a,b, 2006) and the Department of Environment and Conservation (2007a)

Table 6: Undescribed or Poorly Known Taxa Recorded Within the Dongara Project Area

Table 7: Introduced Flora Recorded in the Dongara Project Area

Table 8: Conservation Significant Taxa Recorded in each FCT Within the Dongara Project Area

Table 9: Extent (hectares) and Presence of Conservation Significant Flora in each FCT Recorded Within the Dongara Project Area

Table 10: Comparison of Native Plant Taxa Recorded Within the Dongara Project Area to Regional Studies

Table 11: Priority 3 and Priority 4 Flora Species Recorded from the Dongara Project Area Recommended to be Removed from the Priority Flora List (WEC 2008c)

Table 12: Conservation Significance Ranking of FCTs within the Tiwest Dongara Project Area

PLATES

Plate 1: *Paracaleana dixonii* (DRF) photo by D. Coultas

EXECUTIVE SUMMARY

Tiwest Pty Ltd (Tiwest) currently operate the Cooljarloo Mineral Sands Mine (tenements M70/1162, M268SA and ML70/268SA) near Cataby and propose to expand operations within Western Australia with the addition of mining of the Dongara tenements E70/1592, E70/2263, E70/2430 and E70/2347.

Studies were conducted during 2006 by Woodman Environmental Consulting Pty Ltd (Woodman Environmental) to assess the flora, vegetation and *Phytophthora cinnamomi* distribution in the project area. The intent of these studies was to meet statutory requirements to support exploration drilling of the tenements. This was achieved by:

- mapping the distribution of structural vegetation communities within the project area;
- identifying conservation significant flora species within the project area and habitats that support these species;
- interpreting and mapping the project area for *Phytophthora cinnamomi* distribution; and
- conducting a flora risk assessment using the above data to manage potential impacts to flora and vegetation of conservation significance.

During 2007 Tiwest identified economic ore reserves at Dongara and initiated a feasibility assessment for mining of the reserves. Tiwest commissioned Woodman Environmental to conduct an additional survey in spring 2007 to describe the vegetation of the project area using statistical based analysis and map the distribution of Floristic Community Types (FCTs). The analysis of the Dongara quadrat dataset was conducted in conjunction with available regional datasets (data collected for Iluka Resources, ARC Energy and Origin Energy, and data supplied by Dr. Ted Griffin) to determine the local and regional distribution of FCTs recorded within the project area.

A total of 454 quadrats established on the northern sandplain were used during the initial analysis, including 150 quadrats established within the Dongara project area (Figures 2.1 to 2.4). Statistical analysis using PATN was conducted on species presence/absence data (perennials only).

A total of 543 native vascular plant taxa belonging to 68 plant families were recorded within the Dongara project area during the surveys conducted between 2006 and 2008. Conservation Significant and Poorly Known taxa recorded in the project area by Woodman Environmental in addition to historical records provided by the Department of Environment and Conservation and Western Botanical include:

- 1 DRF species
- 3 P1 species
- 6 P2 species
- 12 P3 species
- 8 P4 species
- 7 Undescribed or Poorly Known taxa

A total of 42 FCTs from 2 supergroups were identified during the initial analysis, of which 21 FCTs were recorded from the Dongara project area. None of these FCTs are considered to be Threatened Ecological Communities (TECs) as determined by the Department of Environment and Conservation.

Additional surveys of the wetland suites within the Dongara project area were conducted during winter and spring 2008. Tiwest commissioned Woodman Environmental to carry out surveys for annual species within quadrats previously established within the wetland FCTs identified during the initial analysis. In addition, a total of 9 quadrats were established within the northern portion of the project within wetland areas requiring further mapping definition. Statistical analysis using PATN was conducted on species presence/absence data (annuals and perennials) to meet the requirements and recommendations provided by the Department of Environment and Conservation (DEC). It has been hypothesised by the DEC that the wetlands within the project area are characterised by suites of annual species found within the understory. A total of 54 quadrats established within wetland FCTs were used during the wetlands analysis. This subsequent study has split 2 FCTs identified during the initial analysis. FCTs 9b and 12 were split dichotomously to form new sub-groupings (FCT9b.1, FCT9b.2, FCT12.1 and FCT12.2 respectively). The analysis has resulted in minor changes to the mapping of wetland FCTs previously identified using the perennial dataset, where a small number of quadrats have moved into different FCT groups. This demonstrates that some wetlands within the project area are structurally quite similar however support differing suites of annuals.

The majority of the FCTs mapped within the Tiwest Dongara project area have a high conservation significance ranking of 4. This is due to the high species richness and endemism of the Geraldton Sandplain GS3-Lesueur Sandplain subregion coupled with the presence of conservation significant taxa. Those FCTs with the highest conservation significance rankings correspond to regionally restricted landforms, primarily wetland basins. FCTs 7, 9b, 11, 17, 18, 19a, 20 are all associated with drainage depressions and basins, however FCT 11 has the most restricted distribution and attracts the highest level of conservation significance.

The following recommendations are made to guide future exploration drilling programmes based on the results of the survey:

1. FCTs containing DRF species within proposed drill lines should be searched for the presence of these taxa to allow appropriate management of impacts. FCTs 4a and 5e are habitat for *Paracaleana dixonii* DRF and any proposed impacts within these FCTs should be searched prior to disturbance to comply with the *Wildlife Conservation Act 1950*. These surveys should be conducted within the appropriate flowering period (October to January).

The following recommendations are made based on the results of various flora and vegetation surveys conducted in the Dongara project area and are relevant for all future operations:

1. A monitoring program with baseline vegetation data should be developed preceeding potential water drawdown impacts. The need for a monitoring program will be investigated further during drawdown modelling developed for the impact assessment.
2. Additional quadrats should be established during Spring 2009 in the burnt area south-west of the project area in polygons of FCTS previously missed during the quadrat

based survey conducted in 2007. These additional plots will be reanalysed in conjunction with the combined Tiwest/Iluka dataset early in 2010 following additional field based surveys to be conducted by Woodman Environmental within the Iluka leases (Spring 2009).

3. Additional quadrats should be established within subgroup FCT12.2 to further delineate its association from subgroup FCT12.1, particularly if this community falls within potential water drawdown areas. To date, subgroup FCT12.2 is represented by only one quadrat. FCT12 (including subgroup FCT12.1 and 12.2) is likely to be regionally restricted and the conservation status of this community requires further investigation in the long term term to determine this.

4. Any significant impacts to FCTs identified during the impact assessment will require additional quadrat based survey of the local nature reserves to identify representation of floristic units from proposed mining areas within the conservation reserve system. FCTs located within the central and eastern portions of the project area were not sampled within the Yardanogo Nature Reserve.

5. Weed and *Phytophthora cinnamomi* hygiene should be implemented for all future operations in the project area to protect the integrity of the flora of the region.

6. FCTs containing DRF species within proposed orebodies and infrastructure should be searched for the presence of these taxa to allow appropriate management of impacts. FCTs 4a and 5e are habitat for *Paracaleana dixonii* DRF and any proposed impacts within these FCTs should be searched prior to disturbance to comply with the *Wildlife Conservation Act 1950*. These surveys should be conducted within the appropriate flowering period (October to January).

1 INTRODUCTION

Tiwest Joint Venture (Tiwest) operates the Cooljarloo Mineral Sands Mine located approximately 160km north of Perth, Western Australia. Operations currently involve dry mining in shallow ore bodies north of Mullering Farm. Tiwest also own a number of exploration leases including the Dongara tenements E70/1592, E70/2263, E70/2430 and E70/2347 in addition to mining leases ML70/1195 to ML70/1200, located approximately 20km south east of Dongara. The Dongara tenements/leases are located on Unallocated Crown Land and private property and have been previously impacted by 3D Seismic Survey Programs conducted by Origin Energy during 1998 and 2001. The Beharrra Springs Gas Plant is central to the project area and there has been minor clearing for pipeline corridors. The Yardanogo Nature Reserve is located on the north western border of the project area.

Initial drilling programs conducted on the leases were supported by field studies involving the detailed searching of proposed drill lines for significant flora species by Western Botanical in 2005 and 2006 (WB 2005a&b, 2006). Additional studies were conducted by Woodman Environmental Consulting (2007a) in 2006 to define structural plant communities and map *Phytophthora cinnamomi* distribution within the project area as a basis for identifying potential impacts of proposed exploration drilling programs on conservation significant flora. A Risk Management Plan compiling available data from the above sources in addition to information provided by the Department of Environment and Conservation (DEC)(DEC 2007a&b) was developed by Woodman Environmental Consulting (2007b) to mitigate these environmental impacts.

During 2007 Tiwest identified economic ore reserves at Dongara and initiated a feasibility assessment for mining of the reserves. Tiwest commissioned Woodman Environmental Consulting (Woodman Environmental) to conduct additional flora and vegetation assessments to support a Public Environmental Review (PER) level of assessment under the *Environmental Protection Act 1986*. The additional assessments were to include quadrat based studies of the Dongara tenements to determine Floristic Community Types within the project area. This initial analysis was conducted as part of a larger regional survey of the northern sandplains in conjunction with data collected from the Eneabba area during various studies for Iluka Resources (WEC 2002, 2006, 2008a&b). This joint study will facilitate the identification of cumulative impacts of proposed mineral sand mining on the Eneabba sandplain area and aid in the management of conservation significant flora and vegetation communities at the local and regional scale.

The initial joint analysis was conducted using PATN on species presence/absence data (perennials only). A subsequent study was conducted by Woodman Environmental using quadrat data obtained from wetland FCTs identified during the initial analysis within the Dongara project area. In addition, a total of 9 quadrats were established within the northern portion of the project within areas requiring further definition. Statistical analysis using PATN was conducted on species presence/absence data (annuals and perennials) to meet the requirements and recommendations provided by the Department of Environment and Conservation (DEC). It has been hypothesised by the DEC that the wetlands within the project area are characterised by suites of annual species found within the understory. This subsequent analysis uses only the Tiwest Dongara project area dataset and does not provide a regional analysis of FCTs identified. From this point forth within this document, an FCT

denoted as 'sub-group FCT' is a product of the subsequent wetlands analysis of the Dongara project area dataset using annual and perennial data. Where this document denotes 'FCT', this has been determined by utilising the regional dataset using only perennial data during the joint analysis.

2 AIMS

The aim of this project was to obtain information on the local and regional distribution of Floristic Community Types (FCTs) and conservation significant taxa within the project area. Information collected during these surveys will facilitate management of impacts to flora and vegetation for future proposed exploration and subsequent mining.

The tasks required to meet this aim were:

1. Review and collate existing data on flora and vegetation within the project area
2. Collect quantitative data from quadrats located within each community identified during previous studies conducted by Woodman Environmental Consulting (WEC 2007a)
3. Conduct detailed quadrat based floristic analysis to determine Floristic Community Types (FCTs) within the broader project area
4. Review the conservation status of each FCT within the project area by comparing its distribution to regional studies and the TEC database (DEC 2008c)
5. Review the distribution of Declared Rare and Priority Flora species within the project area and compare to regional studies
6. Produce a list of the vascular plant species recorded within each FCT and discuss the conservation significance of taxa identified

3 EXISTING ENVIRONMENT

3.1 REGIONAL SOILS AND LANDFORMS

The Dongara tenements are located within the Geraldton Sandplains (GS) Biogeographical Region (Environment Australia 2000). The Geraldton Sandplains bioregion is situated on the 'sandy earths of an extensive, undulating, lateritic sandplain mantling Permian to Cretaceous strata' (Desmond and Chant 2001). The Lesueur Sandplain (GS3) subregion more specifically comprises 'coastal Aeolian and limestones, Jurassic siltstones and sandstones (often heavily laterised) of the central Perth Basin' (Desmond and Chant 2001).

The Dongara area was broadly mapped and described by Beard (1976) at a scale of 1:250,000. Within the Dongara survey region, Beard describes the vegetation, soils and landforms of 11 systems, 3 of which overlap the project area; the Illyarrie, Eridoon and Tathra Systems.

The Illyarrie System is a coastal limestone belt up to 15km wide with undulating hilly country of lithified calcarenite overlain by yellow siliceous sands (Beard 1976). In parts, the sand depth is minimal and the limestone rock is exposed. East of the coastal limestone belt is a flat coastal plain, the Eridoon System. Small rivers and creeks have transported sand onto the plain and formed longitudinal ridges in parts where the sand has been blown. The sands are bleached, turning yellow at depth with clay-loams approximately 1m below the surface. There are some small lakes and swamps in depressions and limited occurrences of heavier soils on

alluvial flats. East of the Eridoon System is the Tathra System where outcrops of laterite on ridges and breakaways are a feature.

3.2 REGIONAL FLORA AND VEGETATION

The project area is located within the Irwin Botanical District (Northern Sandplains Region), of the Southwest Botanical Province as defined by Beard (1990). Dominant plant families within the Irwin Botanical District include Proteaceae (*Grevillea, Banksia*), Myrtaceae (*Eucalyptus, Melaleuca*), Mimosaceae (*Acacia*), Casuarinaceae (*Casuarina, Allocasuarina*), Asteraceae (daisies), Chenopodiaceae (salt bushes) and Poaceae (grasses).

Vegetation systems within the region were broadly mapped and described by Beard at a scale of 1:250,000 (Beard 1976). The western margin of the project area intersects the coastal limestone belt characteristic of the Illyarrie System and is dominated by woodlands of *Eucalyptus erythrocorys* up to 10m in height over an open shrub understorey containing *Acacia blakelyi, A. pulchella, A. spathulata, Banksia sessilis, Hakea costata, Hibbertia hypericoides, Hibiscus huegelii, Hybanthus calycinus, Scholtzia* sp. and Restionaceae (Beard 1976). North of the Arrowsmith River the vegetation is pre dominantly thickets of *Acacia, Melaleuca* and mallee.

The Eridoon System is characterised by a sandplain community of scattered small trees up to 5m tall, an open layer of tall shrubs to 3m and a closed layer of small heath-like shrubs <1m (Beard 1976). In low lying, winter wet areas the heath is approximately 30cm tall with scattered *Xanthorrhoea,* with *Calytrix strigosa, Eremaea pauciflora, Grevillea eriostachya, Melaleuca scabra, Petrophile media* and Restionaceae. In wetter areas, *Melaleuca thyoides, M. lanceolata* and *M. rhaphiophylla* are present.

The Tathra System consists of low, lateritic heaths and scrub heaths. Species present on lateritic heath include *Hakea auriculata, Banksia fraseri, Melaleuca scabra, Allocasuarina humilis, Petrophile* sp., *Melaleuca radula* and Restionaceae (Beard 1976). The scrub heath is quite diverse and heterogeneous and generally consists of scattered shrubs to 2m over a dense layer of small shrubs with occasional *Nuytsia floribunda*. Taller tree species *Eucalyptus todtiana, Banksia attenuata, B. menziesii* and *B. prionotes* are usually confined to valleys and deep sands.

These systems were further divided into vegetation community types (associations), related to physiognomy by Shepherd *et al.* (2002). There are 8 vegetation associations located within the Dongara project area (Table 1, Figure 2). Vegetation Association 392 'Shrublands; *Melaleuca thyoides* thicket' is considered to have a High priority rating for future reservation (Desmond and Chant 2001). This vegetation association was not recorded within the project area and is discussed further in Section 5.2.2.

Table 1: Description, Pre-european extent, Current Extent and Reservation Status of Vegetation Associations Related to Physiognomy in the Dongara Project Area (Shepherd *et al.* 2002: Desmond and Chant 2001)

Vegetation Association	Description	Current Extent (ha)	Percentage of Pre-european Extent Remaining	Percentage held in IUCN Class Reserves	Reservation Priority*
352	Medium woodland; York Gum	113,255	15.2	3	L
377	Mosaic: Shrublands; scrub heath on limestone/ Sparse low woodland; illyarrie	72,491	99.4	74	L
378	Shrublands; scrub heath with scattered *Banksia* spp., *Eucalyptus todtiana* and *Xylomelum angustifolium* on deep sandy flats	68,049	62.0	21.1	M
379	Shrublands; scrub heath on the lateritic sandplains	128,007	20.2	20.3	M
392	Shrublands; *Melaleuca thyoides* thicket	1554	42.6	16.4	H
433	Mosaic: Shrublands; *Acacia rostellifera* and *Melaleuca cardiophylla* thicket/ Sparse low woodland; illyarrie	15,234	40.9	11.7	M
619	Medium woodland; River Gum (*Eucalyptus camaldulensis*)	114,211	99.9	0.2	N/A
748	Shrublands; *Melaleuca thyoides* thicket with scattered rivergum	312	79.7	48.9	M

*as defined by Desmond and Chant (2001), L= Low, M= Medium, H= High

A search of The Department of Environment and Conservation's (DEC) Threatened Ecological Community (TEC) database was conducted for the project area with an approximate 5km buffer for the following coordinates:

- NW 29° 18' 03.93" 115° 00' 09.39"
- SE 29° 39' 57.39" 115° 17' 04.95"

There were no TECs recorded within the project boundary (DEC 2007b). However, there are occurrences of TECs within 25km of the project area, including:

- 'Assemblages of organic mound springs of the Three Springs area' (considered to be Endangered)
- 'Ferricrete floristic community (Rocky Springs type)' (considered to be Vulnerable)

A search of the DEC Rare and Priority Flora Database and Herbarium specimens (DEC 2007a) revealed that 5 Declared Rare Flora (DRF) species have been previously recorded within the search area:

- *Caladenia wanosa*
- *Calectasia cyanea*
- *Eucalyptus leprophloia*
- *Paracaleana dixonii*
- *Thelymitra stellata*

A summary of results received from these databases in addition to the Department of Environment and Conservation regional database is provided in Appendix H. Definitions of Declared Rare and Priority Flora categories are given in Appendix A.

A search of the Department of Environment, Water, Heritage and the Arts database (DEWHA 2008) for the above coordinates revealed that there are no occurrences of wetlands of national or international importance within the search area. The south west of the project area supports an Australian Heritage Site 'Arrowsmith Lake Area, Brand Hwy, Dongara, WA'. This wetland is on the Register of the National Estate and includes an area of approximately 10,000ha surrounding the lower reaches of the Arrowsmith River, including Arrowsmith Lake and Arrowsmith Hill. This community supports unique flora and a range of waterfowl and land birds.

A total of 9 Threatened Species were identified from the search of the DEWHA databases (2008). These are listed below:

- *Banksia serratuloides* subsp. *perissa*
- *Chorizema humile*
- *Eucalyptus crispata*
- *Eucalyptus leprophloia*
- *Hemigenia ramosissima*
- *Hypocalymma longifolium*
- *Paracaleana dixonii*
- *Schoenia filifolia* subsp. *subulifolia*

- *Stawellia dimorphantha*

All of these species are listed as Declared Rare Flora (DRF) under the *Wildlife Conservation Act 1950* with the exception of *Stawellia dimorphantha* which has recently been downgraded to a P4 species. Only 2 of these species, *Paracaleana dixonii* and *Stawellia dimorphantha* are known from within the project area. The remainder of these species are located outside of the mapped area.

Known populations of *Banksia serratuloides* subsp. *perissa* are located approximately 60km south of the project area on lateritic soils associated with the Tathra System. This species has a restricted distribution of approximately 35km, south of Eneabba.

The nearest recorded population of *Chorizema humile* is located approximately 20km north-east of the project area. This historical WAHerb collection (PERTH 03414183) was recorded in 1970 and recent surveys (Stack and English 1999) did not relocate the population, which may have been subjected to intensive grazing. *Chorizema humile* has close affinities to a number of *Chorizema* species however no taxa within this genus were identified during studies conducted within the project area by Woodman Environmental. *Chorizema humile* is associated with *Allocasuarina campestris, Hypocalymma angustifolium* and *Acacia* spp. on red loam or brown sandy clay plains in scrub or open tree mallee. This association has not been observed within the project area by Woodman Environmental.

The nearest known population of *Eucalyptus crispata* is located approximately 10km east of the project area on the lateritic hills associated with the Tathra System. This species is commonly found on lateritic breakaways or gullies between breakaways. These soil associations/landscapes are not located in the eastern margins of the project area (within the Tathra System). This area of the project is typically a sand over laterite soil association unlikely to be suitable habitat for this species.

Populations of *Eucalyptus leprophloia* are located approximately 10km east of the project area on the lateritic hills associated with the Tathra System. This species prefers lateritic soils on valley slopes and grey sands over laterite in hilly areas.

Hemigenia ramosissima is a species located approximately 120km south-east of Perth near the Beaufort River bridge adjacent to Albany Highway. This species is not located within the Geraldton Sandplains bioregion.

Hypocalymma longifolium has a population distribution located north of Geraldton, approximately 130km north of the project area. This species is associated with sandstone breakaways and clay swamps.

Schoenia filifolia subsp. *subulifolia* has a population distribution predominantly located west of Mingenew with isolated populations located in the Geraldton area. This species is associated with depressions in breakaway areas and swamps. The nearest known population is located approximately 50km north of the project area.

The Dongara project area has been extensively surveyed by Woodman Environmental over a number of seasons. None of the above species were recorded during the surveys and the likelihood of these species occurring within the project area is very low. The project area does

not support suitable habitat for a number of these species and the considerable distance between the project and known populations further support this notion.

3.3 PREVIOUS STUDIES

A number of surveys within the Northern Sandplains region have been undertaken, including several by Beard (1976), Burbidge and Boscacci (1989); Griffin and Keighery (1989), Griffin (1998), *ecologia* Environmental Consultants (1995) and Halpern Glick and Maunsell (2000).

Woodman Environmental Consulting (2005) conducted vegetation mapping for ARC Energy's 3D seismic survey during spring 2004. The project encompassed an area of approximately 39,400ha, including 11,455ha of nature reserves (Yardanogo, Beekeepers and Dongara N.R). A total of 515 vascular plant taxa belonging to 81 plant families were recorded during the survey, including 8 Priority Flora species as listed below.

- *Anthocercis intricata* P2
- *Baeckea* sp. Walkaway (A.S. George 11249) P3
- *Banksia elegans* P4
- *Dampiera tephrea* P2
- *Eucalyptus zopherophloia* P4
- *Hemigenia saligna* P3
- *Schoenus* sp. Eneabba (F.Obbens & C.Godden I154) P2
- *Stawellia dimorphantha* P4

In 2005 and 2006 Western Botanical conducted targeted searches for significant species along proposed exploration drill lines within the Dongara project area (Western Botanical 2005a&b, 2006). A total of 13 Priority Flora species were recorded during the surveys (Table 2).

Table 2: Significant Flora Species Recorded in the Dongara Project Area by Western Botanical (2005a&b, 2006) and Woodman Environmental Consulting (2007a)

Species	Conservation Code	Western Botanical	Woodman Environmental Consulting
Banksia elegans	P4	X	X
Banksia scabrella	P4	X	X
Calytrix chrysantha	P4	X	X
Eucalyptus macrocarpa subsp. *elachantha*	P4		X
Eucalyptus zopherophloia	P4		X
Guichenotia alba	P3	X	
Hopkinsonia anoectocolea	P3		X
Hemiandra sp. Eneabba (H. Demarz 3687)	P3	X	X
Lasiopetalum ogilvieanum	P1		X
Mesomelaena stygia subsp. *deflexa*	P3	X	X
Paracaleana dixonii	DRF		X
Persoonia filiformis	P2	X	
Persoonia rudis	P3	X	X
Schoenus griffinianus	P3		X
Schoenus sp. Eneabba (F. Obbens & C. Godden I154)	P2	X	X
Stawellia dimorphantha	P4	X	X
Stylidium carnosum subsp. Narrow leaves (J.A. Wege 490)	P1	X	
Synaphea ?*aephynsa*	P3	X	
Verticordia luteola var. *luteola*	P3	X	

In addition, 3 potentially undescribed *Stylidium* species related to the *Stylidium piliferum* complex were identified during the survey (Table 3). Tiwest subsequently commissioned a revision of the *Stylidium piliferum* complex which was conducted by Allen Lowrie, a taxonomic specialist in the *Stylidium* group (Lowrie 2007), in collaboration with Woodman Environmental. Specimens of *Stylidium piliferum* collected from the project area were compared to herbarium records to determine conservation significance. This study concluded that all 3 species were the same taxa, *Stylidium* sp. Kalbarri (A. Carr 145) which has a flower colour morph of white, yellow and pink. This species has a distribution of approximately 700km and is therefore not considered to be conservation significant.

Table 3: *Stylidium piliferum* species Identified in the Dongara Project Area by Western Botanical (2005a&b, 2006) and Woodman Environmental Consulting (2007a)

Label by Western Botanical (2005a&b, 2006)	Label by Woodman Environmental Consulting (2007a)	Taxonomical Determination by A. Lowrie
Stylidium sp nova 'pink flowers' (KM0318, AR1019)	*Stylidium* sp. 1	*Stylidium* sp. Kalbarri (A. Carr 145)
Stylidium sp nova '*Stylidium piliferum* complex' (KM0268)	*Stylidium* sp. 2	*Stylidium* sp. Kalbarri (A. Carr 145)
Stylidium sp nova 'golden yellow glands on hypanthium' '*Stylidium piliferum* complex' (DET0075)	*Stylidium* sp. 3	*Stylidium* sp. Kalbarri (A. Carr 145)

Woodman Environmental (2007a) conducted detailed flora and vegetation studies of the project area in spring 2006 to define structural plant community boundaries and identify conservation significant flora to facilite the management of impacts of proposed exploration drilling programs. A total of 376 vascular plant taxa were recorded during the survey, including 14 Declared Rare and Priority Flora species (Table 2). A total of 19 structural plant communities were described and mapped within the project area:

Forests

F1: Low Forest *of Melaleuca rhaphiophylla* over Open Dwarf Scrub on sandy clay in drainage lines.

Woodlands

W1: Woodland of *Eucalyptus camaldulensis* over mixed shrubs dominated by *Acacia* spp. and *Melaleuca* spp. on sandy clay soils in valleys and floodplains.

W2: Low Woodland of *Melaleuca preissiana* and *Casuarina obesa* on clay soils in basins and floodplains.

W3: Low Woodland of *Eucalyptus erythrocorys* over Thicket to Low Heath dominated by *Acacia* spp. or *Melaleuca* spp. on sand over limestone on mid to upper slopes.

W4: Low Woodland dominated by *Banksia prionotes* on yellow sand with occasional limestone outcropping on upper slopes and ridges.

W5: Open Low Woodland of *Eucalyptus todtiana* with occasional *Xylomelum angustifolium* and *Banksia* spp. over Open Shrubs to Heath dominated by myrtaceous and proteaceous species on grey sand on mid to upper slopes.

W5a: Open Low Woodland of *Eucalyptus todtiana* over Open Low Scrub dominated by *Calothamnus quadrifidus* on grey brown sand in creeklines.

W6: Open Low Woodland to Heath of *Banksia attenuata* and *Banksia menziesii* over mixed myrtaceous and proteaceous shrubs on grey and brown sand on mid to upper slopes.

W7: Open Low Woodland of *Eucalyptus todtiana* and *Actinostrobus pyramidalis* over Heath of mixed shrubs on grey brown sand on lower to mid slopes and swales.

Scrub

S1: Low Scrub dominated by *Jacksonia hakeoides, Melaleuca systena, Acacia blakelyi* and *Hakea trifurcata* on yellow sand over limestone on mid slopes.

Thickets

T1: Thicket dominated by *Actinostrobus pyramidalis* on clayey soils in basins and lower slopes.

T2: Thicket dominated by *Allocasuarina campestris* and *Acacia* spp. on sandy clay on lower slopes, gullies and basins.

T3: Thicket to Heath dominated by *Banksia hookeriana* and *Banksia attenuata* on yellow sand on mid to upper slopes.

T4: Dense Thicket of *Melaleuca huegelii* over Open Dwarf Scrub on sandy clay over limestone on lower slopes.

Heaths

H1: Heath dominated by *Melaleuca systena* in pans with impeded drainage

H2: Heath dominated by *Banksia leptophylla, Calothamnus hirsutus* and myrtaceous species in pans with impeded drainage

H3: Heath dominated by *Hakea polyanthema, Beaufortia elegens, Calothamnus blepharospermus* or *Eremaea beaufortioides* over Dwarf Scrub dominated by *Ecdeiocolea monostachya* on brown or yellow sand on lower to upper slopes.

H4: Heath dominated by *Acacia* spp. *Calothamnus quadrifidus, Hakea lissocarpha* and *Melaleuca leuropoma* with emergent *Eucalyptus* spp. on grey sand on lower slopes.

H5: Heath to Low Heath dominated by *Banksia* spp. and *Melaleuca aspalathoides* on sand over laterite on lower to mid slopes.

None of these plant communities were considered to be Threatened Ecological Communities as defined by the Department of Environment and Conservation (DEC 2008c). However a number of structural plant communities were considered to have restricted distributions within the project area, particularly wet communities associated with the north south oriented belt of wetlands.

Phytophthora cinnamomi

The majority of the project area was determined to be 'Mappable' for the presence of *Phytophthora cinnamomi* (dieback) (Glevan 2006). There were no recorded infestations of *Phytophthora cinnamomi* in the mappable area. Four samples of root and soil material were collected for analysis from suspect *Banksia hookeriana*, *Banksia menziesii* and *Xanthorrhoea preissii* plants. None of these samples returned a positive result for *Phytophthora cinnamomi*.

A small part of the project area was determined to be unmappable due to the recent burn in adjacent vegetation. Coincidently, the unmappable areas were determined to be at the greatest risk of dieback infestation. These areas include the public, gravelled Mt Adams Road and the access road to the Beharra Springs gas plant.

Additional surveys were conducted during 2007 (Glevan 2007) – the burnt areas adjacent to Mt Adams Road were considered 'Mappable' for dieback as the vegetation had recovered sufficiently. Three samples of root and soil material were collected for analysis adjacent to Mt Adams Road, none of which returned a positive result for *Phytophthora cinnamomi*. Approximately 3,900 ha of the project area was considered to be 'Unmappable' due to the lack of indicator species within disturbed pastoral lands and recent burns south of the Beharra Springs gas plant. The 'Mappable' portion of the project area (approximately 19,500 ha) was determined to be 'Protectable' (uninfested) from dieback.

4 METHODS

4.1 FIELD SURVEY

Aerial photography of the project area was initially interpreted at a scale of 1:10,000 and surveyed for structural plant community boundaries during 2006 (WEC 2007a). Additional aerial photography interpretation was conducted prior to field studies in 2007 to extend the mapped area slightly in the northern end and to facilitate quadrat location selection.

Quadrats were positioned in areas where vegetation was not disturbed away from boundaries with roads and cleared areas. Quadrats were allocated to each structural plant community according to the proportion of the project area encompassed by each community. A minimum of three quadrats were allocated to each structural plant community with quadrats positioned across the geographical spread of the community and also covering where possible any variation in topography.

Experienced botanists carried out the quadrat based assessment during the months of October and November 2007 to determine the boundaries of FCTs within the project area.

A total of 150 permanent 10 x 10m quadrats with a north – south orientation were established within the project area (Figures 2.1 to 2.4). The corners of each quadrat were marked with aluminium fence droppers and the north-west corner labelled with an identifier (07-001 onwards) on a metal tag.

Within each 10 x 10m quadrat the following information was collected:

- Date
- Personnel
- Location (GDA 94, Zone 50)
- Soil colour and type
- Slope
- Topographic position
- Fire History
- Condition (Government of Western Australia 2000)
- Species Present (Height and Cover)

Additional winter and spring surveys were conducted during August and October 2008 to complement previous surveys conducted within the project area during periods of low rainfall. Quadrats established within the project area during 2007 in wetland FCTs identified during the initial analysis were revisited and surveyed for annuals. An additional 9 quadrats were established within the northern portion of the project within wetland areas requiring further mapping definition. This data was collected for the wetland analysis which used only the Tiwest project area wetland dataset to identify subgroup FCTs located within the project area.

4.2 LICENSES

Specimens were collected for identification at the WAHerb where flora species unknown to the surveyors were encountered during the surveys. All plant collections were undertaken under the following licenses:

- Bianca Taylor SL008044, 80-0708
- David Coultas SL008065, 79-0708
- Kylie Greenacre SL008064, 78-0708
- Catherine Anderson SL007779

4.3 STATISTICAL ANALYSIS OF QUADRAT DATA AND REPORTING

The initial classification and ordination analyses were conducted on a data matrix compiled from quadrat data sourced from numerous studies conducted by Woodman Environmental (WEC 2002, 2006, 2008a&b). The analyses were run utilising the following data permutations:

- All native species

- All perennial native species
- All perennial native species with singletons omitted

The results of the separate analyses were then inspected and mapped to determine whether the final groupings accurately reflected patterns in soil, landform and floristics. The analysis that best represented patterns in floristics and environment was generated using only perennial native species and this dataset was used to generate the final floristic community types FCTs over the broader project area including both the Tiwest Dongara tenements and the Iluka Eneabba tenements. This analysis best accounted for the highly fluctuating occurrences of annual species across the project area due to poor rainfall experienced in 2006 and 2007 (Figure A) and the varying times of survey for each study, particularly those conducted south of Eneabba.

Pattern analysis was conducted using PATN (V3.03) (Belbin 1989). The Bray-Curtis coefficient was used to generate an association matrix for classification and ordination analyses. Within PATN the agglomerative hierarchical clustering method using flexible UPGMA (ß=-0.1) was used to generate a species by site classification (Sneath and Sokal 1973) and two way tables. Indicator species analysis (INDVAL) was conducted with PC-Ord (McCune and Mefford 1999) using the method adopted by Dufrene and Legendre (1997). The INDVAL measures were used to determine the indicator species for each FCT and a Monte Carlo permutation was used to test for the significance of these indicator species.

The wetland analysis was conducted using data obtained from quadrats located within the Tiwest Dongara project area within wetland FCTs identified during the initial analysis. This subsequent PATN analysis was conducted using presence/absence data (annual and perennial data). New groupings identified during the wetland analysis were labelled as subgroup FCTs and mapped accordingly.

An adaptation of the Muir (1977) classification of vegetation structure was used to describe the FCTs and subgroup FCTs within the project area. This adaption utilises the vegetation classification system described in Table 1 in Muir (1977) and omits the use of floristic and soil codes which have been replaced by full Genus and Species labels in addition to descriptions of surface soils and topography.

Where possible, the conservation status of each FCT was determined by referring to available regional studies in addition to comparisons with the Threatened Ecological Community (TEC) database provided by the Department of Environment and Conservation (DEC 2008c). However, the geographic spread and coverage of regional soil types of the current study provides reasonably good representation of plant communities within the Eridoon system (Beard 1976) with some representation from the adjacent Tathra and Illyarrie systems. Therefore it is expected that FCTs that have restricted distributions within the broader project area and are not wholly associated with the Tathra and Ilyarrie systems are conservation significant.

Plant species nomenclature used in this report follows that used by Packowska *et al*. (2000). All names were checked using the Max Database to ensure they are current. The conservation status of all species collected was checked using the current Department of Environment and Conservation list (DEC 2008d).

The Department of Environment and Conservation requested that the project take into account historical floristic studies conducted by Dr Ted Griffin in the Northern Sandplains region when determining regional conservation significance of floristic community types. A regional flora dataset was provided by Dr. Griffin and consultation with him indicated the following:

- the dataset was collected over a range of years;
- the dataset was collected by various botanists;
- the dataset included both quadrat derived data and relevee (plotless site assessment) data; and
- the taxonomy of the dataset was not consistent with current taxonomic revisions.

The dataset as provided only contained floristic data from sites that Dr. Griffin believed may be representative of the study area and therefore a broader regional assessment was not possible. It was concluded that the dataset should not be combined with the Woodman Environmental dataset for the purposes of analysis as the identified inconsistencies would produce anomalies in the results.

Following inspection of the data and mapping of the Griffin site and quadrat locations in relation to the Northern Sandplains Study Area and final FCT boundaries, it was determined that the dataset had very poor coverage within the northern portion of the study area on the Tiwest Dongara leases. While the areas around the Iluka Resources mining area were better sampled, this created a bias in the dataset. These sites were also mainly located in areas that have historically been cleared for mining. It was decided that the most appropriate use for the data would be to analyse it in isolation and then manually compare where data collection sites and quadrats fell within Woodman Environmental FCTs to determine whether floristically related groups were represented elsewhere in the region.

The Dr. Griffin data was analysed using PATN following the method described above and the resultant dendogram inspected to determine whether those sites that fell into the Woodman Environmental study area were closely related to sites elsewhere in the region. Sites that were located in the local Nature Reserves were identified and where they correlated closely with sites in the study area, they were recorded as potentially representing the same FCT as mapped by Woodman Environmental.

5 LIMITATIONS OF THE STUDY

This study incorporates a number of field surveys conducted between 2001 and 2008 (Table 4). The majority of the quadrats were established during 2007.

Table 4: Various Surveys Incorporated into the Northern Sandplains Study Area

Study	Year Surveyed	Months Surveyed	No. of Quadrats
Eneabba Lease Mapping	2001	February, March, May^	65
Eneabba Adamson B Plots	2005	November	20
Eneabba P1 Areas	2007	February, March, April*	93
Eneabba P2 Areas	2007	September, October, November	126
Dongara Areas	2007	October, November	150
Dongara Areas, Additional Wetland Study	2008	August, October	9#
TOTAL	**-**	**-**	**463**

^ followup survey for annuals within the general project area conducted in November and December
*followup survey for annuals in plots within wetlands conducted in September
quadrats not used in the initial PATN joint analysis

Historical rainfall data collected from the Iluka Eneabba minesite weather station shows that below average rainfall conditions were experienced during 2006 and 2007 (Figure A). During this period annual rainfall was approximately 100mm less than the historical trend. These conditions are unfavourable for flowering (hence positive taxonomical identification) and the germination of annual species, therefore the statistical analysis included only perennial species to account for the variation of annuals recorded between studies.

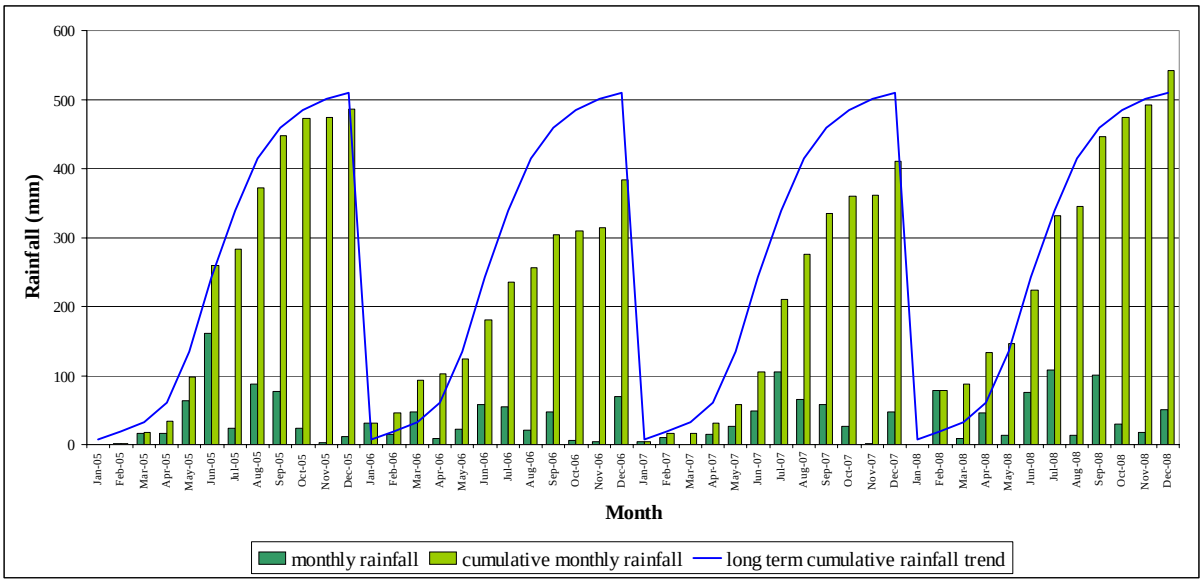


Figure A: Monthly Rainfall Received at the Eneabba Minesite Between 2005 and 2008 Compared with the Long Term Cumulative Trend

It has been hypothesised that the seasonal wetlands and damplands within the Dongara project area are floristically defined by suites of annual species that occur within the understory. Due to the ommission of annuals in the statistical analyis, the initial study may have potentially grouped a number of FCTs.

The wetland analysis using presence/absence data (perennials and annuals) was conducted using quadrats established within wetlands identified within the Tiwest Dongara project area. This analysis did not utilise the regional dataset due to the inconsistency of annuals recorded between studies as a product of varying seasonal surveys and adverse rainfall conditions. Due to the method used, the resultant subgroup FCTs determined during the secondary analysis were not able to be compared to regional wetland FCTs identified during the initial joint analysis.

This report presents the results of surveys conducted on the Tiwest Dongara tenements only. Flora lists for the entire broader project area incorporating the Iluka Resources tenements have not been included here, however full species distributions have been utilised to discuss the conservation status of significant taxa.

FCTs have been developed utilising the joint dataset to allow for direct comparisons over the whole study area, however only those FCTs identified from the Tiwest leases are discussed in this report with regional representation discussions utilising the full broader study.

6 RESULTS

6.1 FLORA

A total of 543 native vascular plant taxa belonging to 72 plant families were recorded within the Dongara project area during the surveys conducted between 2006 and 2008 (Appendix B). The dominant families were Myrtaceae (75 taxa), Proteaceae (64 taxa) and Cyperaceae (30 taxa).

One Declared Rare Flora species, *Paracaleana dixonii* was recorded within the project area. *Paracaleana dixonii* is a member of the Orchidaceae family and is a tuberous perennial herb to 0.2m (Plate 1). *P. dixonii* has an unusual flowering period that occurs between the months of late October and January (Hoffman and Brown 1998). This niche, where the conditions are hot and dry, is achieved by producing a succulent, nutrient storing stem during the wetter months of spring. A total of 90 plants of this species were recorded from 39 locations within FCT 4a and 5e.

Plate 1: *Paracaleana dixonii* (DRF) photo by D. Coultas

A total of 21 Priority Flora species were recorded in the survey area by Woodman Environmental Consulting during surveys conducted between 2006 and 2008. A summary of these species, in addition to data provided by Western Botanical (2005a&b, 2006) and the Department of Environment and Conservation (2007a) is provided in Table 5 and Figures 3.11 to 3.44.

Table 5: Priority Flora Species Recorded in the Dongara Project Area during Surveys Conducted by Woodman Environmental Consulting in 2006 (WEC 2007a), 2007 and 2008 in Addition to Data Provided by Western Botanical (2005a&b, 2006) and the Department of Environment and Conservation (2007a)

Species	Family	No. of Locations	FCTs recorded	Comments
Acacia vittata (P2)	Mimosaceae	7	4a, 22a	Dense rounded shrub to 4m with yellow flowers in Aug. Found on grey sands and clays on the margins of seasonal lakes
Baeckea sp. Walkaway (A.S George 11249) (P3)	Myrtaceae	3	4b, 21a	A dense multistemmed shrub to 2m. White flowers between Dec – Jan. Found on yellow, brown or white sand
Banksia elegans (P4)	Proteaceae	192	3b, 4a, 4b, 17, 19a, 20, 21a, 21b, 22a	Fire tolerant shrub to 4m. Yellow green flowers between Oct – Nov. Found on yellow, white or red sands on sandplains and dunes
Banksia scabrella (P4)	Proteaceae	57	4a, 5e	Many branched shrub to 2m. yellow, purple flowers between Sep – Jan. Found on white, grey or yellow sands on sandplains and lateritic ridges
Beyeria gardneri (P3)	Euphorbiaceae	2	4a	Shrub to 0.5m with yellow flowers between Aug – Sep. Found on yellow sand
Calectasia palustris (P1)	Dasypogonaceae	2	4a, 5e	Stilted herb to 0.7m with blue flowers between Jul – Oct. Found on white or grey sand and clay in damp areas.
Calytrix chrysantha (P4)	Myrtaceae	5	2b, 4a, 22a	Shrub to 1.3m with yellow flowers between Dec – Feb. Found on white, grey or yellow sand flats.
Comesperma griffinii (P2)	Polygalaceae	2	5e	herb to 0.2m with white flowers in Oct. Found on yellow or grey sand on plains
Eremaea acutifolia (P2)	Myrtaceae	3	3b	Spreading shrub to 0.7m with orange and pink flowers between Aug – Nov. Found on grey or yellow sand
Eucalyptus macrocarpa subsp. *elachantha* (P4)	Myrtaceae	9	4a, 5e	Spreading mallee to 4m. Red or pink flowers between Aug – Dec. Found on white and grey sands over laterite on sandplains, hills and ridges
Eucalyptus macrocarpa x *pyriformis* (P3)	Myrtaceae	1	5e	Erect open mallee to 6m. Red flowers between Apr-Oct. Found on sand and lateritic soils.
Eucalyptus zopherophloia (P4)	Myrtaceae	4	22a	Spreading mallee to 4m. Cream, white flowers between Oct – Jan. Found on grey or white sand with coastal limestone
Gastrolobium callistachys (P4)	Papilionaceae	3	3b	Weeping shrub to 3m with yellow and orange flowers between Sep – Nov. Found on sandy soils and granite outcrops.

Table 5: Priority Flora Species Recorded in the Dongara Project Area during Surveys Conducted by Woodman Environmental Consulting in 2006 (WEC 2007a), 2007 and 2008 in Addition to Data Provided by Western Botanical (2005a&b, 2006) and the Department of Environment and Conservation (2007a)

Species	Family	No. of Locations	FCTs recorded	Comments
Georgeantha hexandra (P4)	Ecdeiocoleaceae	1	3b	Rhizomatous herb to 0.8m. Found on deep sands and damp sites.
Goodenia trichophylla(P3)	Goodeniaceae	1	5e	Herb to 0.3m with pink and blue flowers. Found on grey sand over laterite.
Grevillea erinacea (P3)	Proteaceae	3	16b	Prickly, spindly shrub to 1.8m with green, white and cream flowers between Jul – Dec. Found on white, grey and yellow sands and laterite
Guichenotia alba (P3)	Sterculiaceae	15	4a, 5e	Slender shrub to 0.5m. White flowers between Jul – Aug. Found on sandy, gravelly soils in low flats and depressions
Hemiandra sp. Eneabba (H. Demarz 3687) (P3)^	Lamiaceae	192	3b, 4a, 4b	Straggly shub to 0.9m. Blue, violet flowers in February growing on sandy soils
Hopkinsia anoectocolea (P3)	Restionaceae	10	7, 21a, 21b, 22a	Rhizomatous, perenial to 1m. Brown flowers between Sep – Dec. Found on white or grey sands and in saline depressions.
Hypocalymma gardneri (P3)	Myrtaceae	12	4a, 5e	Shrub to 0.3m with yellow flowers between Aug – Sep. Found on grey and brown sands and laterite
Lasiopetalum ogilvieanum (P1)	Sterculiaceae	1	4a	Shrub to 1.5m Pink, white flowers between Jul – Oct. Found on white, grey or yellow sands and stoney soils.
Mesomelaena stygia subsp. *deflexa* (P3)	Cyperaceae	5	4a, 4b	Tufted grass-like sedge to 0.5m. Brown, black flowers between Mar – Oct. Found on white or grey lateritic sands and gravelly clays
Persoonia filiformis (P2)	Proteaceae	8	4a, 5e	Spreading shrub to 0.4m. Yellow flowers between Nov – Dec. Found on yellow or white sands over laterite
Persoonia rudis (P3)	Proteaceae	19	2b, 3a, 4a, 4b	Erect or spreading shrub to 1m. Yellow flowers between Sep – Jan. Found on white, grey or yellow sands, sometimes over laterite
Schoenus griffinianus (P3)	Cyperaceae	11	3b, 4a, 4b	Small tufted perennial to 1m., flowering between Sep – Oct. Found on white sands.
Schoenus sp. Eneabba (F. Obbens & C. Godden I154) (P2)	Cyperaceae	25	3b, 4a	clumped rhizomatous sedge to 0.8m. Found on grey, yellow or white sands
Stawellia dimorphantha (P4)	Anthericaceae	199	3a, 3b, 4a, 4b, 20, 21a, 21b, 22a	stilted herb to 0.2m with cream flowers between Jun – Nov. Found on white, grey or yellow sands.

Table 5: Priority Flora Species Recorded in the Dongara Project Area during Surveys Conducted by Woodman Environmental Consulting in 2006 (WEC 2007a), 2007 and 2008 in Addition to Data Provided by Western Botanical (2005a&b, 2006) and the Department of Environment and Conservation (2007a)

Species	Family	No. of Locations	FCTs recorded	Comments
Stylidium carnosum subsp. Narrow leaves (J.A. Wege 490) (P1)	Stylidiaceae	13	4a	Cormaceous herb to 1m with white flowers between Oct - Nov.
Stylidium pseudocaespitosum (P2)	Stylidiaceae	2	3b	Rosetted perennial to 0.2m with yellow flowers between Sep – Nov. Found on white, grey or yellow sands over laterite.
Verticordia luteola var. *luteola* (P3)	Myrtaceae	10	3b, 4a, 19a	Slender shrub to 1.4m. White, yellow flowers between Nov – Dec. Found on grey sands over gravel

^includes specimen locations identified as Hemiandra ?sp. Eneabba (H. Demarz 3687)

A number of potentially undescribed species have been been collected from the project area (Table 6).

Table 6: Undescribed or Poorly Known Taxa Recorded Within the Project Area

Species	No. of Locations	FCT	Comments	Potential Conservation Significance
Levenhookia sp.	1	20	located between Dongara and Wubin[1]	no
Calandrinia aff. *liniflora*	1	3a	located between Dongara and Kalbarri[2]	no
Calandrinia aff. *remota*	2	10, 22a	located between Dongara and Kalbarri[2]	no
Stylidium aff. *cygnorum*	3	4a	located between Jurien Bay and Dongara, abundant in the Coomalloo Nature Reserve[1]	no
Melaleuca aff. *preissiana*	6	12	located within Arrowsmith Lake and Yardanogo Nature Reserve	yes
Lepidosperma cf. *tenue*	9	4a, 4b, 11, 21a, 22a	group currently being studied, definitive genetic work unlikely to be finished in 2009[3]	unlikely[3]
Lepidosperma sp. "Yuna Scabrid"	1	19a	a number of populations known between Yuna and Wubin[3]	no

[1] pers. comm. Allen Lowrie
[2] pers. comm. Frank Obbens
[3] pers. comm. Russell Barrett

A total of 36 introduced (weed) taxa were recorded within the project area (Table 7). In general, weed invasion into native vegetation was very low. However, weeds were prevalent in disturbed areas adjacent to farming properties surrounding the tenements.

Table 7: Introduced Flora Recorded in the Dongara Project Area

Species
**Aira caryophyllea*
**Aira cupaniana*
**Anagallis arvensis* var. *caerulea*
**Avena barbata*
**Brassica tournefortii*
**Briza maxima*
**Briza minor*
**Bromus diandrus*
**Centaurea melitensis*

Table 7: Introduced Flora Recorded in the Dongara Project Area

Species
**Centaurium* ?*tenuiflorum*
**Chenopodium murale*
**Cotula coronopifolia*
**Ehrharta longiflora*
**Erodium* sp.
**Galium murale*
**Hypochaeris glabra*
**Hordeum leporinum*
**Isolepis marginata*
**Lolium* sp.
**Melilotus* ?*indicus*
**Mesembryanthemum crystallinum*
**Mesembryanthemum nodiflorum*
**Oxalis corniculata*
**Pentaschistes airoides*
**Phyllopodium cordatum*
**Plantago coronopus*
**Polypogon monspeliensis*
**Raphanus raphanistrum*
**Schismus* ?*barbatus*
**Sonchus oleraceus*
**Spergularia* ?*diandra*
**Spergularia* ?*rubra*
**Ursinia anthemoides*
**Vulpia* ?*bromoides*
**Vulpia* sp.
**Wahlenbergia capensis*

None of the weed species recorded in the project area are listed as Declared Plants by the Department of Agriculture and Food Western Australia (DAF 2008).

6.2 FLORISTIC COMMUNITY TYPES

6.2.1 JOINT ANALYSIS

A total of 716 taxa were used during the statistical joint analysis to determine FCTs within the project area. All annuals and introduced taxa were removed from the dataset prior to analysis.

Statistical analysis of the project area and regional quadrat dataset using PATN (perennials only) has resulted in the identification of 2 supergroups as described below:

Super Group 1: Woodlands, Thickets and Heaths on well drained sandy soils and sandy clays over lateritic gravel;

Super Group 2: Woodlands, Thickets, Heaths and Scrub predominantly on heavier clay soils on lowerslopes, drainage lines and depressions and sandy soils over limestone.

Statistical analysis further divided these super-groups into 22 groupings and 42 FCTS. The delineation of FCTs was determined by manually dissecting the dendrogram to reflect structural and floristic characteristics of quadrats (Appendix E). A summary matrix of species presence within each quadrat is provided in Appendix F.

A total of 42 FCTs were identified during the statistical analysis of the regional dataset, of which 21 of these FCTs were recorded within the project area (Figures 2.01, 2.1, 2.2, 2.3, 2.4). A summary of species recorded within each FCT within the Dongara project area is provided in Appendix C. A photographic record of each FCT is provided in Appendix D.

Supergroup 1: Woodlands, Thickets and Heaths on well drained sandy soils and sandy clays over lateritic gravel

FCT2b: Heath to Thicket of mixed shrubs commonly including *Melaleuca leuropoma*, *Hibbertia hypericoides*, *Banksia shuttleworthiana* and *Allocasuarina humilis* over *Ecdeiocolea monostachya* on yellow or brown sand and sandy clay

no. quadrats established in Northern Sandplains Study Area:	34
no. quadrats established in Dongara project area:	2

FCT2b is located in the south-west of the project area and is predominantly a Heath with emergent *Eucalyptus todtiana* and occasional *Xylomelum angustifolium* on deeper sands. The structure of this community is strongly influenced by fire, with frequent burning often suppressing the stature of trees. This FCT corresponds with structural community W5 and is located within the Eridoon system.

The mean species richness recorded for FCT2b was 41.4 ± 1.6 taxa per quadrat. There are no strong indicator species for this FCT as calculated values were low (<20%).

FCT3a: Open Low Woodland to Heath of *Banksia* spp. over mixed shrubs commonly including *Melaleuca leuropoma*, *Eremaea beaufortioides* and *Scholtzia laxiflora* on yellow sand on lower to mid slopes

no. quadrats established in Northern Sandplains Study Area:	17
no. quadrats in Dongara project area:	1

FCT3a is located in the western section of the project area on yellow sands adjacent to cleared paddocks and is dominated by a number of *Banksia* species including *B. attenuata*, *B. candolleana*, *B. menziesii* and *B. leptophylla* with emergent *Eucalyptus todtiana*. This FCT corresponds with structural community W5 and is located within the Eridoon system. The differences between FCT3a and FCT3b within the project area are not fully

understood. Large areas of native vegetation in the south west of the project area were burnt before the quadrat based survey. Only 1 quadrat was placed in an unburnt section of W5.

The mean species richness recorded for FCT3a was 31.4 ± 1.5 taxa per quadrat. Indicator species for this FCT include *Hibbertia subvaginata* and *Stachystemon axillaris*.

FCT3b: Low Woodland to Thicket of *Banksia attenuata* and *Banksia menziesii* over mixed shrubs dominated by myrtaceous species on brown or yellow sand on lower to mid slopes and plains

no. quadrats established in Northern Sandplains Study Area:	17
no. quadrats in Dongara project area:	15

FCT3b is a vegetation type that dominates the western half of the project area and is located on the lower to mid slopes of large sandy rises and sandy plains. This FCT corresponds predominantly with structural community W6 and a small area previously mapped as T3 and is located within the Eridoon system.

The mean species richness recorded for FCT3b was 34.1 ± 2.0 taxa per quadrat. Indicator species include *Banksia menziesii*, *Conostephium preissii*, *Leucopogon conostephioides* and *Calytrix sapphirina*.

FCT4a: Species rich Woodlands and Heaths on grey sand in the eastern portion of the Eneabba sandplain. Common species include *Conospermum boreale* subsp. ?*boreale*, *Ecdeiocolea monostachya*, *Eremaea beaufortioides*, *Hakea polyanthema* and *Banksia candolleana*

no. quadrats established in Northern Sandplains Study Area:	25
no. quadrats in Dongara project area:	24

FCT4a is located in the eastern section of the project area on bleached sands associated with the Eridoon system and is bordering the lateritic rises of the Tathra System. In some areas the understorey is dominated by *Hakea polyanthema* P3. This species seems to be intolerant to drought conditions and there are a number of areas on the sandplain where mass deaths have occurred, reflecting the lower than average rainfall conditions experienced in 2006 and 2007 (Figure A). This FCT corresponds with structural communities H3, W5 and the lower slopes of T3.

The mean species richness recorded for FCT4a was 42.3 ± 1.6 taxa per quadrat. *Conospermum boreale* subsp. ?*boreale* was the only indicator species recorded for this FCT.

FCT4b: Thicket dominated by *Banksia hookeriana* and/or *Banksia attenuata*, with emergent *Banksia prionotes* on yellow sand on upper slopes and dune crests

no. quadrats established in Northern Sandplains Study Area: 18
no. quadrats in Dongara project area: 18

FCT4b is located in the western section of the project area on upperslopes and ridges with a deep yellow sand profile. The structure of this community is strongly influenced by fire. Trees of *Banksia hookeriana* up to 3m in height were observed in areas that had not been periodically burnt during controlled burns. Dominant understorey species include *Ecdeiocolea monostachya* and *Pileanthus filifolius*. This FCT corresponds with the upperslopes of structural community T3 and is associated with the Eridoon system. FCT4b is located higher in the landscape than FCT4a on large dunes with deep yellow sands where stands of *Eucalyptus todtiana* are rarely seen.

The mean species richness recorded for FCT4b was 33.3 ± 0.87 taxa per quadrat. Indicator species for this FCT include *Banksia hookeriana* and *Persoonia acicularis.*

FCT5e: Heath to Low Heath dominated by *Banksia* spp. and *Melaleuca* spp. over *Ecdeiocolea monostachya* on grey or brown sandy clay or gravel on lower slopes and plains

no. quadrats established in Northern Sandplains Study Area: 15
no. quadrats in Dongara project area: 9

FCT 5e is located in the eastern margins of the project area on the lateritic soils of the Tathra System. Typical understorey species include *Allocasuarina microstachya, Melaleuca aspalathioides, Ecdeiocolea monostachya* and *Banksia carlinoides*. This community is quite heterogenous in species composition and is likely to increase in species richness towards Eneabba where the rainfall is higher (Beard 1976). FCT5e corresponds with structural community H5.

The mean species richness recorded for FCT5e was 46.1 ± 2.3 taxa per quadrat. Indicator species include *Calothamnus longissumus, Boronia cymosa, Melaleuca aspalathoides, Baeckea camphorosmae, Anarthria polyphylla* and *Opercularia vaginata.*

Supergroup 2: Woodlands, Thickets, Heaths and Scrub predominantly on heavier clay soils on lowerslopes, drainage lines and depressions and sandy soils over limestone

FCT7: Low Woodland to Low Forest of *Melaleuca rhaphiophylla* and/or *Eucalyptus camaldulensis* var. *obtusa* over a species poor understorey dominated by annuals on grey or brown sandy clay in wet depressions and drainage lines

no. quadrats established in Northern Sandplains Study Area: 10
no. quadrats in Dongara project area: 3

FCT 7 is predominantly located in the south-west of the project area within the catchments of the Arrowsmith River associated with the Eridoon system. It is also located within the Yardanogo Nature Reserve fringing a large basin and at the Beharra Spring Site. The soils of Beharra Spring feature an impervious layer of clay sediments within the Guildford Formation and the vegetation at this site is considered to be a potential Groundwater Dependant Ecosystem (DEC 2005). The soils of FCT 7 are generally seasonally damp in the winter months. However, water inundation was observed during winter where this FCT drains into the Arrowsmith Lake, reflecting the rainfall received during 2008 (Figure A). The understorey of FCT 7 is generally quite sparse and dominated by introduced (weed) annual species. Emergent shrubs include *Acacia saligna* and *A. blakelyi* however species richness is quite low. FCT 7 corresponds with structural community W1.

The mean species richness recorded for FCT 7 was 5.6 ± 1.2 taxa per quadrat. *Melaleuca rhaphiophylla* is the primary indicator species for this FCT.

FCT9a: Thicket dominated by *Melaleuca huegelii* subsp. *huegelii* and *Acacia* spp. on brown sandy clay over limestone on lower slopes and depressions

no. quadrats established in Northern Sandplains Study Area:	9
no. quadrats in Dongara project area:	7

Three small occurrences of FCT9a are located in the south western section of the project area in minor depressions overlying coastal limestone associated with the Illyarrie System. The understorey is very sparse and species such as *Dianella revoluta* var. *divaricata*, *Melaleuca systena* and *Isotoma hypocrateriformis* were commonly seen. FCT9a corresponds with structural community T4.

The mean species richness recorded for FCT9a was 9.9 ± 1.0 taxa per quadrat. Indicator species include *Comesperma integerrimum*, *Thomasia rulingioides* and *Melaleuca huegelii* subsp. *huegelii*.

FCT9b: Low Woodland to Low Forest of *Eucalyptus camaldulensis* over Open Scrub of *Acacia rostellifera*, *Chamelaucium uncinatum* and *Melaleuca* spp. on grey or brown sandy clay in drainage lines and depressions

no. quadrats established in Northern Sandplains Study Area:	10
no. quadrats in Dongara project area:	10

FCT9b is located in an isolated basin in the northern section of the project area and within drainage areas of the Irwin River and Arrowsmith River catchments. This FCT corresponds with structural community W1 and is associated with the Illyarrie and Eridoon systems. FCT9b differs from FCT9a due the presence of *Eucalyptus camaldulensis* which is indicative of higher water availability. These wetlands are considered to be seasonally

damp, with isolated occurrences of water ponding during winter months with high rainfall.

The mean species richness recorded for FCT9b was 8.67 ± 1.38 taxa per quadrat. Indicator species include *Acacia rostellifera, Eucalyptus camaldulensis* and *Chamelaucium uncinatum*.

FCT10: Low Woodland of *Eucalyptus erythrocorys* over Thicket dominated by *Melaleuca cardiophylla* on brown sand over massive limestone outcropping in a drainage line

no. quadrats established in Northern Sandplains Study Area:	1
no. quadrats in Dongara project area:	1

Only one occurrence of FCT10 was recorded during the survey, located outside of the mapped area, within the Yardanogo Nature Reserve. This community is associated with the Illyarrie system and supports habitat for a suite of species shared only with FCT22a, namely *Dodonaea aptera, Jasminum calcarium, Eucalyptus erythrocorys* and *Grevillea argyrophylla*. FCT10 is also dominated by *Melaleuca* ?*campanae*. This species has not been recorded elsewhere within the project area and represents a range extension to the south of the Geraldton townsite.

A total of 14 native plant taxa (standard error not applicable) were recorded within FCT10. No indicator species were recorded for this FCT as it consisted of only 1 quadrat.

FCT11: Heath dominated by *Melaleuca systena* and *Melaleuca huegelii* subsp. *huegelii* on grey or brown sand and sandy clay in depressions

no. quadrats established in Northern Sandplains Study Area:	5
no. quadrats in Dongara project area:	5

An isolated occurrence of FCT11 is located within a basin in the central section of the project area within the Eridoon system. Common understorey species include *Allocasuarina lehmanniana* subsp. *lehmanniana, Acacia lasiocarpa* var. *lasiocarpa* and *Poranthera microphylla*. This community is experiencing considerable drought stress due to lower than average rainfall conditions experienced during 2006 and 2007 (Figure A). FCT11 corresponds with structural community H1 and is considered to be a seasonal dampland.

The mean species richness recorded for FCT11 was 11.0 ± 0.8 taxa per quadrat. Indicator species include *Allocasuarina lehmanniana* subsp. *lehmanniana, Austrostipa flavescens, Thysanotus patersonii, Samolus repens* var. *floribundus, Acacia lasiocarpa* var. *lasiocarpa* and *Melaleuca systena*.

FCT12: Low Woodland to Low Forest of *Melaleuca* aff. *preissiana* over a sparse, often disturbed, shrub layer on grey sandy clay in depressions

no. quadrats established in Northern Sandplains Study Area: 6
no. quadrats in Dongara project area: 5

FCT12 is located in the western section of the project area in basins within the Yardanogo Nature Reserve (Yardanogo Swamp) and Arrowsmith Lake. The basin of Arrowsmith Lake is composed of swamp deposits with low permeability overlying Tamala limestone (DEC 2005). It is a subhaline, seasonally inundated basin with muddy sand and lateritic sedementation. Yardanogo Swamp is a seasonally inundated basin underlain by coffee rock which ponds precipitation. The species richness of FCT12 is low and few similarities in the understorey composition exist between sites. This FCT corresponds with structural community W2 and is associated with the Eridoon system.

The mean species richness recorded for FCT12 was 3.7 ± 0.8 taxa per quadrat. Indicator species include *Melaleuca preissiana, Tecticornia pergranulata* subsp. *pergranulata* and *Wilsonia rotundifolia*. The latter of these species are indicative of saline soils. Additional salt tolerant species recorded in the understorey of this FCT include ?*Atriplex semilunaris, Calocephalus francisii, Enchylaena tomentosa* and *Maireana brevifolia*.

FCT16b: Highly disturbed Scrub with *Calothamnus quadrifidus* on grey or brown sand in drainage lines

no. quadrats established in Northern Sandplains Study Area: 3
no. quadrats in Dongara project area: 2

FCT16b is located in the south east of the project area within a degraded drainage line adjacent to cleared paddocks. Historical clearing and grazing has impacted the structure of this community – the scrub layer is quite sparse and the understorey is dominated by annual weeds. Common understorey shrub species include *Conostylis aculeata, Hakea lissocarpha* and *Xanthorrhoea drummondii.* FCT16b corresponds with structural community H4 and is located on the borders of the Eridoon and Tathra systems.

The mean species richness recorded for FCT16b was 23.0 ± 6.4 taxa per quadrat. A number of introduced taxa (pastoral weeds) were not collected during the survey as they had senesced and were unidentifiable. Indicator species include *Ptilotus manglesii, Acacia multiflora, Drosera gigantea, Elythranthera emarginata, Gompholobium aristatum, Hemigenia diplanthera, Scaevola lanceolata* and *Conostylis aculeata*.

FCT17: Shrublands and Thickets dominated by *Melaleuca* spp. and *Banksia* spp. on grey or brown sandy clays and sandy loams with some lateritic gravel on flats, depressions and creek-lines

no. quadrats established in Northern Sandplains Study Area: 22
no. quadrats in Dongara project area: 8

A total of four occurrences of FCT17 were recorded within seasonally damp wetlands central to the project area. Common understorey species include *Banksia leptophylla*, *Melaleuca leuropoma* and *Calothamnus hirsutus*. This FCT corresponds with structural communities W7 and H2 and is associated with the Eridoon system.

The mean species richness recorded for FCT17 was 20.8 ± 1.2 taxa per quadrat. There are no indicator species recorded for this FCT.

FCT18: Thicket dominated by *Melaleuca concreta* and/or *Allocasuarina campestris* on grey sandy clay in depressions and clay pans

no. quadrats established in Northern Sandplains Study Area:	8
no. quadrats in Dongara project area:	6

FCT18 was recorded in several locations, usually within isolated, seasonally damp basins but also fringing wetter sites. The understorey is quite sparse and species richness is low. Common species include *Melaleuca huegelii* subsp. *huegelii* and *Acacia saligna*. This FCT corresponds with structural community T2 and is located within the Eridoon system.

The mean species richness recorded for FCT18 was 7.8 ± 1.9 taxa per quadrat. There are no indicator species recorded for this FCT.

FCT19a: Heath to Thicket dominated by *Allocasuarina campestris* and/or *Banksia leptophylla* var. *leptophylla* on grey or brown sandy clay in drainage lines

no. quadrats established in Northern Sandplains Study Area:	5
no. quadrats in Dongara project area:	4

FCT19a is located in a number of small isolated, seasonally damp basins within the northern section of the project area. Common species include *Calothamnus hirsutus, Verticordia densiflora*, *Kunzea micrantha* subsp. *petiolata* and *Acacia saligna*. This FCT corresponds with structural community T2 and H2 and is located within the Eridoon system. A mosaic of FCT3b and FCT19a is located to the north of the project area. These distinct FCTs were unable to be delineated within the polygon using the aerial photographs.

The mean species richness recorded for FCT19a was 14.3 ± 2.5 taxa per quadrat. Indicator species include *Stylidium burbidgeanum* and *Calothamnus hirsutus.*

FCT19b: Scrub of *Acacia* spp., *Allocasuarina campestris* and *Calothamnus* spp. on grey sand on lower slopes and drainage lines

no. quadrats established in Northern Sandplains Study Area:	2
no. quadrats in Dongara project area:	2

FCT19b was recorded at two locations to the east of the project area along drainage lines with alluvial sedimentation derived from the lateritic rises of the Tathra system. Common species include *Acacia scirpifolia*, *A. saligna* and *Calothamnus quadrifidus* with emergent *Eucalyptus todtiana*. This FCT corresponds with structural communities T2 and W5a.

The mean species richness recorded for FCT19b was 10.5 ± 2.5 taxa per quadrat. Indicator species include *Acacia scirpifolia*, *Guichenotia* ?*macrantha*, *Scholtzia* sp. Eneabba (S. Maley 8) and *Acacia saligna*. This FCT is represented by 2 quadrats, one with a fire history of approximately 10 years and the other less than 5 years. The presence of *Acacia scirpifolia* and *Acacia saligna* may be a reflection of fire history within this community as these species are disturbance opportunists. However, *Guichenotia* ?*macrantha* and *Scholtzia* sp. Eneabba (S. Maley 8) are indicative of laterite and therefore differentiate the soil substrate of this FCT from FCT19a. In addition, FCT19b differs from FCT19a due to the presence of well drained sandier soils and the absence of *Calothamnus hirsutus*, a wet species indicator.

FCT20: Thicket dominated by *Actinostrobus pyramidalis* on grey diatomaceous earth on lower slopes and depressions

no. quadrats established in Northern Sandplains Study Area:	6
no. quadrats in Dongara project area:	6

FCT20 is located in the north west of the project area, with smaller occurrences to the south and is associated with powdery, diatomaceous earth in low lying, seasonally damp depressions. This FCT corresponds predominantly with structural community T1 and community T2 near Beharra Springs and is located within the Eridoon System.

The mean species richness recorded for FCT20 was 12.9 ± 1.0 taxa per quadrat. Indicator species include *Actinostrobus pyramidalis*, *Kunzea micrantha* subsp. *petiolata* and *Hakea trifurcata*.

FCT21a: Low Woodland of *Banksia prionotes* and/or *Casuarina obesa* over Low Scrub of *Banksia* spp. and *Calothamnus* spp. on yellow or brown sand

no. quadrats established in Northern Sandplains Study Area:	12
no. quadrats in Dongara project area:	11

FCT21a is located in the west of the project area adjacent to the limestone belt associated with the Illyarrie system, with isolated occurrences further west associated with the Eridoon system. Occasional limestone outcropping is evident within this community and common understorey species include *Calothamnus quadrifidus*, *C. blepharospermus* and *Ecdeiocolea monostachya*. This FCT corresponds with structural community W4 and isolated occurences of communities previously mapped as H3, W5a and T2.

The mean species richness recorded for FCT21a was 18.6 ± 1.5 taxa per quadrat. *Banksia prionotes* is the only indicator species recorded for this FCT.

FCT21b: Thicket to Open Scrub dominated by *Acacia* spp. on lower slopes and *Banksia* spp. on mid slopes over *Hakea* spp. and *Ecdeiocolea monostachya* on brown sand and sandy clay

no. quadrats established in Northern Sandplains Study Area:	12
no. quadrats in Dongara project area:	12

FCT21b is variable in structure depending on soil type and is found in the south-west of the project area on lower slopes adjacent to wetland communities on the border of the Illyarrie and Eridoon systems. The shrub layer consists of *Acacia blakelyi* and/or *Acacia saligna* and common understorey species include *Conostylis candicans* subsp. *calcicola*, *Desmocladus asper* and *Jacksonia hakeoides* which are indicators of calcareous soils. On sandier sites *Banksia attenuata* and *B. menziesii* are often seen and species richness increases. FCT21b is generally located lower in the landscape adjacent to drainage areas in comparison to FCT21a where deeper yellow sands are evident. This FCT corresponds with a number of areas previously mapped as structural communities H2, H4, W6, W7, S1 and W4.

The mean species richness recorded for FCT21b was 15.25 ± 1.2 taxa per quadrat. There are no indicator species recorded for this FCT.

FCT22a: Low Woodland of *Eucalyptus erythrocorys* on brown or yellow sand over limestone on mid to upper slopes

no. quadrats established in Northern Sandplains Study Area:	8
no. quadrats in Dongara project area:	8

FCT22a is located in the south west of the project area and is associated with the limestone soils of the Illyarrie system. In some areas the understorey is highly disturbed due to grazing. *Eucalyptus erythrocorys* is a fire sensitive species with strong root systems that penetrate limestone crevices. Shrub species are less likely to penetrate the limestone rock, therefore the shrub layer is typically open and the intensity of fires subsequently reduced where heavy outcropping is evident (Beard 1976). Common understorey species include *Acacia blakelyi, A. spathulifolia*, *Conostylis candicans* subsp. *calcicola, Desmocladus asper* and *Melaleuca systena*. This FCT corresponds with structural community W3.

The mean species richness recorded for FCT22a was 21.1 ± 1.5 taxa per quadrat. Indicator species include *Eucalyptus erythrocorys*, *Acacia*

spathulifolia, Conostylis candicans subsp. *calcicola, Scholtzia umbellifera, Acanthocarpus preissii* and *Desmocladus asper*.

Table 8 presents the number of conservation significant taxa recorded in each FCT within the Dongara project area. FCT4a recorded the highest number (20) of conservation significant taxa. FTC4a is located within the Eridoon System and is the predominant community type located within Tiwest Dongara orebodies.

Table 8: Conservation Significant Taxa Recorded in each FCT Within the Dongara Project Area

FCT	Conservation Significant Taxa	Total
2b	*Calytrix chrysantha* P4 and *Persoonia rudis* P2	2
3a	*Stawellia dimorphantha* P4	1
3b	*Banksia elegens* P4, *Eremaea acutifolia* P2, *Gastrolobium callistachys* P4, *Georgeantha hexandra* P4, *Hemiandra* sp. Eneabba (H. Demarz 3687) P3, *Schoenus griffinianus* P3, *Schoenus* sp. Eneabba (F. Obbens & C. Godden I154) P2, *Stawellia dimorphantha* P4 and *Verticordia luteola* var. *luteola* P3	9
4a	*Acacia vittata* P2, *Banksia elegans* P4, *Banksia scabrella* P4, *Beyeria gardneri* P3, *Calectasia palustris* P1, *Calytrix chrysantha* P4, *Eucalyptus macrocarpa* subsp. *elachantha* P4, *Guichenotia alba* P3, *Hemiandra* sp. Eneabba (H. Demarz 3687) P3, *Hypocalymma gardneri* P3, *Lasiopetalum ogilvieanum* P1, *Mesomelaena stygia* subsp *deflexa* P3, *Paracaleana dixonii* DRF, *Persoonia filiformis* P2, *Persoonia rudis* P3, *Schoenus griffinianus* P3, *Schoenus* sp. Eneabba (F. Obbens & C. Godden I154) P2, , *Stawellia dimorphantha* P4, *Stylidium carnosum* subsp. Narrow leaves) J. Wege 490) P1 and *Verticordia luteola* var. *luteola* P3	20
4b	*Baeckea* sp. Walkaway (A.S. George 11249) P3, *Banksia elegans* P4, *Hemiandra* sp. Eneabba (H. Demarz 3687) P3, *Mesomelaena stygia* subsp. *delflexa* P3, *Persoonia rudis* P3, *Schoenus griffinianus* P3 and *Stawellia dimorphantha* P4	7
5e	*Banksia scabrella* P4, *Calectasia palustris* P1, *Comesperma griffinii* P2, *Eucalyptus macrocarpa* subsp. *elachantha* P4, *Eucalyptus macrocarpa* x *pyriformis* P3, *Goodenia trichophylla* P3, *Guichenotia alba* P3, *Hypocalymma gardneri* P3, *Paracaleana dixonii* DRF and *Persoonia filiformis* P2	10
7	*Hopkinsia anoectocolea* P3	1
9a	None	0
9b	None	0
10	None	0
11	None	0
12	None	0
16b	None	0
17	*Banksia elegans* P4	1
18	None	0
19a	*Banksia elegans* P4 and *Verticordia luteola* var. *luteola* P3	2
19b	None	0
20	*Banksia elegans* P4 and *Stawellia dimorphantha* P4	2
21a	*Baeckea* sp. Walkaway (A. S. George 11249) P3, *Banksia elegans* P4 and *Stawellia dimorphantha* P4	3
21b	*Banksia elegans* P4, *Hopkinsia anoectocolea* P3 and *Stawellia dimorphantha* P4	3
22a	*Acacia vittata* P2, *Banksia elegans* P4, *Calytrix chrysantha* P4, *Eucalyptus zopherophloia* P4, *Hopkinsia anoectocolea* P3 and *Stawellia dimorphantha* P4	6

Table 9 summarises the extent (hectares) of each FCT, both within the Northern Sandplains Study Area and the Tiwest Dongara Project Area, as well as the number of DRF and Priority Flora recorded within each FCT. The majority of FCTs are represented with at least 1 quadrat per averaged square kilometre (100 ha). FCTs 2b, 3a, 3b, 4a and 4b were less sampled mainly due to recent burns in the south. These FCTs have been surveyed extensively in 2006 (WEC 2007a) during structural mapping studies and are complemented with additional detailed recording sites (6, 3, 22, 36 and 16 sites respectively). Taking into account detailed recording sites from studies conducted in 2006 (WEC 2007a), the survey effort for each FCT within the project area is considerably less than 1 detailed recording site/quadrat per averaged square kilometre (100ha).

Table 9: Extent (hectares) and Presence of Conservation Significant Flora in each FCT Recorded Within the Dongara Project Area

FCT	Tiwest Dongara Project Area (ha)	No. Quadrats Established	Average ha per quadrat	Northern Sandplain Study Area (ha)	Extent^ (%)	DRF and Priority Flora
2b	1602.1	2	801.1	5697.2	9.8	2 PF
3a	311.8	1	311.8	796.0	1.4	1 PF
3b	7798.71	15	519.9	7951.5	13.7	9 PF
4a	10466.5	24	436.1	10876.3	18.8	19 PF, 1 DRF
4b	7564.5	18	420.3	7564.5	13.1	7 PF
5e	1067.6	9	118.7	1521.9	2.6	9 PF, 1 DRF
7	268.8	3	89.6	398.4	0.69	1 PF
9a	127.8	7	18.3	147.4	0.25	None
9b	218.8	10	21.9	218.8	0.34	None
11	49.3	5	9.9	53.4	0.09	None
12	115.0	5	23	126.0	0.22	None
16b	29.2	2	14.6	79.5	0.14	None
17	151.6	8	19.0	634.01	1.10	1 PF
18	104.7	6	17.5	113.0	0.20	None
19a	247.8	4	62.0	256.56	0.44	2 PF
19b	37.4	2	18.7	37.6	0.06	None
20	512.2	6	85.4	512.2	0.88	2 PF
21a	539.8	11	49.1	599.0	1.03	3 PF
21b	267.7	12	22.3	267.7	0.46	3 PF
22a	1059.2*	8	132.4	1059.2*	1.83	6 PF
Cleared	2922.7	N/A	N/A	18816.1	N/A	N/A

*includes 210.0 ha of disturbed vegetation

^extent calculated as a percentage of the total area mapped of native vegetation within the Northern Sandplains Study Area (57893 ha) considering clearing boundaries on Iluka tenements current to December 2008

A total of 3 FCTS (2b, 4a, 4b) within the Dongara project area are considered to be widespread in the Northern Sandplains Study Area, recording over 5000 ha each. Four of the FCTs mapped are restricted to the Dongara project area and are listed below:

- FCT 9b
- FCT 20
- FCT 21b
- FCT 22a

FCTs 9b, 21b, and 22a are associated with the Illyarrie System, which was not mapped within the Iluka Eneabba tenements.

The most restricted FCTs mapped in the Dongara project area were 11, 16b and 19b, all recording less than 100 ha within the Northern Sandplains Study Area.

Inspection of the dendogram produced by analyzing the Dr. Griffin dataset identified that few of the FCTs from this dataset correlated with the Woodman Environmental FCTs directly, therefore this dendogram is not presented in this report and the possible reasons for this lack of close correlation discussed in later sections. However some manual correlation of individual sites with those sites mapped in local reserves was possible. This indicated that some FCTs recorded within the Northern Sandplains Study Area are potentially present within the unmapped Lake Logue Nature Reserve including FCTs 2b and 5e.

6.2.2 WETLANDS ANALYSIS

A total of 99 taxa were used during the wetlands analysis to determine subgroup FCTs within the project area. All introduced species were removed from the dataset prior to analysis.

Statistical analysis of wetlands within the project area using PATN (annuals and perennials) has resulted in the identification of 2 supergroups as described below:

Super Group 1: Heaths, Shrublands and Thickets on sandy clay soils on lowerslopes and depressions

Super Group 2: Forests, Woodlands, Thickets and Heaths predominantly on heavier clay soils on lowerslopes, drainage lines and depressions and sandy soils over limestone

Statistical analysis further divided these super-groups into 8 groupings and 9 FCTS. The majority of these FCTs correlate with the findings of the initial joint analysis. However, FCTs 9b and 12 have been further split dichotomously into subgroup FCTs (9b.1, 9b.2, 12.1 and 12.2 respectivley) and are described below:

FCT9b.1: Low Woodland of *Eucalyptus camaldulensis* over Scrub to Thicket of *Acacia* spp. on brown sand on lower slopes and drainage lines

Subgroup FCT9b.1 is located within drainage areas adjacent to isolated basins to the west of the project area and is associated with the Illyarrie system. These wetlands are considered to be seasonally damp, with isolated occurrences of water ponding during winter months with high rainfall. Common understory species include *Acacia rostellifera*, *Acacia blakelyi,*

Rhagodia preissii subsp. *obovata* and *Calocephalus francisii*. *Acacia blakelyi* was the primary indicator species for this subgroup FCT.

FCT9b.2: Open Low Woodland to Low Forest of *Eucalyptus camaldulensis* over Scrub to Thicket dominated by *Melaleuca huegelii* subsp. *huegelii* or *Chamelaucium uncinatum* on grey or brown sand on lower slopes and depressions

Subgroup FCT9b.2 is located predominantly to the north of the project area, with an isolated occurrence to the south west, within basins associated with the Eridoon System. Indicator species include *Chamelaucidum uncinatum, Austrostipa variabilis* and *Acacia rostellifera*

FCT12.1: Low Woodland of *Melaleuca preissiana* over a sparse, often disturbed shrub layer of scattered species including *Tecticornia pergranulata* subsp. *pergranulata* and *Rhagodia preissii* subsp. *obovata* on grey sandy clay in depressions and seasonally inundated basins

Subgroup FCT12.1 is located in the western section of the project area within basins associated with the Eridoon System of the Yardanogo Nature Reserve (Yardanogo Swamp) and Arrowsmith Lake (see section 6.2.1).

Indicator species include *Melaleuca preissiana, Tecticornia pergranulata* subsp. *pergranulata, Wilsonia rotundifolia* and *Rhagodia preissii* subsp. *ovata*. The latter of these species are indicative of saline soils

FCT12.2: Low Forest of *Melaleuca preissiana* and *Casuarina obesa* over herbs on grey sandy clay in depressions

An isolated occurrence of subgroup FCT12.2 was located to the west of the project area within a basin. This subgroup FCT differs from subgroup FCT12.1 due to the absence of a number of salt tolerant species including *Tecticornia perganulata* subsp. *pergranulata, Rhagodia preissii* subsp. *obovata* and *Wilsonia rotundifolia*. Subgroup FCT12.2 displayed a differing suite of saline tolerant species in the understory, including ?*Atriplex semilunaris, Enchylaena tomentosa* and *Casuarina obesa*

No indicator species were recorded for this FCT as it consisted of only 1 quadrat.

.

7 DISCUSSION

7.1 FLORA AND VEGETATION

The Dongara project area is situated on the Geraldton Sandplain GS3-Lesueur Sandplain subregion. This region contains a large number of DRF species and exhibits extremely high levels of endemic flora. Over 250 species of the sandplain are endemic to the GS3 subregion (Desmond and Chant 2001). The flora of the Dongara project area has been extensively surveyed and documented during studies conducted by Woodman Environmental Consulting through structural mapping (WEC 2007a) and quadrat based surveys, in addition to searches for conservation significant taxa conducted by Western Botanical (WB 2005a&b, 2006) along exploration drill lines.

A number of field surveys and investigations have been conducted by Woodman Environmental Consulting to determine the conservation significance of poorly known taxa in the project area as described below:

- targetted searches for *Stylidium carnosum* subsp. Narrow leaves (J.A. Wege 490) P1 in previously burnt vegetation (<1yr), extending the known population beyond the proposed Hebe orebody;
- searches and data collation facilitating the downgrading of the conservation significance of *Stawellia dimorphantha* from DRF to a P4 species;
- reviewing the *Stylidium piliferum* complex in conjunction with Herbarium studies conducted by a taxonomic specialist (Lowrie 2007), to resolve the conservation signficance of potentially new taxa highlighted in previous reports (WB 2005a&b, 2006). Taxa now considered to be *Stylidium* sp. Kalbarri (A. Carr 145);
- targetted searches for *Paracaleana dixonii* DRF to identify the extent of the population within the project area, which was previously known from only 1 location;
- additional survey for individuals of *Schoenus* sp. Eneabba (F. Obbens & C. Godden I154); and
- reviewing Herbarium specimen data. It is now known that the Herbarium specimen *Calectasia cyanea* DRF (Specimen Number 03706664) is synonomous with *Calectasia narragara* (pers. comm. Lorraine Cobb). The herbarium specimen *Caladenia wanosa* DRF (Specimen Number 06734898) has an erroneous latitude/longitude in the database. This species was historically collected from East Yuna Nature Reserve, approximately 100km north of the project area.

A comparison between regional studies shows that the number of native plant taxa recorded within the Dongara project area is similar to that recorded for the ARC Energy Denison 3D Seismic Survey Area. Surveys for the Dongara project area were conducted in 2006 and 2007 (below average rainfall years) and it is possible that a number of annual species were not collected during the surveys. Despite this, the project area has been comprehensively surveyed and the knowledge of the flora and vegetation is adequately understood. This has been achieved through the compilation of information sourced from a number of studies from Western Botanical (WB 2005a & b, 2006), Woodman Environmental Consulting (WEC 2005, 2007a, 2008c) and historical records provided by the Department of Environment and Conservation.

Studies of the Iluka Eneabba project area have recorded a higher number of native plant taxa in comparison to studies of the Dongara project area (Table 10). The Eneabba tenements support a wider range of habitat types (36 FCTs) in comparison to the Dongara project area (21 FCTs). A larger portion of the Eneabba tenements are located on the highly diverse Tathra System and these tenements also intersect the Gingin Scarp and Warradarge Fault. The Eneabba area displays a high level of endemism and this is reflected in the number of conservation significant taxa found during the surveys conducted for the Iluka Eneabba project area (82 taxa) in comparison to that recorded for the Dongara project area (31 taxa).

Table 10: Comparison of Native Plant Taxa Recorded Within the Dongara Project Area to Regional Studies

Project	Survey Area (ha)*	No. of Native Plant Taxa
Tiwest Dongara (WEC 2007, 2008)	32,967	543
Iluka Eneabba (WEC2008b)	27,373	899
ARC Energy Denison 3D (WEC 2004)	21,355	447

*does not include cleared areas

7.2 REGIONAL SIGNIFICANCE AND CONSERVATION STATUS OF FLORA

A large number of significant flora species have been recorded within the project area (Tables 5 and 8). The local distribution of these species, incorporating the Tiwest Dongara project area and the Iluka Eneabba project area, is presented in Figures 3.01 to 3.44.

Declared Rare Flora

- *Paracaleana dixonii* (DRF) was recorded at 5 locations within FCT4a and FCT5e, representing a total of 69 individuals. This species is ranked as Critically Endangered under the *Wildlife Conservation Act 1950* and Endangered under the *Environment Protection and Biodiversity Conservation Act 1999. Paracaleana dixonii* has a fragmented distribution of approximately 250km between the project area and the Moore River National Park. A total of 5 populations and 69 individuals of *Paracaleana dixonii* have been recorded within the Dongara project area, representing the largest and the most northern population within its range. Regionally, a total of 92 plants are known from within 10 populations.

  The largest known populations of *Paracaleana dixonii* are under threat due to exploration and mining activities, therefore it is suggested that this species retain a ranking of DRF (WEC 2008c).

Priority 1 Flora

- *Calectasia palustris* (P1) was recorded at 2 locations within FCT4a and 5e. This species is known from 5 populations between Cataby and Coorow, a range of

approximately 75km. Only 1 of these populations is found within secure tenure, within the Pinjarrega Nature Reserve. The collection of this species from the project area represents a range extension further north west approximately 110km from Coorow.

- *Lasiopetalum ogilvieanum* (P1) was recorded at 1 location within the project area within FCT4a. This species is known from 6 populations between Three Springs and Walkaway, a range of approximately 130km. None of these populations are located within secure tenure.

- A total of 69 individuals of *Stylidium carnosum* subsp. Narrow leaves (J.A. Wege 490) P1 were recorded at 13 locations in the project area within FCT3b and 4a. *Stylidium carnosum* is widespread throughout the south-west and requires fire to stimulate flowering. Consequently, this species has been poorly collected across its range. The specimen collected from the Dongara project area has narrower leaves compared to the type specimen and is only known regionally from the Lake Indoon area, a range of approximately 45km. The initial population of *Stylidium carnosum* subsp. Narrow leaves (J.A. Wege 490) within the project area was recorded by Western Botanical (WB 2005a & b, 2006) during searches along exploration drill lines within the Hebe orebody. Additional surveys conducted by Woodman Environmental during spring 2007 has identified that the population of this species extends further south beyond the Hebe orebody within FCT4a. This FCT dominates the eastern portion of the project area and it is possible that the population of *Stylidium carnosum* subsp. Narrow leaves (J.A. Wege) is more widespread than reported here.

Priority 2 Flora

- *Comesperma griffinii* (P2) was recorded at 2 locations in the project area within FCT5e. Regionally, this species is located 60km north east of Wubin to 15km south of Eneabba, a range of approximately 200km. A disjunt population has also been recorded approximately 380 km east of Eneabba within the Avon Wheatbelt, near Mt Gibson. A total of 5 populations of *Comesperma griffinii* are known, two of which are located on secure tenure within the Petrudor Rock Nature reserve near Dallwallinu and Indarra Nature Reserve, south west of Mullewa. Regional records for this species lack quantitave counts and due to the low number of populations known it has been recommended that *Comesperma griffinii* remain as Priority 2 species (WEC 2008c).

- *Eremaea acutifolia* (P2) was recorded at 3 locations within the project area within FCT3b. This species has a range of approximately 75km and is known from 9 populations between the project and Geraldton. This species is found on secure tenure within the Burma Road Nature Reserve and Yardanogo Nature Reserve.

- *Persoonia filiformis* (P2) was recorded at 8 locations in the project area within FCT4a and 5e. A total of 11 populations of this species have been recorded between Cataby and Dongara, a range of approximately 250km. The majority of these populations are located within mining tenements in the Eneabba area. Two populations have been previously recorded within the Lesueur National Park and South Eneabba Nature Reserve.

- *Schoneus* sp. Eneabba (F. Obbens & C. Godden I154) (P2) was recorded at 26 locations within FCT3b and 4a. This species is known regionally from 7 populations

and has a range of approximately 80km between the project area and Eneabba. The largest known populations are located within the South Eneabba Nature Reserve and Yardanogo Nature Reserve.

- *Stylidium pseudocaespitosum* (P2) was recorded at 2 locations in the project area within FCT3b. This species has a range of approximately 120km and is known from between Carnamah and Walkaway. This species is found within the Burma Road Nature Reserve and Reserve Number 28608.

.

Priority 3 and Priority 4 Flora

- *Baeckea* sp. Walkaway (A.S. George 11249) (P3) was recorded at 3 locations in the project area within FCT4b and 21a. This species has a range of approximately 150km and is known from between the project area and Walkaway, extending further east to Morowa. Populations have been recorded within the Yardanogo Nature Reserve and Burma Road Nature Reserve.

- *Goodenia trichophylla* (P3) was recorded at 1 location within FCT5e. This species is known from 18 populations and has a range of approximately 900km between Ravensthorpe and Dongara. The distribution of these populations is quite fragmented and only 2 populations are known to be located on secure tenure, within the Tathra National Park and Beaufort Bridge Nature Reserve. This species has been recommended to remain as a Priority 3 species (WEC 2008c).

- *Grevillea erinacea* (P3) was recorded at 3 locations in the project area within FCT16b. This species is known from 19 populations and has a range of approximately 200km between Leeman and Walkaway. Populations have been recorded within the Beekeepers Nature Reserve, Burma Road Nature Reserve and Reserve Number 29806.

- *Guichenotia alba* (P3) was recorded at 6 locations in the project area within FCT 4a and 5e. This species has a range of approximately 200km and is known from 27 populations between Cataby and Dongara. A total of 5 populations are located on secure tenure within the Badgingarra National Park, Lesueur National Park, Twarta Nature Reserve and Lake Logue Nature Reserve. Although a large number of populations are known for this species, little is known about the size of these populations - only 55 individuals have been recorded. This species will require further survey of populations within secure tenure to discern whether large populations are present within the conservation estate. This species has not been adequately surveyed within WA and has been recommended to retain a Priority 3 status (WEC 2008c).

- *Hemiandra* sp. Eneabba (H. Demarz 3687) (P3) was recorded at 43 locations within the project area within FCT4a and 4b. A total of 12 populations of this species are known from between Eneabba and Dongara, a range of approximately 80km. It is estimated that over 10,000 individuals of *Hemiandra* sp. Eneabba (H. Demarz 3687) are located in the Eneabba area, the majority of which are located within the Iluka tenements. This species is located in secure tenure within the South Eneabba Nature Reserve.

- *Hypocalymma gardneri* (P3) was recorded at 12 locations in the project area within FCT4a and 5e. This species has a range of approximately 230km and is known from 15 populations between Cataby and Eneabba. A total of 3 of these populations are located on secure tenure within the Lake Logue Nature Reserve, South Eneabba Nature Reserve and the Lesueur National Park.

- *Persoonia rudis* (P3) was recorded at 10 locations in the project area within FCT 2b, 3a, 4a and 4b. This species has a range of 300km and is known from 25 populations between Mogumber and Dongara. A total of 7 populations are located on secure tenure within the Lesueur National Park, Bullsbrook Nature Reserve and South Eneabba Nature Reserve. There is inadequate quantitative data for this species, therefore it has been recommended that a status of Priority 3 be retained until further survey is conducted (WEC 2008c).

- *Schoenus griffinianus* (P3) was recorded at 11 locations in the project area within FCT3b, 4a and 4b. This species has a range of approximately 360km between Perth and Dongara, extending east to Wongan Hills. Land tenure for the 13 populations is predominantly unsecured with the majority located on mining lease or private property. One population is located on an agricultural research station, with two populations in road reserves. A single population is located in a Conservation Park north of Perth.

- *Verticordia luteola* var. *luteola* (P3) was recorded at 10 locations in the project area within FCT3b, 4a and 19a. This species has a range of approximately 120km and is known from 14 populations between Eneabba and west of Walkaway. A total of two populations are located in secure tenure within the Beekeepers Nature Reserve and Wilson Nature Reserve.

- *Banksia elegans* (P4) is common in the project area and was recorded at 43 locations within FCT3b, 4a, 4b, 17, 19a, 20, 21a, 21b and 22a. This species is known from 27 populations between Badgingarra, Three Springs and Greenough, a range of approximately 200km. Five of these populations are located on secure tenure within the Yardanogo Nature Reserve, Lake Logue Nature Reserve and Beekeepers Nature Reserve. This species is recommended to remain as a Priority 4 species (WEC 2008c).

- *Banksia scabrella* (P4) was recorded at 57 locations in the project area within FCT4a and 5e. This species has a range of approximately 150km and is known from over 20 populations located between Eneabba and Walkaway. This species is found within the Burma Road Nature Reserve.

- *Eucalyptus macrocarpa* subsp. *elachantha* (P4) was recorded at 12 locations in the project area within FCT 4a and 5e. This species is known from 46 populations between Cataby and Dongara, a range of approximately 200km. As of 2007, a total of 377 individuals have been recorded from 20 populations, with an additional five locations recording common, occasional and uncommon occurrences of *Eucalyptus macrocarpa* subsp. *elachantha*. There are no records of this species within secure tenure, therefore it has been recommended that a status of Priority 4 remain (WEC 2008c).

- *Gastrolobium callistachys* (P4) was recorded at 3 locations in the project area within FCT3b. This species has a range of approximately 480km between Narembeen and Dongara and is known from over 25 populations. Populations have been recorded within the Gathercole Nature Reserve, Mokine Nature Reserve, Boonanarring Nature Reserve, White Gums Nature Reserve, Dingo Rock Nature Reserve, Kookanooka Nature Reserve and Alexander Morrison National Park.

- *Georgeantha hexandra* (P4) was recorded at 1 location in the project area within FCT3b. A total of 34 populations have been recorded between Gingin and Eneabba, a range of approximately 190km. 12 of these populations are located on secure tenure within the Coomallo Nature Reserve, South Eneabba Nature Reserve, Rocky Springs Nature Reserve and Lesueur National Park. The size of populations within secure tenure is unknown and it has been recommended that the status of this species remains a Priority 4 (WEC 2008c)

- *Hopkinsia anoectocolea* (P3) was recorded at 10 locations within FCT 7, 21a, 21b and 22a. This species has a disjunct range and is known from the Arrowsmith region within the Geraldton Sandplains and the Cunderdin/Tammin region within the Avon Wheatbelt. This species has been recorded within the Lake Logue Nature Reserve.

- *Calytrix chrysantha* (P4) was recorded at 5 locations within FCT 2b, 4a and 22a. This species is known from 29 populations between Morowa and Dongara, a range of approximately 130km. A total of 8 populations are locted on secure tenure within Natture Reserves (Beekeepers, Coomallo and South Eneabba).

- *Stawellia dimorphantha* (P4) was recorded at 199 locations in the project area within FCT3a, 3b, 4a, 4b, 20, 21a, 21b and 22a. This species is known from 47 populations between Eneabba and Dongara, a range of approximately 80km. A total of 16 populations are located on secure tenure within the Yardanogo Nature Reserve and Lake Logue Nature Reserve. *Stawellia dimorphantha* was recently considered a DRF species, however additional population data provided to the Department of Environment and Conservation by Woodman Environmental facilitated the downgrading of the conservation status to Priority 4. It has been recommended that the status of this species remains a Priority 4 (WEC 2008c).

Undescribed Species

A total of 7 undescribed species are located within the project area (Table 6). Two of these species are considered to have potential conservation significance.

- *Lepidosperma* cf. *tenue* was recorded at 9 locations within the project area within FCT 4a, 4b, 11, 21a, 22a. Specimens have been identified by the taxonomic specialist currently working on the *Lepidosperma* genus. This species is not restricted to Tiwest orebodies and has a scattered distribution within the project area spanning approximately 20km. The 'tenue' group is currently being studied by taxonomic specialists and a definitive taxonomic finding for this specimen will not be determined during 2009. In general, 'tenue' groups are widespread and are unlikely to be conservation significant (pers. comm. Russell Barrett). Due to the small scale of

mining anticipated within the Dongara tenements and wide geographic spread of this species within a number of FCTs, it is anticipated that the impacts to this potential new taxon will be minimal and further survey work will not be required until a taxonomic resolution is provided.

- *Melaleuca* aff. *preissiana* is the dominant tree species within FCT12 and is located within Arrowsmith Lake and Yardanogo Nature Reserve. This species has straight, thin trunks in comparison to typical stands of *Melaleuca preissiana* where the trunks are gnarled and branching. This may be a reflection of water availability, however it was noted that stands of *Melaleuca rhaphiophylla* fringe the margins of these wetlands. *Melaleleuca rhaphiophylla* is a species that tends to occupy the wetter soils within wetland areas and can tolerate waterlogging of its roots throughout the year. This species is also present on ephemeral wetland basins with clay and sometimes saline soils as present in Arrowsmith Lake. The unusual biology of these two species will require further investigation to determine whether this collection of *Melaleuca* aff. *preissiana* is a new taxon, which to date has been taxonomically identified using only fruiting material.

Range Extensions

Several range extensions were identified during the surveys and are discussed below. All specimens will be submitted to the WAHerb to expand the knowlege base for these species.

- *Leucopogon glaucifolius* was recorded at 1 location in the project area within FCT5e. This species has a fragmented range of approximately 600km between Albany and Badgingarra. The collection of this species represents a range extension 120km further north.
- *Schoenus* sp. A3 ciliate sheaths (K. Newbey 9402) was recorded at 1 location in the project area within FCT4a. This species has a range of approximately 50km between Cataby and Warradarge. This collection doubles the known range of this species and represents a significant range extension further north approximately 50km.
- *Gonocarpus confertifolius* var. *confertifolius* was recorded at 1 location in the project area within FCT12. This species has a range of approximately 1000km between Kalbarri and Plumridge Lakes. The collection of this species represents a range extension approximately 200km south within the Geraldton Sandplains.
- *Melaleuca* ?*campanae* was recorded at 1 location within the project area within FCT10. This species has a range of approximately 250km between Geraldton and south of Shark Bay. This collection represents a range extension of approximately 70km further south from Geraldton.
- *Calocephalis francisii* was recorded at 4 locations within the project area within FCT7, FCT9b and FCT12. This species is known from between Geraldton and the Pilbara region and has a range in excess of 1000km. The collection of this species represents a range extension of approximately 70km further south from Geraldton.

7.3 REGIONAL SIGNIFICANCE & CONSERVATION STATUS OF FLORISTIC COMMUNITY TYPES

The majority of the vegetation within the Dongara tenements is considered to be in Pristine or Excellent condition. However, the vegetation is subjected to frequent fires and the boundaries of the project area are adjacent to previously cleared agricultural land with encroaching weed

infestations. Previous clearing currently under rehabilitation from 3D Seismic Surveys lattice the project area and are visible from the aerial photographic images.

As discussed previously in section 4.3, rainfall in the Eneabba area was significantly lower than the historical average trend during 2006 and 2007. Surveys conducted during this period in spring noted that the vegetation was under drought stress and leaf drop was evident in a number of heath communities (FCT11, FCT4a, FCT5e). In addition, mass deaths of *Hakea polyanthema* were observed in some areas where this species dominated a community. Rainfall received to during 2008 was slightly above the historical average (33mm) and it is anticipated that the health of the vegetation within the project area will recover if similar rainfall conditions are experienced in 2009.

A total of 6 Threatened Ecological Communities (TECs) are recognised within the Geraldton Sandplains subregion (DEC 2008c) as listed below:

- Lesueur-Coomallo Floristic Community D1
- Lesueur-Coomallo Floristic Community D2
- *Acacia rostellifera* low forest with scattered *Eucalyptus camaldulensis* on Greenough Alluvial Flats
- Clay flats assemblages of the Irwin River (TEC 63)
- Thetis-microbialite Stromatolite commuity of stratified hypersaline coastal lakes
- Ferricrete floristic community (Rocky Springs type)

None of the FCTs recorded within the project area correspond with these TECs. FCT 9b is similar to the TEC '*Acacia rostellifera* low forest with scattered *Eucalyptus camaldulensis* on Greenough Alluvial Flats' and TEC 63 Clay flats assemblages of the Irwin River, however this FCT is associated with drainage areas of the Arrowsmith River. The TEC associated with the Irwin River is now presumed to be totally destroyed. In addition, the vegetation association considered to have a High reservation priority '392 – Shrublands; *Melaleuca thyoides* thicket' (as reported by Shepherd *et al.* 2000) (Table 2, Figure 2) was not found within the project area. Rather, this vegetation association has been split into 3 FCTs (11, 19a, 20), none of which contain *Melaleuca thyoides*.

A ranking scale was developed to identify the relative conservation significance of individual FCTs, with a ranking of 1 being of low conservation significance and 5 representing an FCT that is considered to have very high conservation significance (Appendix G). As only South Eneabba Nature Reserve, Reserve No. C39744 north of Eneabba and Yardanogo Nature Reserve have any FCT mapping coverage, representation within the reserve system can only include these areas. FCTs may be present in other conservation reserves but as none have been mapped in detail, this cannot be determined for this assessment.

Table 12 details the conservation significance of each FCT mapped within the Tiwest Dongara project area, based on the criteria presented in Appendix G.

Table 12: Conservation Significance Ranking of FCTs within the Tiwest Dongara Project Area

FCT	Conservation Ranking	Beard System (1976)	Comments
2b	1	Eridoon	>5% of study area and present within South Eneabba Nature Reserve and Reserve No. C39744
3a	3	Eridoon	>1% of study area and represented within South Eneabba Nature Reserve and Reserve No. C39744
3b	2	Eridoon	13.7% of study area and present within Yardanogo Nature Reserve and Reserve No. C39744
4a	4	Eridoon	18.8% of study area but higher ranking due to presence of DRF, not present within the reserve system
4b	2	Eridoon	13.1% of study area and present within Yardanogo Nature Reserve
5e	4	Tathra	>1% of study area but high ranking due to presence of DRF, a very small area present within Reserve No. C39744
7	4	Eridoon	<1% of study area and located on restricted landform, very small areas present within South Eneabba and Yardanogo Nature Reserves
9a	4	Illyarrie	<1% of study area and located on restricted landform
9b	4	Illyarrie and Eridoon	<1% of study area, present within Yardanogo Nature Reserve
11	5	Eridoon	<1% of study area, a single location confirmed with quantitative data and located on restricted landform
12	4	Eridoon	<1% of study area, present within Yardanogo Nature Reserve, Arrowsmith Lake and potential to occur in Lake Logue Nature Reserve
16b	4	Eridoon/Tathra	<1% of study area and located on restricted landform
17	3	Eridoon	>1% of study area and present within South Eneabba Nature Reserve and Reserve No. C39744
18	4	Eridoon	<1% of study area and located on restricted landform, very small area located within Yardanogo Nature Reserve
19a	4	Eridoon	<1% of study area and located on restricted landform, very small area located within Yardanogo Nature Reserve
19b	4	Eridoon/Tathra	<1% of study area and located on restricted landform

Table 12: Conservation Significance Ranking of FCTs within the Tiwest Dongara Project Area

FCT	Conservation Ranking	Beard System (1976)	Comments
20	4	Eridoon	<1% of study area, not present within reserve system
21a	3	Illyarrie and Eridoon	>1% within study area, no DRF recorded, small area mapped within Yardanogo Nature Reserve
21b	4	Illyarrie and Eridoon	<1% of study area, not present within reserve system
22a	3	Illyarrie	>1% of study area and present within the Yardanogo Nature Reserve

The majority of the FCTs mapped within the Tiwest Dongara project area have a high conservation significance ranking of 4. This is due to the high species richness and endemism of the Geraldton Sandplain GS3-Lesueur Sandplain subregion coupled with the presence of conservation significant taxa.

The Northern Sandplain Study Area covers a large proportion of the Eridoon System, with the northern section of this system located within the Tiwest Dongara project area. The remainder of the Eridoon System has been predominantly cleared, particularly in areas west of the South Eneabba Nature Reserve. A number of FCTs recorded within the Tiwest project area are regionally restricted within the Eridoon System and are considered to be conservation significant (Table 12). FCT 11 is a seasonal dampland associated with the Beharra Spring Suite identified by Semenuik (1994) and is located on sandy clay soils in depressions. An isolated occurrence of this community was recorded in the project area south west of the Beharra Springs Production Facility. A total of 49.3 ha of FCT 11 was recorded within the project area, with an additional 4.1 ha identified further south in isolated, small basins. These southern occurrences were identified using field observations and are not represented by quadrat based data. Additional quadrat based survey will be required to determine whether FCT 11 is located outside of the Tiwest Dongara project area. This community has not been identified within secure land tenure and is severely restricted regionally with few occurrences. Field observations of FCT11 during 2006 and 2007 noted that this community is experiencing drought stress and appropriate fire management regimes may be required to preserve the condition of the vegetation.

Numerous occurrences of FCT7 are located in drainage areas throughout the Northern Sandplain Study Area. A total of 398.4 ha of this community was recorded within the Northern Sandplain Study Area, representing <1% of the total mapped area, corresponding with a Conservation Significance Ranking of 4. This community is located within the Yardanogo Nature Reserve and South Eneabba Nature Reserve and is potentially located within large areas of Unallocated Crown Land (UCL) associated with the Arrowsmith River south of the project area.

FCTs 4a and 5e were assigned a conservation significance ranking of 4 due to the presence of *Paracaleana dixonii* DRF. A review of the conservation significance of this species noted that a conservation significance of DRF should be retained given that numerous populations have not been relocated during monitoring programs conducted by the DEC and the largest

populations are under threat from sand mining activities (WEC 2008c). It is recommended that to further clarify the conservation standing of this species, future survey efforts be made to:

(i) confirm that the known populations currently exist and determine the number of individuals within each of these
(ii) determine and expand the known geographic range of the species
(iii)locate further populations on secure tenure such as conservation reserves

Due to the large range of this species (245km) and number of historical populations recorded (12), this species has the potential to be downgraded in conservation significance particularly if additional surveys target and define population numbers. *Paracalaeana dixonii* is currently known from within the South Eneabba Nature Reserve, Lesueur National Park and Moore River National Park.

FCT 12 supports stands of *Melaleuca* aff. *preissiana* which has an unusual biology where this species occupies the wetter soils of the basin, with stands of *Melaleuca rhaphiophylla* fringing the basin edges. The basin of Arrowsmith Lake is composed of swamp deposits with low permeability overlying Tamala limestone (DEC 2005). It is a subhaline, seasonally inundated basin with muddy sand and lateritic sedementation. Yardanogo Swamp is a seasonally inundated basin underlain by coffee rock which ponds precipitation. Due to the restricted nature of this FCT and the landform it occurs within, coupled with the potential for it to contain an undescribed species this FCT has a high conservation significance ranking of 4.

FCTs 19a and 20 are located in a number of isolated basins within the north/south orientated belt of wetland communities central to the project area. Due to the restricted nature of these FCTs and the landforms they occur within, these FCTs have a high conservation significance ranking of 4.

FCTs 9a, 9b, and 21b are associated, or have affinities to, the Illyarrie System. These communities may be located further south west of the project area within unmapped areas of UCL within the Arrowsmith region.

The eastern margins of the Northern Sandplain Study Area are located on the Tathra System. This system has been extensively cleared for agriculture. Isolated remnants of native vegetation outside of the study area are located within the Tathra National Park, Alexander Morrison National Park, Wotto Nature Reserve, Dookanooka Nature Reserve, Reserve No. A37083 in addition to Unallocated Crown Land east of the Tiwest Dongara project area and Unmanaged Crown Reserve east of the South Eneabba Nature Reserve. FCT 16b and 19b are located on the eastern borders of the Eridoon System along drainage lines with alluvial sedimentation derived from the lateritic rises of the Tathra System. A total of 79.5 ha of FCT 16b was recorded within the Northern Sandplain Study Area. The northern most occurrence of FCT 16b within the Tiwest Dongara project area is highly disturbed due to grazing and clearing. FCT 16b is restricted in the study area, however the condition of this community is degraded due to the dominance of introduced (weed) species in the understorey. Due to the poor condition of FCT16b it is assumed that this community has low conservation significance. A total of 2 isolated occurrences of FCT19b were recorded within the Dongara project area representing 37.4 ha. This community is in Very Good or Pristine condition and

may be regionally restricted. Communities associated with drainage lines derived from the Tathra System that flow into the Eridoon System are considered to be uncommon. The Northern Sandplains Study Area predominantly covers the interface between the Eridoon and the Tathra Systems. FCT19b may potentially be located in remnant vegetation within Unallocated Crown Land east of the Dongara project area where the Arrowsmith River flows onto the Eneabba Sandplain.

Comparison of the Woodman Environmental FCTs with the analysis dendogram of the Dr. Griffin dataset identified few direct correlations between the FCTs of each study. The reasons for this stem from the intrinsic nature of the two datasets as follows:

- The Dr. Griffin dataset is a combination of data from different projects collected using different survey teams and methods.
- The Dr. Griffin dataset contains data from different time periods which may impact on consistency of taxonomic identification and survey results as a result of different environmental conditions over the survey periods.
- The Dr. Griffin dataset was collected primarily from areas with easy access such as along roads and other pieces of infrastructure and therefore did not adequately represent the landscape and range of floristic communities within the Woodman Environmental study area.
- The Dr. Griffin dataset covered a much larger area than the Woodman Environmental study area and therefore sampled many other floristic units not represented in the Woodman Environmental dataset. This had the effect of expanding the resultant dendogram well beyond the units sampled by Woodman Environmental and effectively reducing the significance of the Woodman Environmental FCT correlations in relation to the more regional dataset.

The above factors introduce significant error into the PATN analysis, which relies upon consistency in plant taxonomy and sample size (or area of data collection at each location), and creates uncertainty when attempting to compare what are basically incompatible datasets. It is possible that a statistical comparison of the datasets including some level of data transformation to standardize the inconsistencies in the data would provide a stronger indication of regional representation of floristic groupings. However it would be more appropriate to collect representative data from floristic groups within the regional reserve system, particularly the Lake Logue Nature Reserve and those small reserves in the Tathra vegetation system such as the Tathra National Park, Watto Nature Reserve, White Gums Nature Reserve, and Alexander Morrison National Park that may contain floristic units similar to those adjacent to the Gingin scarp at Eneabba and east of the Yardanogo Nature Reserve.

The regional significance of subgroup FCTs identified during the secondary wetlands analysis cannot be determined until a statistical comparison is made with the regional dataset. To date, the regional dataset does not have consistent and comparable annual data and a field reassessment of quadrats within the regional area will be required.

8 RECOMMENDATIONS

8.1 RECOMMENDATIONS FOR EXPLORATION DRILLING

The following recommendations are made to guide future exploration drilling programmes based on the results of the survey:

1. FCTs containing DRF species within proposed drill lines should be searched for the presence of these taxa to allow appropriate management of impacts. FCTs 4a and 5e are habitat for *Paracaleana dixonii* DRF and any proposed impacts within these FCTs should be searched prior to disturbance to comply with the *Wildlife Conservation Act 1950*. These surveys should be conducted within the appropriate flowering period (October to January).

The following recommendations are made based on the results of various flora and vegetation surveys conducted in the Dongara project area and are relevant for all future operations:

1. A monitoring program with baseline vegetation data should be developed preceeding potential water drawdown impacts. The need for a monitoring program will be investigated further during drawdown modelling developed for the impact assessment.
2. Additional quadrats should be established during Spring 2009 in the burnt area south-west of the project area in polygons of FCTs previously missed during the quadrat based survey conducted in 2007. These additional plots will be reanalysed in conjunction with the combined Tiwest/Iluka dataset early in 2010 following additional field based surveys to be conducted by Woodman Environmental within the Iluka leases (Spring 2009).
3. Additional quadrats should be established within subgroup FCT12.2 to further delineate its association from subgroup FCT12.1, particularly if this community falls within potential water drawdown areas. To date, subgroup FCT12.2 is represented by only one quadrat. FCT12 (including subgroup FCT12.1 and 12.2) is likely to be regionally restricted and the conservation status of this community requires further investigation in the long term term to determine this.
4. Any significant impacts to FCTs identified during the impact assessment will require additional quadrat based survey of the local nature reserves to identify representation of floristic units from proposed mining areas within the conservation reserve system. FCTs located within the central and eastern portions of the project area were not sampled within the Yardanogo Nature Reserve.
5. Weed and *Phytophthora cinnamomi* hygiene should be implemented for all future operations in the project area to protect the integrity of the flora of the region.
6. FCTs containing DRF species within proposed orebodies and infrastructure should be searched for the presence of these taxa to allow appropriate management of impacts. FCTs 4a and 5e are habitat for *Paracaleana dixonii* DRF and any proposed impacts within these FCTs should be searched prior to disturbance to comply with the *Wildlife Conservation Act 1950*. These surveys should be conducted within the appropriate flowering period (October to January).

9 REFERENCES

Beard, J.S. (1976)
The Vegetation of the Dongara Area Western Australia. Map and explanatory memoir 1:250 000 series. Vegmap Publications, Perth.

Beard, J. S. (1990)
Plant Life of Western Australia. Kangaroo Press Pty Ltd, NSW

Belbin. L. (1989)
PATN Technical Reference. CSIRO Division of Wildlife and Ecology. Canberra.

Burbidge, A. and Boscacci, L. (1989)
A Spring Reconnaissance Survey of the Flora and Fauna of the Southern Beekeepers Reserve. Department of Conservation and Land Management Technical Bulletin 22: 1-38, March 1989.

Department of Agriculture and Food (2008)
Declared Plant in Western Australia. Publicly available internet database. www.agric.wa.gov.au

Department of Environment and Conservation (2005) formerly Department of Environment
The hydrology of groundwater dependent ecosystems in the Northern Perth Basin. Hydorogeological Report Series HG11, Water Resource Division, Perth.

Department of Environment and Conservation (2007a)
Interrogation of DEC's Threatened Flora Databases, and WAHerb Specimens Records, performed 19th March 2007.

Department of Environment and Conservation (2007b)
Interrogation of DEC's Threatened Ecological Communities database, performed 12th March 2007.

Department of Environment and Conservation (2008a)
Declared Rare and Priority List for Western Australia. www.florabase.calm.wa.gov.au/conservationtaxa

Department of Environment and Conservation (2008b)
Definitions, Categories and Criteria for Threatened Ecological Communities. Publicly available listing. www.dec.wa.gov.au

Department of Environment and Conservation (2008c)
List of Threatened Ecological Communities on the Department of Environment and Conservation's Threatened Ecological Community (TEC) Database endorsed by the Minister for the Environment. Publicly available list, July 2007. www.dec.wa.gov.au

Department of Environment and Conservation (2008d)
Florabase. Publicly available database. www.florabase.calm.wa.gov.au

Department of Environment, Water, Heritage and the Arts (2008)
Interactive Environmental Database Reporting Tool Search, performed July 2008. www.environment.gov.au

Desmond, A. and Chant, A. (2001)
Geraldton Sandplain 3 (GS3 – Lesueur Sandplain Subregion). A Biodiversity Audit of Western Australias 53 Biogeographical Subregions in 2002.

Dufrene, M. and Legendre, P. (1997)
Species Assemblages and Indicator Species: the need for a flexible asymmetrical approach. Ecological Monographs, 1997.

Ecologia Environmental Consultants (1995)
Coastal Road Jurien to Green Head Consultative Environmental Review Appendicies. Unpublished report to Shire of Dandaragan, Shire of Coorow and Main Roads Western Australia.

Environment Australia (2000)
Revision of the Interim Biogeographical Regionalisation for Australia (IBRA) and Development of Version 5.1. – Summary Report. Department of Environment and Heritage, Canberra.

Glevan Consulting (2006)
Dieback Assessment of Tiwest Joint Venture Dongara Infill and Exploration Drilling. Unpublished report for Woodman Environmental Consulting Pty Ltd.

Glevan Consulting (2007)
Tiwest Dongara Dieback Assessment. Unpublished report for Woodman Environmental Consulting Pty Ltd.

Government of Western Australia (2000)
Bush Forever Volume 2, Directory of Bush Forever Sites. Published by the Department of Environmental Protection, Perth

Griffin, E.A. and Keighery, B.J. (1989)
Moore River to Jurien Sandplain Survey. Western Australian Wildflower Society Inc. Perth.

Griffin, E.A. (1998)
Interim Bioregions West Midlands. Unpublished report for Department of Environmental Protection. AGWEST Land Management Job 98/155.

Halpern Glick Maunsell (2000)
Coastal Road – Lancelin to Cervantes Biological Survey. Unpublished report prepared for Main Roads Western Australia.

Hoffman, N. and Brown, A. (1998)
Orchids of South West Australia. University of Western Australia Press, WA.

Lowrie A. (2007)
Stylidium piliferum studies. Unpublished report for Woodman Environmental Consulting.

Martinick W.G and Associates (1989)
Hill River Project, Biological Studies. Vegetation of the Project Area in a Regional Context. Canning Resources Pty Ltd.

McCune, B. and Mefford, M.J. (1999)
PC-Ord. Multivariate Analysis of Ecological Data, Version 4. MjM Software Design, Glenden Beach, Oregon USA.

Muir, B.G. (1977)
Biological Survey of the Western Australian Wheatbelt. Part II. Records of the Western Australian Museum, Supplement No. **3**

Paczkowska, Grazyna, and Chapman, Alex R. (2000).
The Western Australian Flora: A Descriptive Catalogue. Published by The Wildlife Society (Inc.), Western Australian Herbarium (CALM) and Botanic Gardens & Parks Authority, Perth.

Shepherd, D., Beeston, G and Hopkins, A. (2002).
Native Vegetation in Western Australia. Extent, Type and Status. Resource Management Technical Report 249. Department of Agriculture.

Sneath, P.H.A. and Sokal, R.R. (1973)
Numerical taxonomy: The Principles and Practice of Numerical Classification. Published by Freeman, San Fransisco.

Western Botanical (2005a)
DRF and Priority Species survey on proposed drill lines for the Dongara Area tenements (E70/1592, E70/2347 and E70/2263) . Zeus, Hades, Heracles, and Demeter infill drilling and 14 Exploration lines. October - December 2005 Unpublished report for Tiwest Joint Venture.

Western Botanical (2005b)
DRF and Priority species survey on proposed drill lines for the Dongara Area tenements (E70/1592, E70/2347 and E70/2263) Hebe and Dionysus infill drilling October 2005 Unpublished report for Tiwest Joint Venture

Western Botanical (2006)
DRF and Priority species survey on Dongara Area tenements (E70/1592, E70/2347, E70/2430 and E70/2263) 25 Exploration Lines July and August 2006. Unpublished report for Tiwest Joint Venture

Woodman Environmental Consulting (2002)
Flora and Vegetation Survey of the Depot Hill, Brandy Flat, IPL North and IPL South Areas at Eneabba. Unpublished report for Iluka Resources Limited.

Woodman Environmental Consulting (2005)
ARC Energy Ltd/ Origin Energy Denison 3D Seismic Survey – Flora and Vegetation Study. Unpublished report for ARC Energy and Origin Energy.

Woodman Environmental Consulting (2006)
Declared Rare and Priority Flora Survey and Establishment of Permanent Plots in the Adamson Area. Unpublished report for Iluka Resources Limited.

Woodman Environmental Consulting (2007a)
Dongara Tenements - Flora, Vegetation and Phytophthora cinnamomi Assessment. Unpublished report for Tiwest Pty Ltd, June 2007.

Woodman Environmental Consulting (2007b)
Exploration Drilling Risk Assessment, Significant Flora and Vegetation Communities. Unpublished report for Tiwest Pty Ltd, May 2007,

Woodman Environmental Consulting (2008a)
P1 and Hopkins Survey Areas, Flora and Vegetation Studies. Unpublished report for Iluka Resources Limited.

Woodman Environmental Consulting (2008b)
Environmental Review and Management Programme – Flora and Vegetation Studies. Unpublished report for Iluka Resources Limited. Report in prep.

Woodman Environmental Consulting (2008c)
Conservation Significance Assessment of Declared Rare and Priority Flora Known from the Eneabba Area. Executive Summary. Unpublished report for Iluka Resources Limited, September 2008.

Appendix A: Definitions for Categories of Threatened Ecological Communities and Declared Rare and Priority Flora (DEC 2008a,b)

FLORA CONSERVATION CODES

R: 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.

X: Declared Rare Flora - Presumed Extinct Taxa

Taxa which have not been collected, or otherwise verified, over the past 50 years despite thorough searching, or of which all known wild populations have been destroyed more recently, and have been gazetted as such.

1: 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.

2: Priority Two - Poorly Known Taxa

Taxa which are known from one or a few (generally <5) populations, at least some of which are not believed to be under immediate threat (i.e. not currently endangered). Such taxa are under consideration for declaration as 'rare flora', but are in urgent need of further survey.

3: Priority Three - Poorly Known Taxa

Taxa which are known from several populations, and the taxa are not believed to be under immediate threat (i.e. not currently endangered), either due to the number of known populations (generally >5), or known populations being large, and either widespread or protected. Such taxa are under consideration for declaration as 'rare flora' but are in need of further survey.

4: 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.

THREATENED ECOLOGICAL COMMUNITY DEFINITIONS

Presumed Totally Destroyed (PD)

An ecological community which has been adequately searched for but for which no representative occurrences have been located. The community has been found to be totally destroyed or so extensively modified throughout its range that no occurrence of it is likely to recover its species composition and/or structure in the foreseeable future.

An ecological community will be listed as presumed totally destroyed if there are no recent records of the community being extant **and either** of the following applies (A or B):

A) Records within the last 50 years have not been confirmed despite thorough searches of known or likely habitats **or**

B) All occurrences recorded within the last 50 years have since been destroyed

Critically Endangered (CR)

An ecological community that has been adequately surveyed and found to have been subject to a major contraction in area and/or that was originally of limited distribution and is facing severe modification or destruction throughout its range in the immediate future, or is already severely degraded throughout its range but capable of being substantially restored or rehabilitated.

An ecological community will be listed as **Critically Endangered** when it has been adequately surveyed and is found to be facing an extremely high risk of total destruction in the immediate future. This will be determined on the basis of the best available information, by it meeting **any one or more of** the following criteria (A, B or C):

A) The estimated geographic range, and/or total area occupied, and/or number of discrete occurrences since European settlement have been reduced by at least 90% **and either or both** of the following apply (i or ii):

   i) geographic range, and/or total area occupied and/or number of discrete occurrences are continuing to decline such that total destruction of the community is imminent (within approximately 10 years);

   ii) modification throughout its range is continuing such that in the immediate future (within approximately 10 years) the community is unlikely to be capable of being substantially rehabilitated.

B) Current distribution is limited, **and one or more** of the following apply (i, ii or iii):

i) geographic range and/or number of discrete occurrences, and/or area occupied is highly restricted and the community is currently subject to known threatening processes which are likely to result in total destruction throughout its range in the immediate future (within approximately 10 years);

ii) there are very few occurrences, each of which is small and/or isolated and extremely vulnerable to known threatening processes;

iii) there may be many occurrences but total area is very small and each occurrence is small and/or isolated and extremely vulnerable to known threatening processes.

C) The ecological community exists only as highly modified occurrences that may be capable of being rehabilitated if such work begins in the immediate future (within approximately 10 years).

Endangered (EN)

An ecological community that has been adequately surveyed and found to have been subject to a major contraction in area and/or was originally of limited distribution and is in danger of significant modification throughout its range or severe modification or destruction over most of its range in the near future.

An ecological community will be listed as **Endangered** when it has been adequately surveyed and is not Critically Endangered but is facing a very high risk of total destruction in the near future. This will be determined on the basis of the best available information by it meeting **any one or more of** the following criteria (A, B, or C):

A) The geographic range, and/or total area occupied, and/or number of discrete occurrences have been reduced by at least 70% since European settlement **and either or both** of the following apply (i or ii):

i) the estimated geographic range, and/or total area occupied and/or number of discrete occurrences are continuing to decline such that total destruction of the community is likely in the short term future (within approximately 20 years);

ii) modification throughout its range is continuing such that in the short term future (within approximately 20 years) the community is unlikely to be capable of being substantially restored or rehabilitated.

B) Current distribution is limited, **and one or more** of the following apply (i, ii or iii):

i) geographic range and/or number of discrete occurrences, and/or area occupied is highly restricted and the community is currently subject to known threatening processes which are likely to result in total destruction throughout its range in the short term future (within approximately 20 years);

ii) there are few occurrences, each of which is small and/or isolated and all or most occurrences are very vulnerable to known threatening processes;

iii) there may be many occurrences but total area is small and all or most occurrences are small and/or isolated and very vulnerable to known threatening processes.

C The ecological community exists only as very modified occurrences that may be capable of being substantially restored or rehabilitated if such work begins in the short-term future (within approximately 20 years).

Vulnerable (VU)

An ecological community that has been adequately surveyed and is found to be declining and/or has declined in distribution and/or condition and whose ultimate security has not yet been assured and/or a community that is still widespread but is believed likely to move into a category of higher threat in the near future if threatening processes continue or begin operating throughout its range.

An ecological community will be listed as **Vulnerable** when it has been adequately surveyed and is not Critically Endangered or Endangered but is facing a high risk of total destruction or significant modification in the medium to long term future. This will be determined on the basis of the best available information by it meeting **any one or more of** the following criteria (A, B or C):

A) The ecological community exists largely as modified occurrences that are likely to be capable of being substantially restored or rehabilitated.

B) The ecological community may already be modified and would be vulnerable to threatening processes, is restricted in area and/or range and/or is only found at a few locations.

C) The ecological community may be still widespread but is believed likely to move into a category of higher threat in the medium to long term future because of existing or impending threatening processes.

APPENDIX B: Vascular Plant Species Recorded Within the Dongara Project Area During 2006 and 2008

note: *denotes introduced taxa; US denotes Undescribed Species

Family	Species	06	07/08
SELAGINELLACEAE	*Selaginella gracillima*	X	
ZAMIACEAE	*Macrozamia fraseri*	X	X
CUPRESSACEAE	*Actinostrobus arenarius*	X	X
	Actinostrobus pyramidalis	X	X
POACEAE	?*Amphipogon* sp.	X	
	?*Lachnagrostis preissii*	X	
	* *Aira caryophyllea*		X
	* *Aira cupaniana*	X	
	Amphipogon caricinus		X
	Amphipogon turbinatus	X	X
	Austrodanthonia setacea	X	X
	Austrostipa ?*exilis*		X
	Austrostipa compressa	X	
	Austrostipa elegantissima	X	X
	Austrostipa flavescens	X	X
	Austrostipa hemipogon	X	
	Austrostipa macalpinei	X	X
	Austrostipa variabilis		X
	Austrostipa sp.	X	
	* *Avellinia michelii*		X
	* *Avena barbata*	X	
	* *Briza maxima*	X	X
	* *Briza minor*	X	
	* *Ehrharta longiflora*	X	X
	* *Hordeum leporinum*		X
	* *Lolium* sp.		X
	Neurachne alopecuroidea	X	X
	* *Pentaschistis airoides*	X	
	* *Polypogon monspeliensis*	X	X
	* *Schismus* ?*barbatus*		X
	Triodia danthonioides	X	
	* *Vulpia* ?*bromoides*	X	X
CYPERACEAE	*Baumea juncea*		X
	Caustis dioica	X	X
	Cyperus gymnocaulos	X	

APPENDIX B: Vascular Plant Species Recorded Within the Dongara Project Area During 2006 and 2008

note: *denotes introduced taxa; US denotes Undescribed Species

Family	Species	06	07/08
CYPERACEAE cont.	*Gahnia trifida*	X	X
	Isolepis cernua var. *setiformis*		X
	* *Isolepis marginata*		X
	Lepidosperma ?*costale*		X
	Lepidosperma brunonianum		X
	Lepidosperma leptostachyum	X	X
	Lepidosperma cf. *tenue* US	X	X
	Lepidosperma sp. Eneabba scabrum US	X	
	Lepidosperma sp. Yuna Scabrid US	X	
	Lepidosperma gracile	X	
	Lepidosperma pubisquameum	X	X
	Lepidosperma ?*scabrum*		X
	Lepidosperma sp.	X	X
	Lepidosperma sp. P1 small head *(M.D. Tindale 166A)*		X
	Lepidosperma tenue	X	
	Mesomelaena pseudostygia	X	X
	Mesomelaena stygia subsp. *deflexa* P3	X	
	Mesomelaena tetragona	X	
	Schoenus brevisetis		X
	Schoenus clandestinus	X	X
	Schoenus curvifolius	X	X
	Schoenus griffinianus P3	X	X
	Schoenus maschalinus	X	
	Schoenus pedicellatus	X	
	Schoenus pleiostemoneus	X	X
	Schoenus sp. A3 Ciliate Sheaths (K.R. Newbey 9402)		X
	Schoenus sp. Eneabba (F. Obbens & C. Godden I154) P3	X	
	Schoenus subfascicularis	X	X
	Tetraria microcarpa	X	X
RESTIONACEAE	*Alexgeorgea nitens*	X	X
	Anarthria polyphylla		X
	Chordifex sinuosus ms	X	X
	Desmocladus asper	X	X
	Desmocladus lateriticus	X	X
	Desmocladus parthenicus	X	X
	Desmocladus semiplanus	X	X
	Harperia lateriflora		X
	Hopkinsia anoectocolea P3	X	

APPENDIX B: Vascular Plant Species Recorded Within the Dongara Project Area During 2006 and 2008

note: *denotes introduced taxa; US denotes Undescribed Species

Family	Species	06	07/08
RESTIONACEAE cont.	*Lepidobolus chaetocephalus*	X	
	Lepidobolus preissianus subsp. ?*volubilis*	X	
	Lepidobolus preissianus subsp. *preissianus*	X	X
	Lyginia imberbis	X	X
ECDEIOCOLEACEAE	*Ecdeiocolea monostachya*	X	X
	Georgeantha hexandra P4		X
CENTROLEPIDACEAE	*Centrolepis pilosa*		X
DASYPOGONACEAE	*Acanthocarpus preissii*	X	X
	Acanthocarpus sp. Ajana (C.A. Gardner 8596)		X
	Calectasia hispida	X	X
	Calectasia narragara	X	X
	Calectasia palustris P1		X
	Lomandra ?*micrantha* subsp. *micrantha*		X
	Lomandra hastilis	X	X
	Lomandra maritima		X
	Lomandra preissii		X
XANTHORRHOEACEAE	*Xanthorrhoea brunonis*		X
	Xanthorrhoea drummondii	X	X
	Xanthorrhoea preissii	X	X
PHORMIACEAE	*Dianella revoluta* var. *divaricata*	X	X
ANTHERICACEAE	*Chamaescilla versicolor*		X
	Thysanotus arenarius	X	X
	Thysanotus asper		X
	Thysanotus dichotomus	X	X
	Thysanotus manglesianus	X	
	Thysanotus multiflorus		X
	Thysanotus patersonii		X
	Thysanotus ?*patersonii*	X	
	Thysanotus sparteus	X	X
	Thysanotus spiniger		X
	Thysanotus tenellus	X	X
	Thysanotus ?*thyrsoideus*		X
	Thysanotus ?*triandrus*		X

APPENDIX B: Vascular Plant Species Recorded Within the Dongara Project Area During 2006 and 2008

note: *denotes introduced taxa; US denotes Undescribed Species

Family	Species	06	07/08
ANTHERICACEAE cont.	*Tricoryne elatior*	X	X
	Tricoryne sp. Eneabba (E.A. Griffin 1200)		X
	Tricoryne tenella		X
	Anthericaceae sp.		X
COLCHICACEAE	*Burchardia congesta*	X	X
	Wurmbea monantha		X
HAEMODORACEAE	*Anigozanthos humilis* subsp. *humilis*	X	X
	Anigozanthos pulcherrimus	X	
	Conostylis aculeata	X	
	Conostylis aculeata subsp. *breviflora*	X	X
	Conostylis androstemma	X	X
	Conostylis aurea	X	X
	Conostylis candicans subsp. *calcicola*	X	X
	Conostylis candicans subsp. *candicans*	X	X
	Conostylis candicans subsp. ?*procumbens*		X
	Conostylis canteriata	X	X
	Conostylis hiemalis	X	X
	Conostylis neocymosa	X	X
	Conostylis ?*teretiuscula*		X
	Haemodorum spicatum	X	
	?*Haemodorum* sp.	X	
HYPOXIDACEAE	*Hypoxis* ?*glabella* var. *leptantha*		X
IRIDACEAE	*Patersonia occidentalis*	X	X
ORCHIDACEAE	*Caladenia flava* subsp. *flava*		X
	Caladenia footeana		X
	Caladenia latifolia		X
	Caladenia ?*longicauda*		X
	Eriochilus dilatatus		X
	Microtis media		X
	Paracaleana dixonii DRF	X	X
	Paracaleana nigrita		X
	Pheladenia deformis		X
	Pterostylis recurva		X
	Pterostylis scabra		X

APPENDIX B: Vascular Plant Species Recorded Within the Dongara Project Area During 2006 and 2008

note: *denotes introduced taxa; US denotes Undescribed Species

Family	Species	06	07/08
ORCHIDACEAE cont.	*Pterostylis* sp. broad petals (S.D. Hopper 4429)		X
	Pterostylis sp.	X	
	Pterostylis vittata		X
	Pyrorchis nigricans		X
CASUARINACEAE	*Allocasuarina campestris*	X	X
	Allocasuarina humilis	X	X
	Allocasuarina lehmanniana subsp. *lehmanniana*	X	X
	Allocasuarina microstachya	X	X
	Allocasuarina thuyoides	X	
	Casuarina obesa	X	X
PROTEACEAE	*Banksia attenuata*	X	X
	Banksia bipinnatifida	X	X
	Banksia candolleana	X	X
	Banksia carlinoides	X	X
	Banksia dallaneyi var. *dallaneyi*	X	X
	Banksia elegans P4	X	X
	Banksia fraseri var. ?*fraseri*	X	X
	Banksia ?*glaucifolia*	X	
	Banksia hookeriana	X	X
	Banksia lanata	X	X
	Banksia leptophylla var. *leptophylla*	X	X
	Banksia menziesii	X	X
	Banksia prionotes	X	X
	Banksia scabrella P4	X	X
	Banksia sessilis var. *cygnorum*		X
	Banksia sessilis var. *flabellifolia*	X	X
	Banksia shuttleworthiana	X	X
	Banksia tridentata	X	X
	Conospermum boreale subsp. ?*boreale*	X	X
	Conospermum stoechadis subsp. *stoechadis*	X	
	Conospermum unilaterale	X	X
	Grevillea argyrophylla		X
	Grevillea candelabroides	X	
	Grevillea eriostachya	X	X
	Grevillea exposita		X
	Grevillea leucopteris	X	X
	Grevillea preissii subsp. ?*preissii*	X	

APPENDIX B: Vascular Plant Species Recorded Within the Dongara Project Area During 2006 and 2008

note: *denotes introduced taxa; US denotes Undescribed Species

Family	Species	06	07/08
PROTEACEAE cont.	*Grevillea shuttleworthiana*	X	X
	Grevillea shuttleworthiana subsp. *canarina*	X	X
	Grevillea ?*synapheae*		X
	Hakea ?*cygna* subsp. *cygna*		X
	Hakea candolleana	X	X
	Hakea costata	X	X
	Hakea cygna subsp. *cygna*	X	
	Hakea incrassata	X	X
	Hakea lissocarpha	X	X
	Hakea polyanthema	X	X
	Hakea preissii	X	
	Hakea prostrata	X	X
	Hakea psilorrhyncha	X	
	Hakea ruscifolia	X	
	Hakea spathulata		X
	Hakea trifurcata	X	X
	Hakea varia	X	X
	Isopogon divergens	X	X
	Isopogon tridens	X	X
	Persoonia acicularis	X	X
	Persoonia comata	X	X
	Persoonia filiformis P2		X
	Persoonia rudis P3	X	X
	Petrophile axillaris		X
	Petrophile brevifolia	X	X
	Petrophile drummondii	X	X
	Petrophile linearis	X	
	Petrophile macrostachya	X	X
	Petrophile megalostegia	X	X
	Petrophile scabriuscula	X	X
	Petrophile seminuda	X	
	Petrophile shuttleworthiana		X
	Stirlingia latifolia	X	X
	Synaphea spinulosa subsp. *spinulosa*	X	X
	Xylomelum angustifolium	X	X
SANTALACEAE	*Anthobolus foveolatus*	X	X
	?*Choretrum pritzelii*		X
	Exocarpos sparteus	X	

APPENDIX B: Vascular Plant Species Recorded Within the Dongara Project Area During 2006 and 2008

note: *denotes introduced taxa; US denotes Undescribed Species

Family		Species	06	07/08
SANTALACEAE cont.		*Leptomeria ?preissiana*		X
		Santalum acuminatum	X	X
OLACACEAE		*Olax scalariformis*	X	
LORANTHACEAE		*Amyema miquelii*		X
		Amyema miraculosa subsp. *miraculosa*		X
		Amyema preissii	X	X
		Nuytsia floribunda	X	X
POLYGONACEAE		*Muehlenbeckia adpressa*	X	X
CHENOPODIACEAE	*	*Chenopodium murale*		X
		?*Atriplex semilunaris*		X
		Enchylaena tomentosa	X	X
		Maireana brevifolia	X	X
		Rhagodia preissii subsp. *obovata*	X	X
		Sarcocornia quinqueflora		X
		Tecticornia pergranulata subsp. *pergranulata*	X	X
		?*Threlkeldia diffussa*		X
AMARANTHACEAE		*Arnocrinum preissii*	X	X
		Corynotheca micrantha		X
		Corynotheca micrantha var. *micrantha*	X	
		Johnsonia pubescens subsp. *pubescens*	X	X
		Laxmannia ramosa		X
		Laxmannia sessiliflora subsp. *drummondii*		X
		Laxmannia sessiliflora	X	
		Ptilotus declinatus		X
		Ptilotus drummondii		X
		Ptilotus manglesii	X	X
		Ptilotus polystachyus	X	X
		Ptilotus stirlingii var. *stirlingii*	X	
		Ptilotus spathulatus forma *spathulatus*		X
		Stawellia dimorphantha P4	X	X
GYROSTEMONACEAE		*Gyrostemon ramulosus*	X	
AIZOACEAE	*	*Mesembryanthemum crystallinum*		X

APPENDIX B: Vascular Plant Species Recorded Within the Dongara Project Area During 2006 and 2008

note: *denotes introduced taxa; US denotes Undescribed Species

Family		Species	06	07/08
AIZOACEAE cont.	*	*Mesembryanthemum nodiflorum*		X
PORTULACACEAE		*Calandrinia* ?*calyptrata*	X	
		Calandrinia ?*corrigioloides*		X
		Calandrinia aff. *liniflora* US		X
		Calandrinia aff. *remota* US		X
CARYOPHYLLACEAE	*	*Polycarpon tetraphyllum*		X
	*	*Spergularia* ?*diandra*		X
	*	*Spergularia* ?*rubra*		X
RANUNCULACEAE		*Clematis linearifolia*	X	X
LAURACEAE		*Cassytha aurea*		X
		Cassytha glabella		X
		Cassytha glabella forma ?*dispar*	X	
		Cassytha racemosa	X	X
BRASSICACEAE	*	*Brassica* sp.		X
	*	*Brassica tournefortii*	X	
	*	*Raphanus raphanistrum*		X
DROSERACEAE		*Drosera* ?*erythrorhiza*	X	
		Drosera eneabba		X
		Drosera erythrorhiza		X
		Drosera ?*glanduligera*		X
		Drosera menziesii subsp. *penicillaris*		X
		Drosera ?*spilos*	X	
		Drosera sp.	X	
CRASSULACEAE		*Crassula colorata*		X
PITTOSPORACEAE		*Billardiera* ?*fusiformis*		X
		Marianthus bicolor	X	
		Pittosporum ligustrifolium		X
		Pittosporum angustifolium	X	
SURIANACEAE		*Stylobasium australe*	X	X

APPENDIX B: Vascular Plant Species Recorded Within the Dongara Project Area During 2006 and 2008

note: *denotes introduced taxa; US denotes Undescribed Species

Family		Species	06	07/08
MIMOSACEAE		*Acacia auronitens*	X	X
		Acacia barbinervis subsp. *borealis*		X
		Acacia blakelyi	X	X
		Acacia dilatata	X	X
		Acacia fagonioides		X
		Acacia lasiocarpa var. *lasiocarpa*	X	X
		Acacia pulchella var. *pulchella*		X
		Acacia rostellifera	X	X
		Acacia saligna	X	X
		Acacia saligna subsp. *lindleyi* ms		X
		Acacia scirpifolia	X	X
		Acacia spathulifolia	X	X
		Acacia ?*sessilis*	X	
		Acacia comans	X	
		Acacia pulchella	X	
		Acacia pulchella var. *glaberrima*	X	
		Acacia sphacelata subsp. *sphacelata*	X	
		Acacia stenoptera	X	
		Acacia xanthina	X	
CAESALPINIACEAE		*Labichea cassioides*	X	
		Labichea lanceolata		X
PAPILIONACEAE	*	*Melilotus indicus*		X
		Cristonia biloba	X	X
		Daviesia angulata		X
		Daviesia divaricata subsp. *divaricata* ms	X	X
		Daviesia divaricata subsp. *lanulosa* ms	X	X
		Daviesia incrassata subsp. *teres*	X	X
		Daviesia nudiflora subsp. ?*hirtella*	X	X
		Daviesia oxyclada	X	X
		Daviesia pedunculata	X	X
		Daviesia podophylla	X	X
		Daviesia triflora	X	X
		Gastrolobium plicatum	X	X
		Gompholobium tomentosum	X	X
		Isotropis cuneifolia subsp. *cuneifolia*	X	X
		Jacksonia angulata	X	
		Jacksonia floribunda	X	X

APPENDIX B: Vascular Plant Species Recorded Within the Dongara Project Area During 2006 and 2008

note: *denotes introduced taxa; US denotes Undescribed Species

Family		Species	06	07/08
PAPILIONACEAE cont.		*Jacksonia* ?*foliosa*	X	
		Jacksonia furcellata		X
		Jacksonia hakeoides	X	X
		Jacksonia nutans ms		X
		Jacksonia sternbergiana	X	X
		Mirbelia trichocalyx		X
		Sphaerolobium gracile	X	
GERANIACEAE	*	*Erodium* sp.		X
		Pelargonium ?*littorale*		X
OXALIDACEAE	*	*Oxalis* ?*corniculata*	X	
RUTACEAE		*Boronia coerulescens* subsp. *spicata*	X	X
		Boronia cymosa	X	X
		Boronia ramosa subsp. *anethifolia*	X	X
		Diplolaena eneabbensis	X	
		Diplolaena leemaniana	X	
		Diplolaena sp.		X
		Geleznowia verrucosa subsp. *verrucosa* ms	X	X
POLYGALACEAE		*Comesperma acerosum*	X	X
		Comesperma calymega	X	X
		Comesperma confertum		X
		Comesperma griffinii P2		X
		Comesperma integerrimum	X	X
		Comesperma volubile	X	X
EUPHORBIACEAE		?*Euphorbia* sp.		X
		Monotaxis bracteata	X	X
		Phyllanthus calycinus	X	X
		Poranthera microphylla		X
		Stachystemon axillaris	X	
STACKHOUSIACEAE		*Stackhousia monogyna*	X	
		Tripterococcus brunonis	X	X
SAPINDACEAE		?*Dodonaea aptera*		X
		Dodonaea ericoides		X

APPENDIX B: Vascular Plant Species Recorded Within the Dongara Project Area During 2006 and 2008

note: *denotes introduced taxa; US denotes Undescribed Species

Family	Species	06	07/08
SAPINDACEAE cont.	*Dodonaea pinifolia*	X	
RHAMNACEAE	*Cryptandra myriantha*	X	X
	Cryptandra ?nutans		X
	Cryptandra spyridioides	X	
	Polianthion wichurae		X
	Stenanthemum ?notiale subsp. *chamelum*	X	
	Stenanthemum notiale subsp. *notiale*	X	X
VITACEAE	*Clematicissus angustissimia*		X
MALVACEAE	*Hibiscus drummondii*		X
STERCULIACEAE	*Guichenotia ledifolia*	X	X
	Guichenotia macrantha	X	X
	Keraudrenia hermanniifolia	X	X
	Lasiopetalum angustifolium		X
	Lasiopetalum drummondii	X	X
	Lasiopetalum erectifolium ms		X
	Lasiopetalum ogilvieanum P1	X	
	Rulingia borealis		X
	Thomasia cognata		X
	Thomasia rulingioides	X	X
DILLENIACEAE	*Hibbertia acerosa*	X	X
	Hibbertia crassifolia	X	X
	Hibbertia huegelii	X	X
	Hibbertia hypericoides	X	X
	Hibbertia racemosa	X	
	Hibbertia spicata		X
	Hibbertia subvaginata	X	X
VIOLACEAE	*Hybanthus calycinus*	X	X
THYMELAEACEAE	*Pimelea angustifolia*	X	X
	Pimelea floribunda	X	X
	Pimelea imbricata var. *piligera*	X	
	Pimelea leucantha	X	X
	Pimelea sulphurea		X

APPENDIX B: Vascular Plant Species Recorded Within the Dongara Project Area During 2006 and 2008

note: *denotes introduced taxa; US denotes Undescribed Species

Family	Species	06	07/08
MYRTACEAE	*Baeckea camphorosmae*	X	X
	Baeckea grandiflora	X	X
	Baeckea sp. Walkaway (A.S. George 11249) P3	X	
	Beaufortia elegans	X	X
	Calothamnus blepharospermus	X	X
	Calothamnus hirsutus	X	X
	Calothamnus longissimus	X	X
	Calothamnus quadrifidus	X	X
	Calothamnus sanguineus	X	X
	Calytrix acutifolia	X	
	Calytrix chrysantha P4	X	
	Calytrix depressa	X	X
	Calytrix flavescens		X
	Calytrix fraseri		X
	Calytrix gracilis		X
	Calytrix sapphirina	X	X
	Calytrix sp.	X	
	Calytrix strigosa	X	X
	Chamelaucium uncinatum	X	X
	Darwinia pauciflora	X	X
	Darwinia speciosa	X	X
	Eremaea acutifolia P2		
	Eremaea asterocarpa	X	
	Eremaea beaufortioides var. *beaufortioides*	X	X
	Eremaea ectadioclada	X	X
	Eremaea pauciflora	X	
	Eremaea violacea		X
	Eremaea violacea var. ?*violacea*	X	
	Eucalyptus camaldulensis var. obtusa	X	X
	Eucalyptus erythrocorys	X	X
	Eucalyptus gittinsii subsp. *illucida*	X	
	Eucalyptus jucunda	X	
	Eucalyptus loxophleba subsp. *supralaevis*	X	
	Eucalyptus macrocarpa subsp. *elachantha* P4	X	
	Eucalyptus macrocarpa x *pyriformis* P3		X
	Eucalyptus todtiana	X	X
	Eucalyptus zopherophloia P4	X	
	Hypocalymma angustifolium	X	X
	Hypocalymma gardneri P3		X

APPENDIX B: Vascular Plant Species Recorded Within the Dongara Project Area During 2006 and 2008

note: *denotes introduced taxa; US denotes Undescribed Species

Family	Species	06	07/08
MYRTACEAE cont.	*Hypocalymma xanthopetalum*	X	
	Kunzea micrantha subsp. *petiolata*	X	X
	Leptospermum erubescens	X	X
	Leptospermum spinescens	X	X
	Melaleuca ?*campanae*		X
	Melaleuca aspalathoides	X	X
	Melaleuca cardiophylla	X	X
	Melaleuca concreta		X
	Melaleuca hamata	X	
	Melaleuca huegelii subsp. *huegelii*	X	X
	Melaleuca leuropoma	X	X
	Melaleuca platycalyx	X	X
	Melaleuca aff. *preissiana*	X	X
	Melaleuca rhaphiophylla	X	X
	Melaleuca systena	X	X
	Melaleuca trichophylla	X	X
	Melaleuca viminea subsp. *viminea*	X	X
	Myrtaceae sp.	X	
	Phymatocarpus porphyrocephalus	X	
	Pileanthus filifolius	X	X
	Scholtzia chapmanii ms	X	X
	Scholtzia laxiflora	X	X
	Scholtzia leptantha	X	
	Scholtzia sp. Eneabba (S. Maley 8)	X	X
	Scholtzia umbellifera		X
	Thryptomene hyporhytis		X
	Thryptomene racemulosa	X	X
	Verticordia blepharophylla	X	
	Verticordia densiflora var. ?*cespitosa*		X
	Verticordia densiflora var. *densiflora*	X	X
	Verticordia eriocephala		X
	Verticordia grandis	X	X
	Verticordia luteola var. *luteola* P3		X
	Verticordia monadelpha	X	
	Verticordia nobilis	X	X
	Verticordia ovalifolia	X	X
	Verticordia pennigera	X	X
HALORAGACEAE	*Glischrocaryon aureum* var. ?*angustifolium*	X	

APPENDIX B: Vascular Plant Species Recorded Within the Dongara Project Area During 2006 and 2008

note: *denotes introduced taxa; US denotes Undescribed Species

Family		Species	06	07/08
HALORAGACEAE cont.		*Gonocarpus confertifolius* var. *confertifolius*		X
		Gonocarpus nodulosus		X
APIACEAE		*Actinotus leucocephalus*		X
		Daucus glochidiatus		X
		Hydrocotyle hispidula		X
		Platysace xerophila	X	
		?*Trachymene coerulea*		X
		Trachymene pilosa	X	X
		Xanthosia huegelii	X	X
EPACRIDACEAE		*Andersonia heterophylla*	X	X
		Astroloma glaucescens	X	X
		Astroloma microdonta	X	X
		Astroloma xerophyllum	X	X
		Conostephium preissii	X	X
		Leucopogon conostephioides	X	X
		Leucopogon glaucifolius		X
		Leucopogon aff. *hamulosus*		X
		Leucopogon hispidus	X	X
		Leucopogon insularis	X	X
		Leucopogon leptanthus	X	X
		Leucopogon sp. Arrowsmith (M. Hislop 2509)	X	X
		Leucopogon sp. Mid West (J.S. Beard 7388)		X
		Lysinema ciliatum	X	X
PRIMULACEAE	*	*Anagallis arvensis* var. *caerulea*	X	X
		Samolus repens var. ?*floribundus*		X
OLEACEAE		?*Jasminum calcarium*		X
LOGANIACEAE		*Logania spermacocea*	X	X
GENTIANACEAE		*Centaurium spicatum*		X
	*	*Centaurium tenuiflorum*		X
CONVOLVULACEAE		*Bonamia rosea*		X
		?*Wilsonia backhousei*		X
		Wilsonia rotundifolia	X	X

APPENDIX B: Vascular Plant Species Recorded Within the Dongara Project Area During 2006 and 2008

note: *denotes introduced taxa; US denotes Undescribed Species

Family		Species	06	07/08
LAMIACEAE		*Hemiandra ?leiantha*		X
		Hemiandra pungens	X	X
		Hemiandra sp. ?Eneabba (H. Demarz 3687) P3	X	
		Hemiandra sp. Eneabba (H. Demarz 3687) P3		X
		Hemigenia barbata		X
		Pityrodia bartlingii	X	X
		Pityrodia hemigenioides	X	X
		Pityrodia loxocarpa	X	X
		Pityrodia verbascina	X	X
SOLANACEAE		*Anthocercis ilicifolia* subsp. *ilicifolia*	X	X
		Lycium ferocissimum		X
		Solanum oldfieldii		X
SCROPHULARIACEAE	*	*Phyllopodium cordatum*		X
PLANTAGINACEAE	*	*Plantago coronopus*		X
RUBIACEAE	*	*Galium murale*		X
		Opercularia spermacocea		X
		Opercularia vaginata	X	X
CAMPANULACEAE	*	*Wahlenbergia capensis*	X	X
		Wahlenbergia gracilenta		X
		Wahlenbergia sp.	X	
LOBELIACEAE		*Isotoma hypocrateriformis*	X	X
		Lobelia ?rhytidosperma		X
		Lobelia heterophylla	X	X
		Lobelia sp. small flowers (K.F. Kenneally 7705)		X
GOODENIACEAE		*Dampiera oligophylla*	X	X
		Dampiera spicigera		X
		Goodenia berardiana		X
		Goodenia coerulea	X	X
		Goodenia pulchella		X
		Goodenia trichophylla P3		X
		Lechenaultia hirsuta	X	X
		Lechenaultia linarioides	X	X

APPENDIX B: Vascular Plant Species Recorded Within the Dongara Project Area During 2006 and 2008

note: *denotes introduced taxa; US denotes Undescribed Species

Family	Species	06	07/08
GOODENIACEAE cont.	*Scaevola* ?*repens*		X
	Scaevola anchusifolia	X	X
	Scaevola canescens	X	X
	Scaevola phlebopetala	X	
	Scaevola sericophylla	X	X
	Verreauxia reinwardtii	X	X
STYLIDIACEAE	*Levenhookia dubia*		X
	Levenhookia octomaculata		X
	Levenhookia pusilla	X	X
	Levenhookia sp. US		X
	Levenhookia stipitata	X	X
	Stylidium ?*septentrionale*	X	
	Stylidium aff. *cygnorum* US		X
	Stylidium burbidgeanum		X
	Stylidium carnosum subsp. Narrow leaves (J.A. Wege 490) P1		X
	Stylidium crossocephalum	X	X
	Stylidium dichotomum		X
	Stylidium diuroides subsp. *paucifoliatum*	X	X
	Stylidium kalbarriense	X	X
	Stylidium maitlandianum		X
	Stylidium piliferum		X
	Stylidium purpureum ms	X	X
	Stylidium repens	X	X
	Stylidium sp. Kalbarri (A. Carr 145)	X	X
ASTERACEAE	Asteraceae sp.		X
	Asteridea pulverulenta		X
	Blennospora drummondii	X	
	Brachyscome ciliaris		X
	Calocephalus francisii		X
	* *Centaurea melitensis*	X	X
	* *Cotula coronopifolia*		X
	Erymophyllum tenellum		X
	Gnephosis ?*tenuissima*	X	
	Gnephosis angianthoides	X	X
	Gnephosis tenuissima		X
	Hyalosperma cotula	X	X
	* *Hypochaeris glabra*	X	X

APPENDIX B: Vascular Plant Species Recorded Within the Dongara Project Area During 2006 and 2008

note: *denotes introduced taxa; US denotes Undescribed Species

Family		Species	06	07/08
ASTERACEAE cont.		*Olearia dampieri* subsp. ?*eremicola*	X	
		Olearia dampieri subsp. *dampieri* ms		X
		Podolepis capillaris		X
		Podolepis gracilis		X
		Podotheca angustifolia	X	X
		Podotheca gnaphalioides		X
		Podotheca sp.	X	
		Pterochaeta paniculata	X	X
		Rhodanthe oppositifolia subsp. oppositifolia		X
		Senecio sp.		X
		Siloxerus filifolius		X
	*	*Sonchus oleraceus*	X	
	*	*Ursinia anthemoides*	X	X
		Waitzia ?*acuminata* var. *albicans*		X
		Waitzia ?*podolepis*		X
		Waitzia acuminata var. *albicans*	X	

APPENDIX C: Vascular Plant Taxa Recorded in Each Floristic Community Type Within the Dongara Project Area

Species	2B	3A	3B	4A	4B	5E	7	9A	9B	10	11	12	16B	17	18	19A	19B	20	21A	21B	22A
Acacia auronitens						X															
Acacia barbinervis subsp. *borealis*				X																	
Acacia blakelyi	X				X		X		X				X						X	X	X
Acacia dilatata						X							X							X	
Acacia fagonioides				X		X															
Acacia lasiocarpa var. *lasiocarpa*	X							X			X										
Acacia pulchella var. *pulchella*	X		X	X	X									X							
Acacia rostellifera								X	X										X	X	X
Acacia saligna							X	X	X		X				X	X	X		X	X	
Acacia saligna subsp. *lindleyi* ms															X		X				
Acacia scirpifolia			X	X					X							X	X		X		
Acacia spathulifolia					X																X
Acanthocarpus preissii			X	X	X														X	X	X
Acanthocarpus sp. Ajana (C.A. Gardner 8596)	X			X	X	X													X		
Actinostrobus arenarius					X											X					
Actinostrobus pyramidalis			X											X				X		X	
Actinotus leucocephalus						X											X		X		
**Aira caryophyllea*							X	X			X								X	X	X
Alexgeorgea nitens	X		X	X	X									X			X		X	X	
Allocasuarina campestris						X									X	X	X	X	X	X	
Allocasuarina humilis		X	X	X	X	X								X				X	X		
Allocasuarina lehmanniana subsp. *lehmanniana*											X							X			
Allocasuarina microstachya					X	X													X		
Amphipogon caricinus						X															

APPENDIX C: Vascular Plant Taxa Recorded in Each Floristic Community Type Within the Dongara Project Area

Species	2B	3A	3B	4A	4B	5E	7	9A	9B	10	11	12	16B	17	18	19A	19B	20	21A	21B	22A
Amphipogon turbinatus			X	X	X	X										X					
Amyema miquelii	X						X														
Amyema preissii																				X	
**Anagallis arvensis*							X	X	X		X	X							X	X	X
Anarthria polyphylla						X															
Andersonia heterophylla			X	X		X															
Anigozanthos humilis subsp. *humilis*	X	X	X	X	X															X	
Anthobolus foveolatus									X											X	X
Anthocercis ?ilicifolia subsp. *ilicifolia*								X	X		X										
Arnocrinum preissii			X	X	X																
Asteraceae sp.																		X			
Astroloma glaucescens						X															
Astroloma microdonta	X		X	X	X	X															
Astroloma xerophyllum	X		X	X	X																
?*Atriplex semilunaris*												X									
Austrodanthonia setacea					X						X										
Austrostipa elegantissima								X		X			X						X		X
Austrostipa ?exilis									X										X		
Austrostipa flavescens									X		X									X	X
Austrostipa macalpinei	X		X		X			X			X		X		X	X	X	X	X	X	X
Baeckea camphorosmae				X		X							X								
Baeckea grandiflora				X		X															
Baeckea sp. Walkaway (A.S. George 11249) P3																					
Banksia attenuata	X	X	X	X	X									X		X			X	X	

APPENDIX C: Vascular Plant Taxa Recorded in Each Floristic Community Type Within the Dongara Project Area

Species	2B	3A	3B	4A	4B	5E	7	9A	9B	10	11	12	16B	17	18	19A	19B	20	21A	21B	22A
Banksia bipinnatifida						X															
Banksia candolleana				X																	
Banksia carlinoides						X															
Banksia dallanneyi var. *dallanneyi*				X		X							X						X	X	X
Banksia elegans			X	X	X									X		X		X	X	X	X
Banksia fraseri var. ?*fraseri*						X															
Banksia hookeriana				X	X																
Banksia ?*lanata*					X													X	X	X	X
Banksia leptophylla var. *leptophylla*			X	X	X									X	X	X		X			
Banksia menziesii			X		X											X			X	X	
Banksia prionotes			X		X				X							X			X	X	
Banksia scabrella				X		X															
Banksia sessilis var. *cygnorum*					X																X
Banksia sessilis var. *flabellifolia*																					X
Banksia shuttleworthiana	X			X	X	X													X		
Banksia tridentata				X																	
Baumea juncea									X												
Beaufortia elegans			X	X	X	X								X							
Beyeria gardneri				X																	
Billardiera ?*fusiformis*																					X
Boronia coerulescens subsp. *spicata*						X															
Boronia cymosa						X															
Boronia ramosa subsp. *anethifolia*			X	X															X		
**Brassica* sp.																					X

APPENDIX C: Vascular Plant Taxa Recorded in Each Floristic Community Type Within the Dongara Project Area

Species	2B	3A	3B	4A	4B	5E	7	9A	9B	10	11	12	16B	17	18	19A	19B	20	21A	21B	22A
**Briza maxima*																				X	
Burchardia congesta	X			X	X	X													X	X	X
Calandrinia aff. *liniflora* US		X																			
Calandrinia aff. *remota* US										X											X
Calectasia hispida			X	X																	
Calectasia narragara	X		X																		
Calectasia palustris				X		X															
Calocephalus francisii							X		X			X									
Calothamnus blepharospermus	X		X	X	X	X											X		X		
Calothamnus hirsutus			X								X			X		X		X			
Calothamnus longissimus						X															
Calothamnus quadrifidus	X		X		X	X			X				X		X	X	X	X	X	X	
Calothamnus sanguineus	X			X	X	X								X							
Calytrix chrysantha	X		X																		X
Calytrix depressa				X		X															
Calytrix flavescens				X		X															
Calytrix fraseri		X	X		X																
Calytrix gracilis						X															
Calytrix sapphirina			X	X																	
Calytrix strigosa	X		X		X														X	X	
Cassytha aurea	X	X	X	X	X						X					X		X	X		
Cassytha glabella			X	X	X	X		X													
Cassytha racemosa							X		X												
Casuarina obesa												X							X		

APPENDIX C: Vascular Plant Taxa Recorded in Each Floristic Community Type Within the Dongara Project Area

Species	2B	3A	3B	4A	4B	5E	7	9A	9B	10	11	12	16B	17	18	19A	19B	20	21A	21B	22A
Caustis dioica				X		X							X								
**Centaurea melitensis*									X			X									
Centaurium spicatum								X													
Centrolepis pilosa																				X	
Chamelaucium uncinatum									X												
**Chenopodium murale*												X									
Chordifex sinuosus	X		X	X	X	X								X					X		
?*Choretrum pritzelii*							X														
Clematis linearifolia									X												
Comesperma acerosum																X					
Comesperma calymega				X																	
Comesperma confertum																		X			
Comesperma griffinii						X															
Comesperma integerrimum								X	X						X						
Comesperma volubile																					X
Conospermum boreale subsp. ?*boreale*	X		X	X	X	X										X			X	X	
Conospermum unilaterale			X	X																	
Conostephium preissii			X		X														X		
Conostylis aculeata subsp. *breviflora*													X								
Conostylis androstemma						X															
Conostylis aurea	X		X	X	X																
Conostylis candicans	X		X																		
Conostylis candicans subsp. *calcicola*		X	X		X					X									X	X	X
Conostylis candicans subsp. *candicans*			X	X	X				X								X		X	X	X

APPENDIX C: Vascular Plant Taxa Recorded in Each Floristic Community Type Within the Dongara Project Area

Species	2B	3A	3B	4A	4B	5E	7	9A	9B	10	11	12	16B	17	18	19A	19B	20	21A	21B	22A
Conostylis canteriata				X		X															
Conostylis hiemalis				X																	
Conostylis neocymosa				X	X																
Conostylis ?teretiuscula				X																	
Corynotheca micrantha			X		X								X								
**Cotula coronopifolia*							X														
Crassula colorata												X								X	
Cristonia biloba						X															
Cryptandra ?nutans				X		X															
Dampiera oligophylla			X	X	X	X															
Darwinia sanguinea						X															
Dampiera spicigera	X			X		X															
Darwinia pauciflora			X	X	X																
Darwinia speciosa			X	X		X															
Daviesia angulata				X																	
Daviesia divaricata			X	X	X														X		X
Daviesia divaricata subsp. *divaricata* ms					X																
Daviesia divaricata subsp. *lanulosa* ms			X	X	X														X		
Daviesia incrassata subsp. *teres*						X															
Daviesia nudiflora	X			X		X													X		
Daviesia oxyclada						X															
Daviesia pedunculata				X		X															
Daviesia podophylla														X		X		X	X		
Daviesia triflora	X		X	X	X																

APPENDIX C: Vascular Plant Taxa Recorded in Each Floristic Community Type Within the Dongara Project Area

Species	2B	3A	3B	4A	4B	5E	7	9A	9B	10	11	12	16B	17	18	19A	19B	20	21A	21B	22A
Desmocladus asper		X						X									X		X	X	X
Desmocladus ?lateriticus			X													X					
Desmocladus parthenicus		X		X																	
Desmocladus semiplanus	X		X	X																	
Dianella revoluta	X				X			X	X	X							X		X	X	X
Diplolaena sp.				X																	
?*Dodonaea aptera*										X											X
Dodonaea ericoides						X															
Drosera eneabba			X	X	X																
Drosera erythrorhiza	X																		X		
Drosera menziesii subsp. *penicillaris*					X																
Ecdeiocolea monostachya	X			X	X	X													X	X	X
**Ehrharta longiflora*							X		X										X	X	
?*Enchylaena tomentosa*												X									
Eremaea acutifolia			X																		
Eremaea beaufortioides	X		X	X	X	X							X	X		X		X	X		
Eremaea ectadioclada			X	X	X																
Eremaea violacea	X			X	X	X															
**Erodium* sp.																				X	
Eucalyptus camaldulensis var. *obtusa*							X		X						X					X	
Eucalyptus erythrocorys										X											X
Eucalyptus macrocarpa subsp. *elachantha*				X	X																
Eucalyptus macrocarpa x *pyriformis*						X															
Eucalyptus todtiana	X	X	X	X	X									X	X		X	X	X	X	

APPENDIX C: Vascular Plant Taxa Recorded in Each Floristic Community Type Within the Dongara Project Area

Species	2B	3A	3B	4A	4B	5E	7	9A	9B	10	11	12	16B	17	18	19A	19B	20	21A	21B	22A
Eucalyptus zopherophloia																					
?*Euphorbia* sp.								X													
Gahnia trifida							X	X			X				X			X			
Gastrolobium callistachys			X																		
Gastrolobium plicatum						X															
Geleznowia verrucosa subsp. *verrucosa* ms				X		X															X
Georgeantha hexandra			X																		
Gnephosis angianthoides																				X	
Gnephosis tenuissima													X						X	X	
Gompholobium tomentosum	X		X	X	X		X	X			X			X				X	X		X
Gonocarpus confertifolius var. *confertifolius*												X									
Goodenia coerulea		X	X	X	X	X															
Goodenia pulchella								X													
Goodenia trichophylla						X															
Goodeniaceae sp.																		X			
Grevillea argyrophylla										X											X
Grevillea erinacea													X								
Grevillea eriostachya					X																
Grevillea exposita																				X	
Grevillea leucopteris					X																
Grevillea shuttleworthiana subsp. *canarina*				X																	
Grevillea ?*synapheae*				X																	
Guichenotia ledifolia															X	X			X		
Guichenotia ?*macrantha*																	X		X		

APPENDIX C: Vascular Plant Taxa Recorded in Each Floristic Community Type Within the Dongara Project Area

Species	2B	3A	3B	4A	4B	5E	7	9A	9B	10	11	12	16B	17	18	19A	19B	20	21A	21B	22A
Hakea candolleana				X		X														X	
Hakea costata			X	X	X																X
Hakea ?cygna subsp. *cygna*				X		X															
Hakea incrassata						X							X						X		
Hakea lissocarpha						X							X							X	X
Hakea polyanthema	X	X	X	X	X	X		X								X	X		X	X	X
Hakea prostrata														X							
Hakea spathulata						X							X								
Hakea trifurcata														X	X	X		X		X	X
Hakea varia											X										
Harperia lateriflora						X															
Hemiandra ?leiantha			X																		
Hemiandra pungens			X																		
Hemiandra sp. Eneabba (H. Demarz 3687)			X	X	X																
Hemigenia barbata			X																		
Hibbertia acerosa			X						X					X		X		X			
Hibbertia crassifolia	X			X																	
Hibbertia huegelii		X																			
Hibbertia hypericoides	X	X	X	X	X	X			X				X						X	X	X
Hibbertia spicata			X	X		X															
Hibbertia subvaginata									X					X				X			X
Hibiscus drummondii																					X
Hopkinsia anoectocolea							X												X	X	X
Hyalosperma cotula						X															

APPENDIX C: Vascular Plant Taxa Recorded in Each Floristic Community Type Within the Dongara Project Area

Species	2B	3A	3B	4A	4B	5E	7	9A	9B	10	11	12	16B	17	18	19A	19B	20	21A	21B	22A
Hybanthus calycinus																					X
Hypocalymma angustifolium														X							
Hypocalymma gardneri				X		X															
**Hypochaeris glabra*	X						X		X			X						X	X	X	X
Isolepis cernua var. *setiformis*							X														
Isopogon divergens						X															
Isopogon tridens P3	X		X	X	X	X															
Isotoma hypocrateriformis			X					X			X					X			X	X	X
Isotropis cuneifolia			X	X	X	X								X							X
Jacksonia floribunda			X	X																	
Jacksonia furcellata				X																	
Jacksonia hakeoides			X	X	X								X	X		X	X		X	X	X
Jacksonia nutans ms				X	X	X															X
Jacksonia sternbergiana							X														
?Jasminum calcarium										X											X
Johnsonia pubescens subsp. *pubescens*				X																	
Keraudrenia hermanniifolia																				X	
Kunzea micrantha subsp. *petiolata*														X	X	X		X			
Labichea lanceolata									X												
Lasiopetalum angustifolium									X	X											X
Lasiopetalum drummondii				X	X	X															
Lasiopetalum erectifolium ms																X					
Lasiopetalum ogilvieanum				X																	
Laxmannia ramosa					X																X

APPENDIX C: Vascular Plant Taxa Recorded in Each Floristic Community Type Within the Dongara Project Area

Species	2B	3A	3B	4A	4B	5E	7	9A	9B	10	11	12	16B	17	18	19A	19B	20	21A	21B	22A
Laxmannia sessiliflora subsp. *drummondii*	X		X	X		X															
Lechenaultia hirsuta	X																				
Lechenaultia linarioides			X		X														X		
Lepidobolus preissianus	X		X	X	X	X													X	X	X
Lepidobolus preissianus subsp. *preissianus*				X																	
Lepidosperma brunonianum				X																	
Lepidosperma leptostachyum						X															
Lepidosperma pubisquameum						X															
Lepidosperma cf. *tenue* US			X	X	X						X								X		X
Lepidosperma sp.											X										
Lepidosperma sp. Eneabba Scabrum US					X																
Lepidosperma sp. P1 small head (M.D. Tindale 166A)			X					X					X	X	X	X		X	X	X	
Lepidosperma sp. Yuna Scabrid US																X					
Leptomeria ?*preissiana*																		X			
Leptospermum erubescens	X	X	X	X	X	X													X		
Leptospermum spinescens	X	X	X	X	X	X													X	X	
Leucopogon conostephioides			X	X	X	X															
Leucopogon glaucifolius						X															
Leucopogon hamulosus					X																
Leucopogon hispidus				X	X																
Leucopogon insularis																					X
Leucopogon leptanthus						X															
Leucopogon sp. Arrowsmith (M. Hislop 2509)			X	X	X	X								X							
Leucopogon sp. Mid West (J.S. Beard 7388)																					X

APPENDIX C: Vascular Plant Taxa Recorded in Each Floristic Community Type Within the Dongara Project Area

Species	2B	3A	3B	4A	4B	5E	7	9A	9B	10	11	12	16B	17	18	19A	19B	20	21A	21B	22A
Levenhookia octomaculata				X		X													X		
Levenhookia pusilla					X													X	X	X	X
Levenhookia sp. US																		X			
Levenhookia stipitata	X			X	X	X										X			X	X	X
Lobelia heterophylla							X	X	X	X									X		X
Lobelia ?*rhytidosperma*																			X	X	
Lobelia sp. small flowers (K.F. Kenneally 7705)																			X		
Logania spermacocea				X												X					X
**Lolium* sp.												X									
Lomandra hastilis			X	X	X									X						X	
Lomandra maritima																					X
Lomandra ?*micrantha* subsp. *micrantha*																					X
Lomandra preissii				X																	
**Lycium ferocissimum*									X												
Lyginia imberbis			X	X	X								X						X	X	
Lysinema ciliatum			X	X	X	X															
Macrozamia fraseri			X																	X	
Maireana ?*brevifolia*												X									
Melaleuca aspalathoides						X															
Melaleuca ?*campanae*										X											
Melaleuca cardiophylla									X	X											
Melaleuca concreta									X						X					X	
Melaleuca huegelii subsp. *huegelii*								X	X		X				X			X			
Melaleuca leuropoma	X	X	X	X	X	X			X				X	X		X	X	X	X	X	X

APPENDIX C: Vascular Plant Taxa Recorded in Each Floristic Community Type Within the Dongara Project Area

Species	2B	3A	3B	4A	4B	5E	7	9A	9B	10	11	12	16B	17	18	19A	19B	20	21A	21B	22A
Melaleuca platycalyx																X		X			
Melaleuca preissiana												X									
Melaleuca rhaphiophylla							X						X								
Melaleuca systena								X			X							X			X
Melaleuca trichophylla						X															
Melaleuca viminea subsp. *viminea*							X	X							X						
**Melilotus ?indicus*							X														
**Mesembryanthemum crystallinum*												X									
**Mesembryanthemum nodiflorum*												X									
Mesomelaena pseudostygia	X	X	X	X	X	X													X	X	X
Mesomelaena stygia subsp. *deflexa*				X	X																
Microtis media											X										
Mirbelia trichocalyx						X															
Monotaxis bracteata				X	X	X				X									X	X	X
Muehlenbeckia adpressa																				X	X
Neurachne alopecuroidea	X	X	X	X	X	X							X	X		X			X	X	X
Nuytsia floribunda			X													X		X			
Olax scalariformis P3		X		X																	
Olearia dampieri subsp. *dampieri* ms								X	X												X
Opercularia spermacocea					X															X	X
Opercularia vaginata	X		X	X	X	X					X							X			
Paracaleana dixonii				X		X															
Paracaleana nigrita						X															
Patersonia occidentalis							X														X

APPENDIX C: Vascular Plant Taxa Recorded in Each Floristic Community Type Within the Dongara Project Area

Species	2B	3A	3B	4A	4B	5E	7	9A	9B	10	11	12	16B	17	18	19A	19B	20	21A	21B	22A
Persoonia acicularis			X	X	X														X	X	
Persoonia comata				X																	
Persoonia filiformis				X		X															
Persoonia rudis	X	X		X	X																
Petrophile axillaris																					X
Petrophile brevifolia			X	X	X	X							X	X		X		X		X	X
Petrophile drummondii	X		X	X	X									X		X					
Petrophile macrostachya	X	X	X	X	X	X														X	
Petrophile megalostegia				X																	
Petrophile scabriuscula						X															
Petrophile shuttleworthiana					X																
Phyllanthus calycinus																					X
Pileanthus filifolius	X	X	X	X	X	X													X	X	X
Pimelea angustifolia	X		X	X	X																
Pimelea floribunda				X	X								X								
Pimelea leucantha			X																		
Pimelea sulphurea																				X	
Pittosporum ligustrifolium									X												
Pityrodia bartlingii			X																		
Pityrodia hemigenioides				X																	
Pityrodia loxocarpa																					X
Pityrodia verbascina				X																	
Podolepis capillaris																					X
Podolepis gracilis											X										

APPENDIX C: Vascular Plant Taxa Recorded in Each Floristic Community Type Within the Dongara Project Area

Species	2B	3A	3B	4A	4B	5E	7	9A	9B	10	11	12	16B	17	18	19A	19B	20	21A	21B	22A
Podotheca angustifolia	X																				
Podotheca gnaphalioides									X				X						X	X	X
Polianthion wichurae																		X			
**Polypogon monspeliensis*							X														
Poranthera microphylla					X	X		X			X				X			X		X	
Pterochaeta paniculata						X										X		X	X	X	
Ptilotus declinatus																				X	
Ptilotus drummondii				X																	
Ptilotus manglesii													X							X	
Ptilotus polystachyus													X						X		
Pyrorchis nigricans	X																				
**Raphanus raphanistrum*													X								
Rhagodia preissii subsp. *obovata*							X		X	X		X									X
Rhodanthe oppositifolia subsp. *oppositifolia*												X									
Rulingia borealis									X												
Samolus repens var. ?*floribundus*							X														
Santalum acuminatum								X			X				X			X	X		
Sarcocornia quinqueflora							X														
Scaevola anchusifolia	X		X		X																
Scaevola canescens	X			X	X	X															
Scaevola ?repens					X																
Scaevola sericophylla																X			X		
Schoenus brevisetis				X		X															
Schoenus clandestinus	X			X	X	X													X	X	X

APPENDIX C: Vascular Plant Taxa Recorded in Each Floristic Community Type Within the Dongara Project Area

Species	2B	3A	3B	4A	4B	5E	7	9A	9B	10	11	12	16B	17	18	19A	19B	20	21A	21B	22A
Schoenus curvifolius		X	X	X																	
Schoenus griffinianus			X	X	X																
Schoenus pleiostemoneus		X	X	X	X	X															
Schoenus sp. A3 Ciliate Sheaths (K.R. Newbey 9402)				X																	
Schoenus sp. Eneabba (F. Obbens & C. Godden) P1			X	X																	
Schoenus subfascicularis											X					X		X		X	
Scholtzia chapmanii ms			X		X															X	
Scholtzia laxiflora	X	X	X	X	X	X	X										X		X	X	X
Scholtzia sp. Eneabba (S. Maley 8)																	X				
Scholtzia umbellifera					X															X	X
Senecio sp.					X																
Solanum oldfieldii																					X
**Spergularia ?diandra*												X									
Stachystemon axillaris			X	X																	
Stawellia dimorphantha		X	X	X	X													X	X	X	X
Stenanthemum notiale subsp. *notiale*	X		X	X	X	X		X								X			X	X	X
Stirlingia latifolia			X																X		
Stylidium burbidgeanum			X													X	X				
Stylidium carnosum subsp. (Narrow leaves J.A. Wege 490) P1				X																	
Stylidium crossocephalum	X		X	X	X	X															
Stylidium aff. *cygnorum* US				X																	
Stylidium dichotomum						X															
Stylidium diuroides subsp. *paucifoliatum*			X	X	X	X															
Stylidium kalbarriense					X																

APPENDIX C: Vascular Plant Taxa Recorded in Each Floristic Community Type Within the Dongara Project Area

Species	2B	3A	3B	4A	4B	5E	7	9A	9B	10	11	12	16B	17	18	19A	19B	20	21A	21B	22A
Stylidium maitlandianum			X	X																	
Stylidium piliferum			X		X																
Stylidium purpureum ms			X	X	X																
Stylidium pseudocaespitosum P2			X																		
Stylidium repens	X		X	X	X	X															
Stylidium sp. Kalbarri (A. Carr 145)	X			X	X	X															
Stylobasium australe									X												
Synaphea spinulosa subsp. *spinulosa*			X		X														X		
Tecticornia pergranulata subsp. *pergranulata*												X									
Tetraria microcarpa				X	X																
Thomasia cognata								X													
Thomasia rulingioides								X	X												
Thryptomene hyporhytis																			X	X	
Thryptomene ?racemulosa						X							X								
Thysanotus arenarius					X																
Thysanotus asper																			X		
Thysanotus dichotomus				X	X	X														X	X
Thysanotus multiflorus						X															
Thysanotus patersonii			X		X	X		X			X							X	X		
Thysanotus ?sparteus				X	X																
Thysanotus spiniger				X																	
Thysanotus ?tenellus	X		X		X											X					
Thysanotus ?thyrsoideus			X	X	X	X															
Thysanotus ?triandrus				X																	

APPENDIX C: Vascular Plant Taxa Recorded in Each Floristic Community Type Within the Dongara Project Area

Species	2B	3A	3B	4A	4B	5E	7	9A	9B	10	11	12	16B	17	18	19A	19B	20	21A	21B	22A
?*Trachymene coerulea*						X															
Trachymene pilosa	X	X	X		X	X		X	X		X				X	X	X	X	X	X	X
Tricoryne elatior	X			X	X	X													X		X
Tricoryne sp. Eneabba (E.A. Griffin 1200)				X	X	X															
Tricoryne tenella																					X
Tripterococcus brunonis			X																		
**Ursinia anthemoides*	X	X	X				X						X						X	X	X
Verticordia blepharophylla			X	X		X															
Verreauxia reinwardtii			X		X																
Verticordia densiflora	X	X	X	X	X	X							X	X		X			X	X	
Verticordia densiflora var. ?*cespitosa*					X		X							X							
Verticordia densiflora var. ?*densiflora*																		X			
Verticordia grandis	X		X	X	X	X														X	
Verticordia nobilis				X		X															
Verticordia luteola var. luteola			X	X												X					
Verticordia ovalifolia			X																		
Verticordia pennigera				X		X															
**Vulpia* sp.								X				X							X	X	
**Wahlenbergia capensis*																				X	
Wahlenbergia gracilenta	X																				
Waitzia ?acuminata var. *albicans*																				X	
Waitzia ?podolepis																			X	X	X
Wilsonia rotundifolia												X									
Xanthorrhoea brunonis														X							

APPENDIX C: Vascular Plant Taxa Recorded in Each Floristic Community Type Within the Dongara Project Area

Species	2B	3A	3B	4A	4B	5E	7	9A	9B	10	11	12	16B	17	18	19A	19B	20	21A	21B	22A
Xanthorrhoea drummondii						X							X	X		X		X	X	X	X
Xanthosia huegelii	X		X	X															X		
Xylomelum angustifolium		X		X	X																

APPENDIX D: Photographic Record of Floristic Community Types (FCTs) Recorded Within the Dongara Project Area

FCT2b: Heath to Thicket of mixed shrubs commonly including *Melaleuca leuropoma, Hibbertia hypericoides, Banksia shuttleworthiana* and *Allocasuarina humilis* over *Ecdeiocolea monostachya* on yellow or brown sand and sandy clay

FCT3a: Open Low Woodland to Heath of *Banksia* spp. over mixed shrubs commonly including *Melaleuca leuropoma*, *Eremaea beaufortioides* and *Scholtzia laxiflora* on yellow sand on lower to mid slopes

APPENDIX D: Photographic Record of Floristic Community Types (FCTs) Recorded Within the Dongara Project Area

FCT3b: Low Woodland to Thicket of *Banksia attenuata* and *Banksia menziesii* over mixed shrubs dominated by myrtaceous species on brown or yellow sand on lower to mid slopes and plains

FCT4a: Species rich Woodlands and Heaths on grey sand in the eastern portion of the Eneabba sandplain. Common species include *Conospermum boreale* subsp. ?*boreale*, *Ecdeiocolea monostachya*, *Eremaea beaufortioides*, *Hakea polyanthema* (P3) and *Banksia candolleana*

APPENDIX D: Photographic Record of Floristic Community Types (FCTs) Recorded Within the Dongara Project Area

FCT4b: Thicket dominated by *Banksia hookeriana* and/or *Banksia attenuata*, with emergent *Banksia prionotes* on yellow sand on upper slopes and dune crests

FCT5e: Heath to Low Heath dominated by *Banksia* spp. and *Melaleuca* spp. over *Ecdeiocolea monostachya* on grey or brown sandy clay or gravel on lower slopes and plains

APPENDIX D: Photographic Record of Floristic Community Types (FCTs) Recorded Within the Dongara Project Area

FCT7: Low Woodland to Low Forest of *Melaleuca rhaphiophylla* and/or *Eucalyptus camaldulensis* var. *obtusa* over a species poor understorey dominated by annuals on grey or brown sandy clay in wet depressions and drainage lines

FCT9a: Thicket dominated by *Melaleuca huegelii* subsp. *huegelii* and *Acacia* spp. on brown sandy clay over limestone on lower slopes and depressions

APPENDIX D: Photographic Record of Floristic Community Types (FCTs) Recorded Within the Dongara Project Area

FCT9b: Low Woodland to Low Forest of *Eucalyptus camaldulensis* over Open Scrub of *Acacia rostellifera*, *Chamelaucium uncinatum* and *Melaleuca* spp. on grey or brown sandy clay in drainage lines and depressions

FCT10: Low Woodland of *Eucalyptus erythrocorys* over Thicket dominated by *Melaleuca cardiophylla* on brown sand over massive limestone outcropping in a drainage line

APPENDIX D: Photographic Record of Floristic Community Types (FCTs) Recorded Within the Dongara Project Area

FCT11: Heath dominated by *Melaleuca systena* and *Melaleuca huegelii* subsp. *huegelii* on grey or brown sand and sandy clay in depressions

FCT12: Low Woodland to Low Forest of *Melaleuca preissiana* over a sparse, often disturbed, shrub layer on grey sandy clay in depressions

APPENDIX D: Photographic Record of Floristic Community Types (FCTs) Recorded Within the Dongara Project Area

FCT16b: Highly disturbed Scrub with *Calothamnus quadrifidus* on grey or brown sand in drainage lines

FCT17: Shrublands and Thickets dominated by *Melaleuca* spp. and *Banksia* spp. on grey or brown sandy clays and sandy loams with some lateritic gravel on flats, depressions and creek-lines

APPENDIX D: Photographic Record of Floristic Community Types (FCTs) Recorded Within the Dongara Project Area

FCT18: Thicket dominated by *Melaleuca concreta* and/or *Allocasuarina campestris* on grey sandy clay in depressions and clay pans

FCT19a: Heath to Thicket dominated by *Allocasuarina campestris* and/or *Banksia leptophylla* var. *leptophylla* on grey or brown sandy clay in drainage lines

APPENDIX D: Photographic Record of Floristic Community Types (FCTs) Recorded Within the Dongara Project Area

FCT19b: Scrub of *Acacia* spp., *Allocasuarina campestris* and *Calothamnus* spp. on grey sand on lower slopes and drainage lines

FCT20: Thicket dominated by *Actinostrobus pyramidalis* on grey diatomaceous earth on lower slopes and depressions

APPENDIX D: Photographic Record of Floristic Community Types (FCTs) Recorded Within the Dongara Project Area

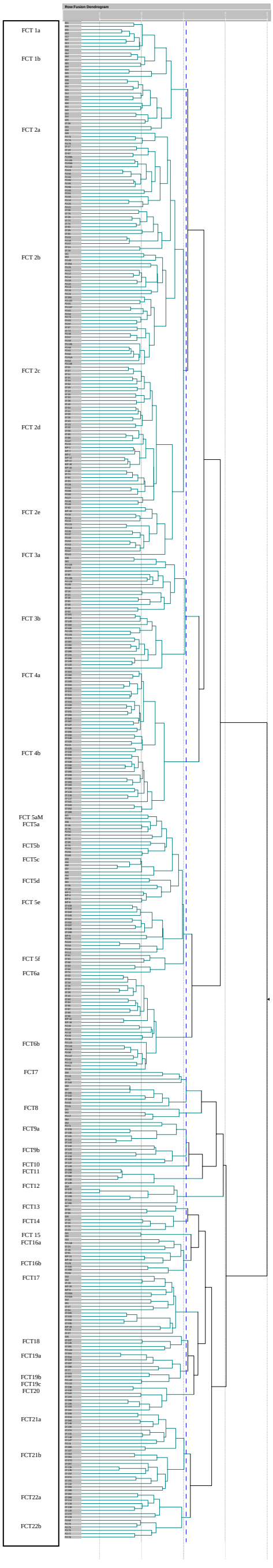
FCT21a: Low Woodland of *Banksia prionotes* and/or *Casuarina obesa* over Low Scrub of *Banksia* spp. and *Calothamnus* spp. on yellow or brown sand

FCT21b: Thicket to Open Scrub dominated by *Acacia* spp. on lower slopes and *Banksia* spp. on mid slopes over *Hakea* spp. and *Ecdeiocolea monostachya* on brown sand and sandy clay

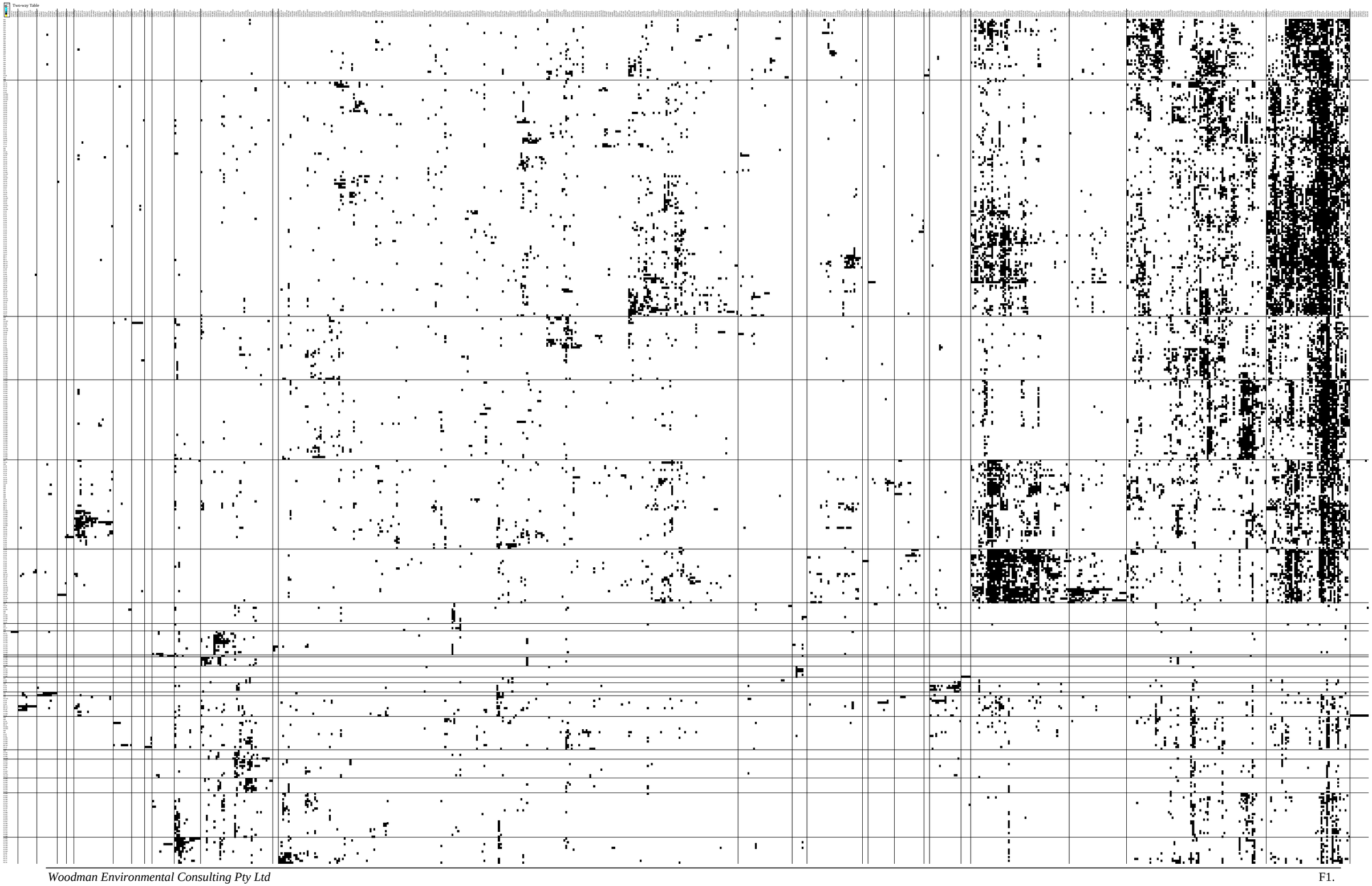
APPENDIX D: Photographic Record of Floristic Community Types (FCTs) Recorded Within the Dongara Project Area

FCT22a: Low Woodland of *Eucalyptus erythrocorys* on brown or yellow sand over limestone on mid to upper slopes

Appendix E: Summary Dendrogram of FCTs, Dongara Quadrat Data and Regional Dataset



Appendix F: Two-way Table, Ordination of Dongara Quadrat Data and Regional Dataset



APPENDIX G: Indicator Species Values (Monte Carlo Test), Dongara Quadrat Data and Regional Dataset

note: Shading denotes highest indicator values per taxon. Indicator values (%) are shown only for taxa which were significant at P<0.05 (Monte Carlo permutation tests: * = p <0.05; ** = p <0.01; *** = p <0.001)

Species	1a	1b	2a	2b	2c	2d	2e	3a	3b	4a	4b	5a	5b	5c	5d	5e	5f	6a	6b	7	8	9a	9b	11	12	13	14	15	16a	16b	17	18	19a	19b	19c	20	21a	21b	22a	22b
Conostylis canteriata ***	64	3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Conospermum triplinervium **	28	18	0	0	0	0	0	0	0	0	0	1	0	1	0	0	1	0	0	0	2	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	1
Lyginia barbata *	21	21	0	0	0	0	0	0	0	0	0	1	0	1	3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0
Petrophile scabriuscula *	18	1	0	0	0	1	0	0	0	0	0	1	0	0	0	2	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Astroloma xerophyllum ***	17	11	1	1	3	3	1	0	8	0	1	0	0	0	9	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Hakea candolleana ***	16	4	0	5	2	4	0	0	0	4	0	2	6	0	0	6	7	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0
Lepidosperma tenue *	15	10	0	0	0	0	0	0	0	0	0	0	0	11	0	0	0	1	0	0	0	1	0	0	0	0	1	0	6	0	0	0	0	0	0	0	0	0	0	3
Calytrix superba *	14	2	1	3	8	6	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Thysanotus spiniger *	13	11	1	3	3	10	6	0	0	0	0	0	1	0	0	2	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Daviesia nudiflora ***	12	2	1	6	6	10	4	0	0	4	0	2	2	0	3	0	0	9	4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Stylidium crossocephalum ***	11	3	6	2	1	4	11	1	4	3	1	2	2	0	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Conothamnus trinervis *	11	2	0	1	6	8	1	0	0	0	0	0	0	0	1	0	0	1	7	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Amphipogon turbinatus ***	9	4	2	3	3	6	4	0	5	1	1	2	2	0	2	1	3	1	1	0	1	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0
Banksia shuttleworthiana ***	9	1	0	6	5	9	1	0	0	9	0	7	3	9	0	6	0	7	9	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Allocasuarina humilis **	8	2	0	1	2	8	5	2	0	1	0	1	0	4	2	0	1	4	6	0	0	0	0	0	0	0	0	0	0	0	2	0	0	0	0	0	0	0	0	2
Petrophile brevifolia ***	6	3	2	2	4	5	2	2	1	1	1	5	4	3	0	2	3	4	5	0	0	0	0	0	0	3	0	0	0	1	4	0	0	0	0	1	0	0	1	3
Melaleuca leuropoma ***	4	4	4	4	4	4	4	4	4	4	4	4	3	0	1	1	4	1	0	0	0	0	0	0	0	0	1	0	1	0	3	0	1	4	4	0	4	2	1	1
Hemiandra sp. Eneabba (H. Demarz 3687) *	1	13	11	1	2	3	1	0	1	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Arnocrinum preisii *	0	12	4	0	0	0	3	0	2	0	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Mesomeleana pseudostygia ***	4	5	5	5	4	5	4	2	3	5	5	4	2	4	5	5	4	5	3	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	2	0	1	1
Conospermum wycherleyi ***	0	0	11	10	10	10	5	4	0	0	0	1	9	0	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2
Verticordia grandis ***	0	8	10	7	6	6	7	0	3	8	5	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Leptospermum erubescens *	4	0	1	13	0	1	0	1	1	7	3	1	1	0	0	2	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Leptospermum spinescens ***	4	4	3	7	5	3	6	1	3	4	4	1	6	1	0	1	0	5	6	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Actinostrobus acuminatus **	0	0	1	0	22	3	19	0	0	0	0	0	0	0	1	0	0	1	7	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Eremaea violacea ***	10	5	3	5	13	10	1	0	0	7	0	5	0	0	0	1	3	0	6	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Leucopogon sp. South Eneabba (E.A. Griffin 8027) *	0	0	0	0	13	2	8	0	0	0	0	7	0	0	0	0	1	2	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0
Jacksonia floribunda ***	7	8	9	4	12	10	7	1	0	2	0	0	1	0	4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Darwinia nieldiana *	9	5	2	1	10	3	0	0	0	0	0	2	8	8	7	0	3	8	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Chordifex sinuosis ***	4	6	4	7	8	8	7	1	3	5	0	2	0	0	8	0	1	7	2	0	0	0	0	0	0	0	0	0	0	0	2	0	0	0	0	0	0	0	0	0
Pileanthus filifolius ***	4	4	5	6	7	7	4	0	4	7	7	1	3	2	4	4	1	3	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Banksia stenoprion *	0	0	0	0	0	21	0	0	0	0	0	0	8	0	1	0	0	2	15	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Hakea flabellifolia *	4	1	0	0	2	18	3	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Lomandra preissii *	0	0	1	0	5	17	1	0	0	0	0	0	6	0	6	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Schoenus pedicellatus *	13	6	0	0	1	15	9	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Lyginia imberbis ***	0	0	3	1	8	12	10	2	6	1	0	0	0	0	2	0	0	0	0	0	0	0	0	0	0	2	0	0	0	2	0	0	0	0	0	0	1	0	0	2
Hakea eneabba *	0	0	0	0	6	12	7	0	0	0	0	0	0	0	4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Petrophile macrostachya ***	4	3	7	6	6	9	3	2	4	3	5	3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Beaufortia elegans ***	5	4	5	1	2	8	8	1	4	4	1	8	7	0	1	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0
Banksia tortifolia **	0	4	0	0	1	0	41	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Stirlingia latifolia ***	0	8	5	0	0	0	32	5	11	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Strangea cynanchicarpa **	0	0	0	0	2	0	30	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Blancoa canescens **	0	3	0	0	0	0	29	2	0	0	0	0	0	7	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Conospermum unilaterale **	0	1	0	0	0	0	27	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Johnsonia pubescens subsp. *pubescens* *	1	4	4	0	0	1	23	0	0	0	0	0	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Drosera eneabba *	0	0	0	0	0	1	22	1	14	1	1	0	2	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Adenanthos cygnorum *	0	5	1	0	0	0	20	15	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	1	0	0	0	0	0	0	0	0	0
Daviesia triflora ***	0	6	3	1	1	1	19	0	10	3	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Petrophile linearis *	0	0	0	0	0	1	19	0	0	0	0	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Daviesia podophylla *	0	1	0	0	0	0	16	0	0	0	0	0	0	0	1	0	0	0	0	0	3	0	0	0	0	0	0	0	1	0	1	0	1	0	0	3	0	0	0	0
Alexgeorgia nitens ***	0	6	5	1	1	5	14	4	10	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	4	0	0	1	0	0	0

APPENDIX G: Indicator Species Values (Monte Carlo Test), Dongara Quadrat Data and Regional Dataset

note: Shading denotes highest indicator values per taxon. Indicator values (%) are shown only for taxa which were significant at P<0.05 (Monte Carlo permutation tests: * = p <0.05; ** = p <0.01; *** = p <0.001)

Species	1a	1b	2a	2b	2c	2d	2e	3a	3b	4a	4b	5a	5b	5c	5d	5e	5f	6a	6b	7	8	9a	9b	11	12	13	14	15	16a	16b	17	18	19a	19b	19c	20	21a	21b	22a	22b
Conostylis crassinervia *	0	0	1	1	0	2	14	0	0	0	0	1	3	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Schoenus curvifolius *	7	12	0	0	2	7	13	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Hibbertia subvaginata *	0	1	0	0	0	0	1	23	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	0	0	0	0	0	0	0	8	0	0	0	0	1	0	0	1	0
Stachystemon axillaris *	0	2	1	0	0	0	0	22	0	0	0	0	0	0	0	0	3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Banksia menziesii ***	0	2	4	0	0	0	4	3	33	0	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	1	0	0
Conostephium preissii **	0	0	0	0	2	0	0	1	25	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0
Leucopogon conostephioides **	0	0	3	2	2	0	4	0	24	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
Calytrix sapphirina *	0	0	1	2	0	0	0	0	20	1	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Banksia attenuata ***	0	5	11	1	2	0	11	6	14	2	13	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	5	0	0	0
Leucopogon sp. Arrowsmith (M. Hislop 2509) *	0	0	0	0	0	0	0	0	13	2	1	0	0	0	0	8	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	0	0	0	9	0	0	0	0	4
Scholtzia laxiflora ***	0	1	5	5	5	1	0	4	7	6	7	5	0	0	1	6	6	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	2	0	0	1	4	0	0
Eremaea beaufortioides ***	2	3	3	1	5	1	2	6	6	5	4	2	4	0	5	2	3	5	0	0	0	0	0	0	0	0	0	0	0	3	4	0	2	0	0	2	2	0	0	0
Conospermum boreale subsp. *?boreale* ***	0	0	0	0	0	0	0	0	6	28	26	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	4	0	0	0
Acanthocarpus sp. Ajana (C.A. Gardner 8596) *	0	0	1	1	0	0	0	0	0	17	1	1	0	0	0	3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	0	0	0
Daviesia divaricata ***	0	6	7	0	6	0	4	0	2	15	14	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0
Persoonia acicularis ***	0	0	4	0	0	0	0	0	2	18	28	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	4	0	0	0
Banksia hookeriana ***	0	6	12	0	0	0	0	1	0	1	23	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Hakea polyanthema ***	0	0	0	4	0	0	0	0	1	17	19	0	0	0	0	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	7	0	0	1	2	0	0
Monotaxis bracteata *	0	0	0	1	0	0	0	0	0	6	18	1	2	0	0	9	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0
Calothamnus blepharospermus *	0	0	1	0	0	0	0	0	0	12	17	0	0	0	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	8	0	0	4	0	0	1
Lepidobolus preissianus ***	0	0	3	1	0	0	0	2	1	5	13	0	9	0	0	3	13	0	0	0	0	0	0	0	0	0	0	0	1	1	0	0	0	0	0	0	8	1	2	0
Phymatocarpus porphyrocephalus *	6	1	1	0	10	2	0	0	0	0	0	13	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Ecdeiocolea monostachya ***	5	1	2	4	4	2	0	0	0	6	6	7	1	5	5	7	3	3	0	0	0	0	0	0	0	0	0	0	2	0	0	0	0	0	0	0	4	2	7	7
Gastrolobium oxylobioides *	0	0	0	0	0	0	0	0	0	0	0	0	40	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Laxmannia grandilfora subsp. *grandiflora* **	0	0	0	0	0	0	0	0	0	0	0	0	40	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Xanthosia tomentosa *	0	0	0	0	0	0	0	0	0	0	0	0	36	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Leucopogon sp. Lesueur (B. Evans 530) **	0	0	0	0	0	1	1	0	0	0	0	1	28	2	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Daviesia angulata *	0	0	0	0	0	0	0	0	0	0	0	0	28	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	3	0	0	0	0	0	0	0	0	0	0	0
Conostylis teretifolia *	0	1	0	0	7	3	0	0	0	0	0	0	14	0	1	0	0	3	12	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Laxmannia sessiliflora *	0	2	2	0	0	1	1	0	0	1	0	0	13	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	4	0	0	0	0	0	0	0	0	0	4
Anigozanthos humilis subsp. *humilis* *	0	0	4	2	0	1	2	1	5	0	0	0	11	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	4
Xanthorrhoea drummondii **	1	0	0	0	5	5	1	0	0	0	1	1	11	0	0	1	0	10	11	0	0	0	0	0	0	0	0	0	1	11	0	0	0	0	0	3	0	2	3	1
Schoenus clandestinus ***	0	0	3	3	5	6	4	0	0	6	7	3	8	0	2	8	2	7	4	0	0	0	0	0	0	0	0	0	2	0	0	0	0	0	0	0	1	1	1	0
Hibbertia hypericoides ***	4	3	4	4	4	4	5	3	1	4	2	3	5	3	4	5	1	5	5	0	0	0	0	0	0	0	0	0	1	3	1	0	0	0	0	0	2	2	3	5
Tetratheca confertifolia **	0	0	0	0	0	0	0	0	0	0	0	0	0	42	0	0	0	0	11	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Banksia armata *	0	0	0	0	0	0	0	0	0	0	0	2	0	34	0	0	0	0	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Calytrix ?angulata *	0	0	0	0	0	0	0	0	0	0	0	0	0	33	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Xanthorrhoea preissii **	1	5	0	0	0	0	0	0	0	0	0	6	0	29	16	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0
Conostylis androstemma **	0	0	0	0	0	0	0	0	0	0	0	0	0	28	1	4	0	17	8	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0
Petrophile shuttleworthiana **	0	0	0	0	0	0	0	0	0	0	0	0	0	28	0	0	0	14	24	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0
Mesomeleana stygia subsp. *deflexa* *	0	0	0	0	0	0	0	0	0	0	0	5	12	24	0	1	0	3	0	0	0	0	0	0	0	0	0	0	2	0	0	0	0	0	0	0	0	0	0	0
Verticordia pennigera *	0	0	0	1	0	0	0	0	0	0	0	9	1	24	0	6	0	1	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0
Goodenia ?glareicola *	18	3	0	0	0	0	0	0	0	0	0	0	0	23	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Banksia carlinoides **	1	0	0	0	0	0	0	0	0	0	0	1	8	22	1	6	0	9	7	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0
Isopogon inconspicuus *	0	0	0	0	0	0	0	0	0	0	0	1	0	20	0	0	0	5	9	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Hypocalymma xanthopetalum *	20	4	0	0	0	3	0	0	0	0	0	1	0	20	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Calothamnus torulosus **	2	0	0	0	4	1	0	0	0	0	0	5	7	18	0	0	1	17	18	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Georgeantha hexandra ***	0	0	2	0	1	1	0	0	0	0	0	5	9	14	0	2	0	14	8	0	0	0	0	0	0	0	1	0	5	2	0	0	0	0	0	0	0	0	0	0
Hakea incrassata *	2	0	0	0	3	1	0	0	0	0	0	11	5	14	0	4	0	10	14	0	0	0	0	0	0	0	0	0	3	2	0	0	0	0	0	0	0	0	0	0
Allocasuarina microstachya **	8	0	0	1	1	2	0	0	0	0	0	10	5	13	1	9	1	10	10	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Melaleuca trichophylla **	5	0	0	0	4	3	1	0	0	0	0	6	7	11	2	5	0	11	11	0	0	0	0	0	0	0	0	0	3	0	0	0	0	0	0	0	0	0	0	0

APPENDIX G: Indicator Species Values (Monte Carlo Test), Dongara Quadrat Data and Regional Dataset

note: Shading denotes highest indicator values per taxon. Indicator values (%) are shown only for taxa which were significant at P<0.05 (Monte Carlo permutation tests: * = p <0.05; ** = p <0.01; *** = p <0.001)

Species	1a	1b	2a	2b	2c	2d	2e	3a	3b	4a	4b	5a	5b	5c	5d	5e	5f	6a	6b	7	8	9a	9b	11	12	13	14	15	16a	16b	17	18	19a	19b	19c	20	21a	21b	22a	22b
Acacia barbinervis *	3	4	0	0	1	5	0	0	0	0	0	0	1	3	12	0	0	3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Calothamnus longissimus ***	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	62	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Boronia cymosa **	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	57	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Melaleuca aspalathoides **	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	50	0	1	0	0	0	0	0	0	0	0	0	0	2	0	0	0	0	0	0	0	0	0	0	0
Baeckea camphorosmae **	0	0	0	0	0	0	0	0	0	1	0	1	0	0	1	33	0	0	0	0	0	0	0	0	0	0	0	0	3	19	0	0	0	0	0	0	0	0	0	0
Opercularia vaginata ***	0	0	1	2	0	0	0	0	1	0	0	0	3	0	0	22	0	0	0	0	0	0	0	14	0	0	0	0	0	2	1	1	0	0	0	0	0	0	0	2
Hakea spathulata *	0	0	0	0	0	0	0	0	0	0	0	2	1	13	0	16	1	0	0	0	0	0	0	0	0	0	0	8	0	13	0	0	0	0	0	0	0	0	0	0
Verticordia blepharophylla ***	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	45	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0
Schoenus andrewsii ***	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	40	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Acacia latipes **	0	0	0	0	0	0	0	0	0	0	0	1	0	8	0	0	31	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Anarthria polyphylla **	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	23	26	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Calytrix chrysantha *	0	0	1	0	0	0	0	2	0	0	0	1	0	0	0	1	17	0	0	0	0	0	0	0	0	0	0	0	1	0	3	0	0	0	0	0	0	0	0	0
Stylidium repens *	3	1	3	4	1	4	1	1	6	3	3	0	2	0	1	6	9	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	3
Tetraria octandra ***	0	0	0	0	1	1	0	0	0	0	0	1	0	0	1	0	0	37	32	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Beaufortia bracteosa **	0	0	0	0	0	0	0	0	0	0	0	1	0	2	0	0	0	29	9	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Banksia glaucifolia **	0	0	0	0	0	1	1	0	0	0	0	0	2	0	0	0	0	27	26	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0
Daviesia epiphyllum **	0	0	0	0	0	0	0	0	0	0	0	0	3	2	0	0	0	26	14	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Astroloma sp. Cataby (E.A. Griffin 1022) *	0	0	0	0	0	0	0	0	0	0	0	0	6	0	0	0	0	23	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Hibbertia spicata ***	0	1	0	0	0	0	0	0	0	7	0	0	0	5	0	8	0	22	17	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0
Cristonia biloba *	0	0	0	0	0	0	0	0	0	0	0	2	10	12	0	6	0	18	12	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Gastrolobium plicatum **	2	0	0	0	1	0	0	0	0	0	0	5	1	14	1	3	0	18	12	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Labichea punctata ***	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	73	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Acacia stenoptera ***	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	66	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Microcorys sp. Coomallo (L. Haegi 2677) ***	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	6	56	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Banksia micrantha ***	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	54	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Acacia moirii subsp. *recurvistipula* **	0	0	0	0	0	0	0	0	0	0	0	2	0	0	0	0	0	1	48	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Schoenus subflavus subsp. *subflavus* **	0	0	0	0	0	0	0	0	0	0	0	0	0	3	0	0	0	0	42	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0
Lepidobolus quadratus ms **	0	0	0	0	0	0	0	0	0	0	0	0	4	0	0	0	0	4	41	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Lomandra sericea **	0	0	0	0	1	3	1	0	0	0	0	1	0	0	1	0	0	2	36	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Darwinia sanguinea ***	0	0	0	0	2	5	7	0	0	0	0	0	0	0	0	0	0	7	35	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Gompholobium confertum **	0	0	0	0	0	1	0	0	0	0	0	2	0	0	0	0	0	0	34	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Gastrolobium polystachyum *	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	33	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Hakea conchifolia ***	0	0	0	0	3	6	0	0	0	0	0	0	1	1	0	0	0	16	29	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Astroloma glaucescens **	0	0	0	0	0	0	1	0	0	0	0	1	1	0	1	6	1	11	28	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Banksia bipinnatifida **	11	0	0	0	0	3	0	0	0	0	0	5	0	1	1	0	0	4	27	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Pimelea sulphurea ***	2	0	0	0	6	5	5	0	0	0	0	0	0	0	0	1	0	5	25	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Grevillea synapheae *	0	0	0	0	0	2	0	0	0	0	0	0	0	0	0	0	0	7	22	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Hakea auriculata *	3	0	0	0	1	0	0	0	0	0	0	4	0	19	0	0	0	13	21	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Hypocalymma gardneri ***	0	0	1	0	8	1	3	0	0	1	0	0	9	0	0	1	0	4	20	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Lambertia multiflora var. *multiflora* ***	6	1	0	0	9	11	7	0	0	0	0	0	0	2	1	0	0	10	18	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Astroloma stomarrhena *	0	1	0	0	0	7	9	0	0	0	0	0	0	0	0	0	0	0	16	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Persoonia filiformis *	0	0	0	0	3	3	0	0	0	1	0	1	2	0	1	1	0	5	14	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Caustis dioica ***	7	1	0	3	3	5	0	0	0	0	0	7	3	9	7	7	4	7	9	0	1	0	0	0	0	0	0	0	0	4	0	0	0	0	0	0	0	0	0	0
Hibbertia crassifolia ***	7	4	2	1	8	6	6	0	0	0	0	1	9	4	2	0	7	8	9	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Melaleuca rhaphiophylla **	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	45	0	0	0	0	0	0	0	0	0	9	1	0	0	0	0	0	0	0	0	0
Melaleuca viminea subsp. *viminea* **	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	1	36	1	0	0	0	4	0	0	0	0	0	1	1	0	9	0	0	0	0	0
Eucalyptus loxophleba subsp. *lissophloia* *	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	25	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Comesperma integerrimum **	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	47	2	0	0	0	0	0	1	0	0	10	0	0	0	0	0	0	0	0
Thomasia rulingioides **	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	43	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Melaleuca huegelii subsp. *huegelii* **	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	24	4	21	0	0	0	0	0	0	0	12	0	0	0	8	0	0	0	0
Dianella revoluta var. *divaricata* *	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	17	1	0	0	0	0	0	2	0	0	0	0	8	0	0	8	1	2	0

APPENDIX G: Indicator Species Values (Monte Carlo Test), Dongara Quadrat Data and Regional Dataset

note: Shading denotes highest indicator values per taxon. Indicator values (%) are shown only for taxa which were significant at P<0.05 (Monte Carlo permutation tests: * = p <0.05; ** = p <0.01; *** = p <0.001)

Species	1a	1b	2a	2b	2c	2d	2e	3a	3b	4a	4b	5a	5b	5c	5d	5e	5f	6a	6b	7	8	9a	9b	11	12	13	14	15	16a	16b	17	18	19a	19b	19c	20	21a	21b	22a	22b
Acacia rostellifera **	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	16	48	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	0
Eucalyptus camaldulensis **	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	21	3	0	51	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Chamelaucium uncinatum *	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	33	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Allocasuarina lehmanniana subsp. *lehmanniana* ***	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	80	0	0	0	0	0	0	0	0	0	0	0	5	0	0	0	0
Austrostipa flavescens **	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	36	0	0	0	0	0	0	0	0	0	0	0	0	0	6	14	0
Thysanotus patersonii ***	0	0	0	0	0	1	1	0	0	0	0	0	0	0	0	3	0	0	0	0	0	7	0	36	0	0	0	0	1	0	0	0	0	0	0	1	0	0	0	0
Samolus repens var. ?*floribundus* *	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	0	0	0	33	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Acacia lasiocarpa **	0	0	0	0	0	0	0	5	0	0	0	0	5	0	4	0	0	0	0	0	0	2	0	29	0	0	0	0	4	3	1	0	0	0	0	0	0	0	0	0
Melaleuca systena **	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	15	0	29	0	0	0	0	0	0	0	0	0	0	0	7	0	0	16	7
Melaleuca preissiana ***	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	95	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Tecticornia pergranulata subsp. *pergranulata* *	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	33	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Wilsonia rotundifolia *	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	33	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Thryptomene mucronulata **	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	9	0	0	0	0	0	0	0	0	37	3	0	0	0	0	0	0	0	0	0	0	0	0	0
Chaetanthus aristatus *	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	33	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Banksia nivea subsp. *nivea* *	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	33	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Calothamnus hirsutus **	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	30	0	0	0	0	2	0	30	0	0	8	0	0	0	0
Melaleuca ciliosa **	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	14	0	6	0	0	0	0	0	0	25	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Melaleuca lateriflora subsp. *acutifolia* ***	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	8	48	0	0	0	0	3	0	0	0	0	0	0	0	0
Conostylis prolifera **	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	7	39	0	0	0	0	0	0	0	15	0	0	0	0	0
Grevillea pinaster **	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	11	36	0	0	0	0	0	0	0	0	0	0	0	0	0
Dodonaea divaricata *	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	33	0	0	0	0	0	0	0	23	0	0	0	0	0
Verticordia chrysanthella *	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	29	20	1	0	0	0	0	0	0	0	0	0	0	0
Gastrolobium axillare ***	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	100	0	0	0	0	0	0	0	0	0	0	0	0
Melaleuca ?*tinkeri* ms ***	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	95	0	0	0	0	0	0	0	0	0	0	0	0
Leucopogon insularis ***	1	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	78	0	0	0	0	0	0	0	0	0	0	0	0
Melaleuca coronicarpa ***	0	0	0	0	0	0	0	0	0	0	0	0	0	2	0	0	0	0	0	0	0	2	0	0	0	0	0	76	0	0	0	0	0	0	0	0	0	0	0	0
Baeckea crispiflora ***	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	70	10	0	0	0	0	0	0	0	0	0	0	0
Petrophile chrysantha ***	0	0	0	0	0	0	0	0	0	0	0	0	0	8	0	0	0	0	0	0	0	0	0	0	0	0	0	69	1	0	0	0	0	0	0	0	0	0	0	0
Eucalyptus arachnaea *	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	50	0	0	0	0	0	0	0	0	0	0	0	0
Jacksonia ?*alata* *	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	50	0	0	0	0	0	0	0	0	0	0	0	0
Marianthus bicolor *	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	50	0	0	0	0	0	0	0	0	0	0	0	0
Stylidium eriopodum *	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	50	0	0	0	0	0	0	0	0	0	0	0	0
Verticordia huegelii var. *huegelii* *	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	50	0	0	0	0	0	0	0	0	0	0	0	0
Cryptandra arbutiflora *	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	6	36	0	0	0	0	0	0	0	0	0	0	0	0
Calytrix flavescens **	0	0	0	0	0	0	0	0	0	0	0	2	1	1	0	0	0	0	0	0	0	0	0	0	0	3	0	31	0	0	0	0	0	0	8	0	0	0	0	0
Melaleuca radula *	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	29	16	0	0	0	0	0	0	0	0	0	0	0
Hakea lissocarpha *	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	1	5	0	0	0	0	0	0	0	0	0	0	19	3	19	0	0	0	0	0	0	0	6	7	5
Eucalyptus accedens ***	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	50	0	0	0	0	0	0	0	0	0	0	0
Hakea gilbertii ***	0	0	0	0	0	0	0	0	0	0	0	0	3	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	42	0	0	0	0	0	0	0	0	0	0	0
Acacia alata *	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	25	0	0	0	0	0	0	0	0	0	0	0
Guichenotia micrantha *	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	25	0	0	0	0	0	0	0	0	0	0	0
Lepidosperma pubisquameum *	0	0	0	0	0	6	0	0	0	0	0	0	0	0	9	0	0	1	0	0	0	1	0	0	0	0	0	0	16	0	0	0	0	0	0	0	0	0	0	0
Ptilotus manglesii ***	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	3	0	0	65	0	0	0	0	0	0	0	7	0	0
Acacia multispicata *	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	33	0	0	0	0	0	0	0	0	0	0
Burchardia multiflora *	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	33	0	0	0	0	0	0	0	0	0	0
Drosera gigantea *	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	33	0	0	0	0	0	0	0	0	0	0
Elythranthera emarginata *	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	33	0	0	0	0	0	0	0	0	0	0
Gompholobium aristatum *	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	33	0	0	0	0	0	0	0	0	0	0
Hemigenia diplanthera *	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	33	0	0	0	0	0	0	0	0	0	0
Scaevola lanceolata *	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	0	0	0	0	0	0	0	0	0	26	0	0	0	0	0	0	0	0	0	0
Conostylis aculeata **	10	8	0	0	0	0	0	2	0	0	0	0	0	0	0	0	2	0	0	3	0	0	0	0	0	2	0	0	3	22	6	0	0	0	0	0	0	0	0	0

APPENDIX G: Indicator Species Values (Monte Carlo Test), Dongara Quadrat Data and Regional Dataset

note: Shading denotes highest indicator values per taxon. Indicator values (%) are shown only for taxa which were significant at P<0.05 (Monte Carlo permutation tests: * = p <0.05; ** = p <0.01; *** = p <0.001)

Species	1a	1b	2a	2b	2c	2d	2e	3a	3b	4a	4b	5a	5b	5c	5d	5e	5f	6a	6b	7	8	9a	9b	11	12	13	14	15	16a	16b	17	18	19a	19b	19c	20	21a	21b	22a	22b
Lepidosperma sp. P1 small head (M.D. Tindale 166A) *	0	0	0	0	0	0	3	0	0	0	0	1	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	17	0	2	10	0	0	2	0	0	0	0
Stylidium burbidgeanum **	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	4	7	1	0	30	0	0	0	0	0	0	0
Drosera erythrorhiza *	0	0	0	3	0	1	0	0	0	0	0	0	0	0	0	2	0	1	1	0	0	0	0	0	0	0	0	0	1	0	1	0	13	0	0	1	0	0	0	0
Acacia scirpifolia ***	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	1	52	0	0	9	0	0	0
Guichenotia ?*macrantha* *	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	43	0	0	1	0	0	0
Scholtzia sp. Eneabba (S. Maley 8) *	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	5	0	2	0	0	0	0	28	0	0	0	0	0	0
Acacia saligna *	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	0	2	5	1	0	0	0	0	0	0	0	7	9	20	5	0	0	14	0	0
Eucalyptus todtiana ***	4	2	6	2	0	1	5	5	1	2	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	3	1	0	14	0	2	1	1	0	0
Cassytha pomiformis ***	0	0	1	2	0	0	0	0	0	0	0	1	0	0	1	0	0	0	0	3	0	0	0	0	0	0	0	0	0	0	1	0	0	0	45	0	0	0	0	0
Banksia strictifolia *	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	0	0	0	41	0	0	0	0	0
Grevillea exposita *	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	43	0	0	1	0	0
Labichea lanceolata *	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	4	0	0	0	0	0	0	0	0	0	0	0	38	0	0	0	0	0
Allocasuarina campestris **	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	8	0	0	0	0	8	10	6	24	1	1	0	0	0
Neurachne alopecuroidea ***	0	0	1	3	0	1	0	0	0	7	7	0	1	0	2	4	0	2	2	0	0	0	0	0	0	0	3	0	2	4	0	0	4	0	8	0	2	3	1	6
Actinostrobus pyramidalis **	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	21	0	0	0	0	1	0	1	0	0	47	0	0	0	0
Kunzea micrantha subsp. *petiolata* **	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	2	15	0	0	35	0	0	0	0
Hakea trifurcata *	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	3	3	5	8	0	0	23	0	1	2	3
Banksia prionotes **	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	29	0	0	23
Eucalyptus erythrocorys ***	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	100	0
Acacia spathulifolia **	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	38	30
Conostylis candicans subsp. *calcicola* **	0	0	0	0	0	0	0	0	7	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	19	33	0
Scholtzia umbellifera **	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	31	3
Acanthocarpus preissii **	0	0	0	0	1	0	0	0	1	1	14	2	0	0	0	0	0	8	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	21	1
Desmocladus asper *	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	7	0	0	0	0	1	0	1	2	0	0	0	5	0	0	1	11	20	9
Lechenaultia linarioides ***	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	8	0	0	68
Acacia cavealis ***	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	67
Scaevola sericophylla **	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	10	0	0	0	2	0	0	38
Lepidobolus chaetocephalus ***	0	2	1	0	4	1	0	0	0	0	0	1	0	4	1	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	37
Jacksonia nutans **	0	0	0	0	0	0	0	1	0	2	0	0	0	0	0	3	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	3	33
Conospermum stoechadis subsp. *stoechadis* *	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	33
Banksia sessilis var. *flabellifolia* *	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	6	24
Banksia lanata *	0	0	0	0	0	1	2	0	0	0	0	0	0	0	0	0	0	1	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	13	1	1	1	23
Stenanthemum notiale *	0	0	0	2	0	0	0	0	4	5	10	0	0	0	0	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	1	1	12	15

APPENDIX H: Declared Rare and Priority Flora Species Recorded in the Dongara Region (DEC 2007a)

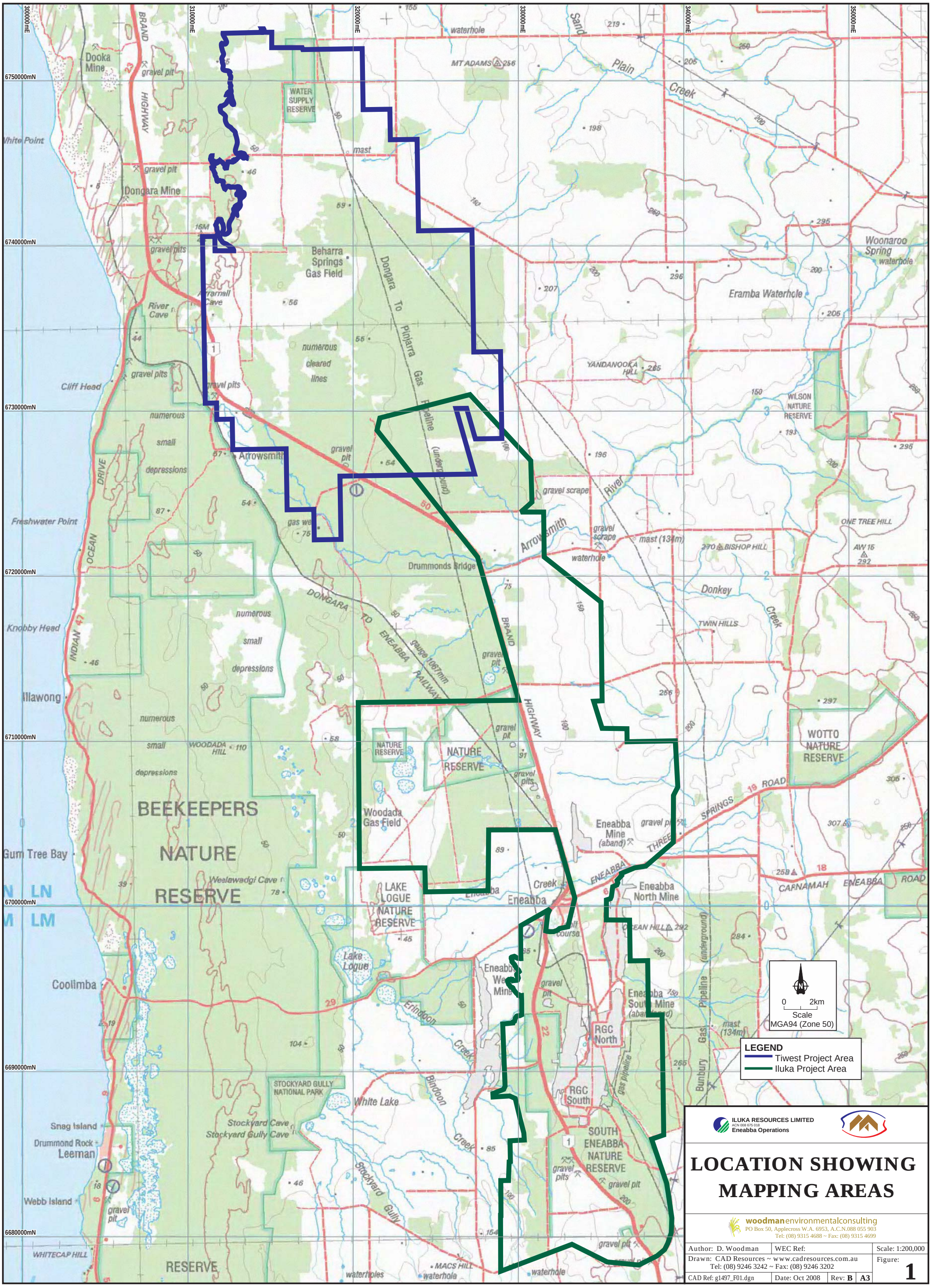
Species	Conservation Code	Locations
Acacia congesta subsp. *cliftoniana*	1	Arrino, Yandanooka, Moora
Acacia latipes subsp. *licina*	3	21km South of Eneabba turnoff
Acacia vittata	2	Lake Logue, Arrowsmith, Mount Kokeby
Anthocercus intricata	3	Dongara, Denham, Port Gregory, Kalbarri
Baeckea sp. Walkaway (A.S George I1249)	3	Mondarra, Yardanogo Nature Reserve
Banksia cypholoba	3	45 km W of Three Springs
Banksia elegans	4	Diamond of Desert Spring, Lake Indoon, Lake Aerosmith
Banksia scabrella	4	Mt Adams Rd, Robb Road, West of Arrino
Caladenia wanosa	R	East Yuna Nature Reserve
Calectasia cyanea	R	Mt Adams Rd
Calytrix chrysantha	4	Billeranga Hills, Eneabba
Calytrix drummondii	3	Alexander Morrison N.P., Tathra N.P., Yandanooka, Northampton, Kalbarri
Calytrix ecalycata	3	Water Supply Rd
Calytrix eneabbensis	3	Eneabba, Lake Indoon, Arrowsmith
Calytrix superba	3	Eneabba
Dampiera tephrea	2	South of Dongara
Diuris sp. Arrowsmith (K Dixon 924)	1	Arrowsmith
Eremaea acutifolia	2	Yardanogo Nature Reserve
Eryngium pinnatifidum subsp. *palustre* ms	3	Serpentine, Kenwick, Upper Swan, Gingin, Forrestdale, Bullsbrook, Mandurah, Arrowsmith, Capel
Eucalyptus abdita	2	Mt Misery, Yandanooka
Eucalyptus diminuta	4	Yandanooka, Moresby Range, Mindaloo, Beacon, Watheroo, Binnu, Three Springs, Eurardy Stn
Eucalyptus leprophloia	R	6km SE of Mt Adams Rd
Eucalyptus macrocarpa subsp. *elachantha*	4	Mt Horner, Mt Adams, Eneabba, Badgingarra, Yandan Hill
Eucalyptus macrocarpa x *pyriformis*	3	Sth of Mt Adams Rd
Eucalyptus zopherophloia	4	Dongara, Cliff Head, Illawong, Jurien Bay, Peron Peninsula, Zuytdorp, Eurardy
Gastrolobium callistachyus	4	43km SW of Mingenew
Geogeantha hexandra	4	S of Arrowsmith River
Grevillea erinacea	3	W of Three Springs
Grevillea leptopoda	3	Coorow, Three Springs, Horrocks, Strawberry, Yandanooka, Gutha
Grevillea makinsonii	3	Arrino, Eneabba, Three Springs, Mt Adams, Yandanooka
Guichenotia alba	3	Mt Adams Rd, Mt Adams, Hill River, Three Springs
Guichenotia quasicalva ms	2	Three Springs, Hutt River, Arrowsmith

APPENDIX H: Declared Rare and Priority Flora Species Recorded in the Dongara Region (DEC 2007a)

Species	Conservation Code	Locations
Haloragis foliosa	3	Winchester, Arrowsmith, Leeman, Beekeepers Reserve, Cliff Head, Dongara
Hemiandra sp. Eneabba (H Demarz 3687)	3	Eneabba, Mt Adams
Hemigenia saligna	3	Yardanogo Natrue Reserve
Hensmania stoniella	3	Eneabba, Watheroo, Cervantes, Nambung, Lesueur, Badgingarra, Mt Adams
Homalocalyx chapmanii	1	Arrowsmith River, Geraldton, One Tree Hill, Three Springs
Hopkinsia anoectocolea	3	Arrowsmith, Eneabba, Meckering, Cunderdin (Mortlock River), Tammin
Hypocalymma gardneri	3	Yardanogo Nature Reserve
Hypocalymma longifolium	R	South of Kalbarri (Murchison River, Arrowsmith River)
Hypocalymma tetrapterum	3	N of Arrowsmith River
Lasiopetalum ogilvieanum	1	Near Mt Adams Rd
Melaleuca barlowii	1	Latham, Koolanooka Hills, Yandanooka, Morawa
Mesomelaena stygia subsp. *deflexa*	3	Eneabba, Yandanooka Hill, Arrino
Micromyrtus rogeri	1	Koojan, Yandanooka, Mt Adams
Paracaleana dixonii ms	R	Eneabba, Coomallo Creek, Sullivan Rock, Arrowsmith, Yandanooka, Moore River NP
Persoonia filiformis	2	Near Mt Adams Rd, Skipper Rd, Eneabba
Persoonia rudis	3	Cockleshell Gully, Eneabba, Three Springs
Pityrodia viscida	3	Yandanooka, Mingenew, Kalbarri NP, Three Springs
Schoenus badius	2	Mt Adams, Moresby Range
Schoenus sp. Eneabba (F. Obbens & C. Godden I154)	2	Yardanogo Nature Reserve, Eneabba
Scholtzia sp. Yandanooka (R. Soullier 646)	1	Yandanooka, Woondod, Arrino
Stawellia dimorphantha	4	Arrowsmith River, Mt Adams Rd, Yardanogo NR
Stylidium drummondianum	3	Three Springs, Mt Adams, Arrino, Northampton, Eneabba
Stylidium pseudocaespitosum	2	Eneabba Rd
Stylidium torticarpum	3	Lesueur, Herschell Range, Arrowsmith River
Synaphea aephynsa	3	near Mt Adams Rd
Synaphea oulopha	1	Eneabba, Arrowsmith, Arrino
Synaphea sparsiflora	2	Three Springs Rd, Arrino
Thelymitra stellata	R	Perth, Jurien Bay Rd turnoff, Eneabba
Thryptomene sp. Mingenew (Diels & Pritzel 332)	3	Yardanooka West Rd
Thysanotus glaucus	4	Yardanogo Nature Reserve
Tricoryne sp. Eneabba (EA Griffin 1200)	2	Jurien, Cataby, Gingin, Eneabba, Mt Adams
Triglochin protuberans	3	Stirling Range NP, Malcolm, Yalgoo, Burnerbinmah Stn, Arrowsmith

APPENDIX H: Declared Rare and Priority Flora Species Recorded in the Dongara Region (DEC 2007a)

Species	Conservation Code	Locations
Verticordia dasystylis subsp. *oestopoia*	1	Arrowsmith
Verticordia luteola var. *luteola*	3	Mt Adams, Three Springs, Arrowsmith, Casuarinas
Verticordia luteola var. *rosea*	1	Eneabba, Arrowsmith
Verticordia penicillaris	4	Bindoo Hill, Moresby Range, Arrowsmith River, Eneabba, Kukerin

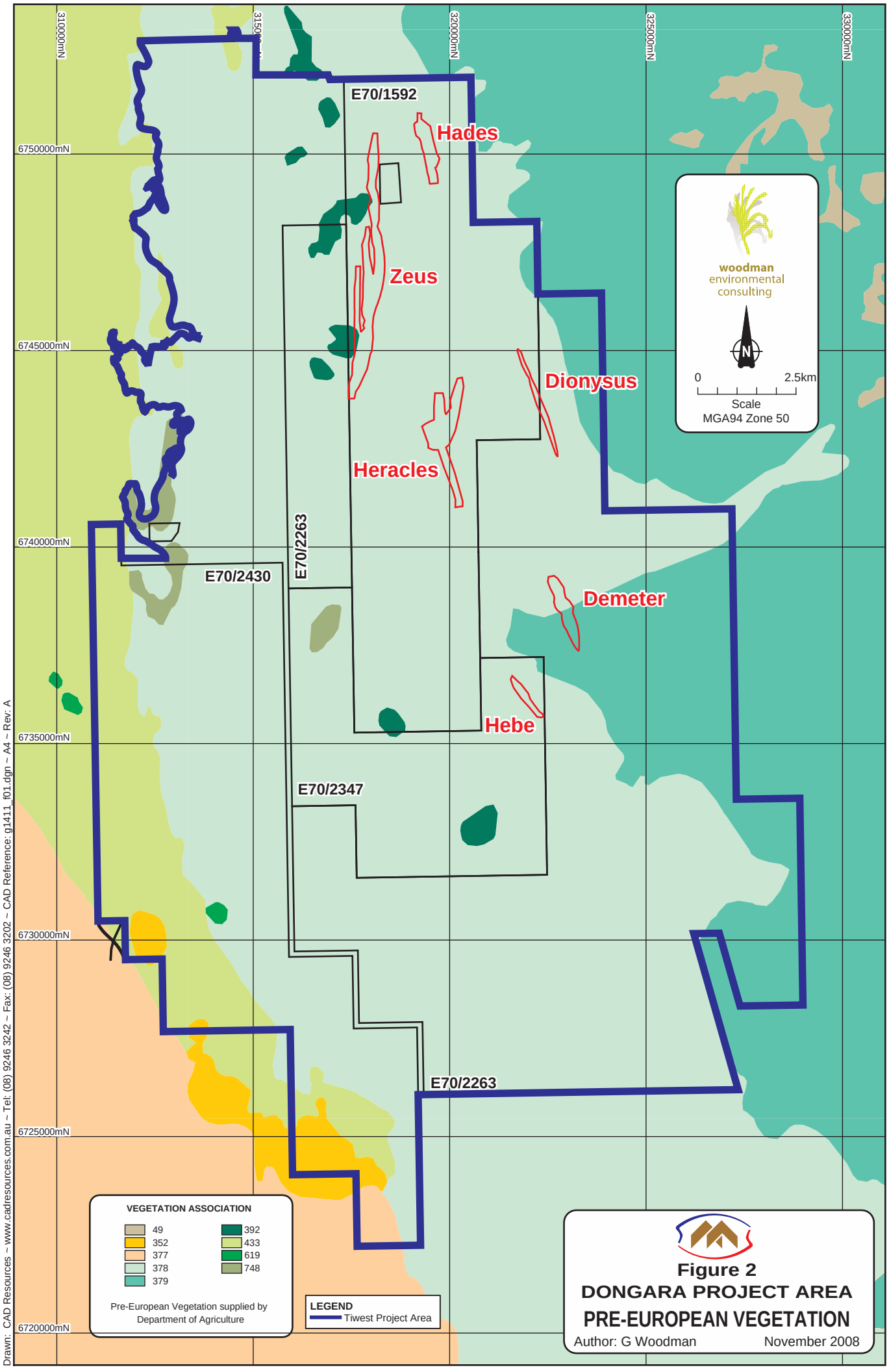


ILUKA RESOURCES LIMITED
ACN 008 675 018
Eneabba Operations

LOCATION SHOWING MAPPING AREAS

woodmanenvironmentalconsulting
PO Box 50, Applecross W.A. 6953, A.C.N.088 055 903
Tel: (08) 9315 4688 ~ Fax: (08) 9315 4699

Author: D. Woodman	WEC Ref:		Scale: 1:200,000
Drawn: CAD Resources ~ www.cadresources.com.au Tel: (08) 9246 3242 ~ Fax: (08) 9246 3202			Figure: 1
CAD Ref: g1497_F01.dgn	Date: Oct 2008	Rev: B A3	


310000mN
315000mN
320000mN
325000mN
330000mN
6750000mN
6745000mN
6740000mN
6735000mN
6730000mN
6725000mN
6720000mN
E70/1592
Hades
Zeus
Dionysus
Heracles
E70/2263
E70/2430
Demeter
Hebe
E70/2347
E70/2263
woodman
environmental
consulting
N
0
2.5km
Scale
MGA94 Zone 50
VEGETATION ASSOCIATION
49
352
377
378
379
392
433
619
748
Pre-European Vegetation supplied by
Department of Agriculture
LEGEND
Tiwest Project Area
Figure 2
DONGARA PROJECT AREA
PRE-EUROPEAN VEGETATION
Author: G Woodman
November 2008
Drawn: CAD Resources ~ www.cadresources.com.au ~ Tel: (08) 9246 3242 ~ Fax: (08) 9246 3202 ~ CAD Reference: g1411_f01.dgn ~ A4 ~ Rev: A

FCT ANALYSIS LEGEND

FCT1a: Woodland to Scrub of *Eucalyptus pleurocarpa* and/or *Eucalyptus todtiana* over mixed shrubs dominated by *Dryandra* spp. over sedges on grey sand on lower to mid slopes

FCT1b: Woodland to Scrub of *Xylomelum angustifolium*, *Eucalyptus* spp. and/or *Banksia* spp. over mixed shrubs dominated by *Eremaea* spp., *Dryandra* spp., and *Jacksonia* spp. on grey sand on upper slopes and dune crests

FCT2a: Predominantly Low Open Woodland of *Eucalyptus todtiana* and *Banksia menziesii* with occasional *Xylomelum angustifolium*, over Low Scrub of mixed species including *Banksia leptophylla* var. *leptophylla*, *Melaleuca leuropoma* and *Hibbertia hypericoides* on brown or grey over brown sand

FCT2b: Heath to Thicket of mixed shrubs commonly including *Melaleuca leuropoma*, *Hibbertia hypericoides*, *Banksia shuttleworthiana* and *Allocasuarina humilis* over *Ecdeiocolea monostachya* on yellow or brown sand and sandy clay

FCT2c: Open Woodland to Scrub of *Eucalyptus pleurocarpa* and *Eucalyptus todtiana* over mixed shrubs dominated by *Banksia* spp. on yellow and grey sandy loam on lower to mid slopes

FCT2d: Low Scrub of mixed species, with common species including *Schoenus pedicellatus*, *Stylidium repens*, *Hakea eneabba* and *Banksia stenoprion* with very occasional Open Woodland of *Eucalyptus todtiana* on grey-brown to brown sands with very occasional laterite influence

FCT2e: Low Woodland to Scrub of *Banksia attenuata* over Low Scrub of *Banksia* spp. on brown or yellow sands on mid and upper slopes

FCT3a: Open Low Woodland to Heath of *Banksia* spp. over mixed shrubs commonly including *Melaleuca leuropoma*, *Eremaea beaufortioides* and *Scholtzia laxiflora* on yellow sand on lower to mid slopes

FCT3b: Low Woodland to Thicket of *Banksia attenuata* and *Banksia menziesii* over mixed shrubs dominated by myrtaceous species on brown or yellow sand on lower to mid slopes and plains

FCT4a: Species rich Woodlands and Heaths on grey sand in the eastern portion of the Eneabba sandplain. Common species include *Conospermum boreale* subsp. *?boreale*, *Ecdeiocolea monostachya, Eremaea beaufortioides*, *Hakea polyanthema* and *Banksia candolleana*

FCT4b: Thicket dominated by *Banksia hookeriana* and/or *Banksia attenuata*, with emergent *Banksia prionotes* on yellow sand on upper slopes and dune crests

FCT5aM: Woodland of *Corymbia calophylla* on grey sand with some lateritic gravel on lower slopes

FCT5a: Low Scrub of mixed species including *Beaufortia elegans* and *Goodenia coerulea* with occasional Low Woodland of *Eucalyptus pleurocarpa* on soil types ranging from white-grey sand, brown sandy clay and brown clays

FCT5a(d): Disturbed area of 5a

FCT5b: Open Low Woodland of *Eucalyptus pleurocarpa* over Low Heath dominated by *Banksia* spp., *Xanthorrhoea drummondii* and *Hakea* spp. over sedges on grey sand with lateritic gravel

FCT5c: Low Scrub of mixed species including *Mesomelaena stygia* subsp. *deflexa*, *Georgeantha hexandra*, *Hakea spathulata* and *Cassytha glabella* on white-grey sand over lateritic gravels

FCT5d: Low Woodland of *Eucalyptus pleurocarpa* over Heath of mixed shrubs. Common species include *Acacia barbinervis* subsp. *borealis*, *Allocasuarina humilis*, *Hibbertia hypericoides* and *Xanthorrhoea preissii* on sandy clay or sandy gravel on lower slopes

FCT5e: Heath to Low Heath dominated by *Banksia* spp. and *Melaleuca* spp. over *Ecdeiocolea monostachya* on grey or brown sandy clay or gravel on lower slopes and plains

FCT5f: Shrublands and Heaths, with occasional Woodland of *Eucalyptus pleurocarpa*, dominated by *Melaleuca* spp. and sedges on flats and depressions on grey-brown sands and sandy clay

FCT6a: Predominantly Low Woodland of *Eucalyptus pleurocarpa* over Low Scrub of mixed species including *Tetraria octandra*, *Cristonia biloba*, *Hibbertia spicata* and *Mesomelaena tetragona* on white-grey, grey and brown sands with lateritic gravel

FCT6b: Species rich Low Heath dominated by *Daviesia* spp., *Banksia* spp., *Lambertia multiflora* var. *multiflora* and *Xanthorrhoea drummondii* on skeletal sands with moderate to heavy laterite outcropping

FCT7: Low Woodland to Low Forest of *Melaleuca rhaphiophylla* and/or *Eucalyptus camaldulensis* var. *obtusa* over a species poor understorey dominated by annuals on grey or brown sandy clay in wet depressions and drainage lines

FCT8: Thicket of *Melaleuca viminea* subsp. *viminea*, with occasional *E. loxophleba* subsp. *lissophloia*, in clay flats

FCT9a: Thicket dominated by *Melaleuca huegelii* subsp. *huegelii* and *Acacia* spp. on brown sandy clay over limestone on lower slopes and depressions

FCT9b.1: Low Woodland of *Eucalyptus camaldulensis* over Scrub to Thicket of *Acacia* spp. on brown sand on lower slopes and drainage lines

FCT9b.2: Open Low Woodland to Low Forest of *Eucalyptus camaldulensis* over Scrub to Thicket dominated by *Melaleuca huegelii* subsp. *huegelii* or *Chamelaucium uncinatum* on grey or brown sand on lower slopes and depressions

FCT10: Low Woodland of *Eucalyptus erythrocorys* over Thicket dominated by *Melaleuca cardiophylla* on brown sand over massive limestone outcropping in a drainage line

FCT11: Heath dominated by *Melaleuca systena* and *Melaleuca huegelii* subsp. *huegelii* on grey or brown sand and sandy clay in depressions

FCT12.1: Low Woodland of *Melaleuca preissiana* over a sparse, often disturbed shrub layer of scattered species including *Tecticornia pergranulata* subsp. *pergranulata* and *Rhagodia preissii* subsp. *obovata* on grey sandy clay in depressions and seasonally inundated basins

FCT12.2: Low Forest of *Melaleuca preissiana* and *Casuarina obesa* over herbs on grey sandy clay in depressions

FCT13: Thickets of *Calothamnus hirsutus*, *Melaleuca* spp. and/or *Actinostrobus ?pyramidalis* on sandy clay in seasonally inundated depressions

FCT14: Thickets of *Calytrix depressa*, *Melaleuca lateriflora* subsp. *acutifolia* and *Melaleuca concreta* over *Borya sphaerocephala* and *Dodonaea* spp. on sandy loams, clay and ferricrete in depressions

FCT ANALYSIS LEGEND

FCT15: Low Heath dominated by *Petrophile chrysantha*, with occasional emergent *Eucalyptus arachnaea*, on shale

FCT16a: Low Woodland of *Eucalyptus accedens* and/or *Eucalyptus* spp. over Shrubland dominated by *Banksia* spp. and *Petrophile* spp. on sandy gravels on flats

FCT16b: Highly disturbed Scrub with *Calothamnus quadrifidus* on grey or brown sand in drainage lines

FCT17: Shrublands and Thickets dominated by *Melaleuca* spp. and *Banksia* spp. on grey or brown sandy clays and sandy loams with some lateritic gravel on flats, depressions and creek-lines

FCT18: Thicket dominated by *Melaleuca concreta* and/or *Allocasuarina campestris* on grey sandy clay in depressions and clay pans

FCT19a: Heath to Thicket dominated by *Allocasuarina campestris* and/or *Banksia leptophylla* var. *leptophylla* on grey or brown sandy clay in drainage lines

FCT19b: Scrub of *Acacia* spp., *Allocasuarina campestris* and *Calothamnus* spp. on grey sand on lower slopes and drainage lines

FCT19c: Thicket to Low Scrub dominated by *Allocasuarina campestris*, *Calothamnus quadrifidus* and *Banksia strictifolia* on ferricrete on mid-slopes

FCT20: Thicket dominated by *Actinostrobus pyramidalis* on grey diatomaceous earth on lower slopes and depressions

FCT21a: Low Woodland of *Banksia prionotes* and/or *Casuarina obesa* over Low Scrub of *Banksia* spp. and *Calothamnus* spp. on yellow or brown sand

FCT21b: Thicket to Open Scrub dominated by *Acacia* spp. on lower slopes and *Banksia* spp. on mid slopes over *Hakea* spp. and *Ecdeiocolea monostachya* on brown sand and sandy clay

FCT22a: Low Woodland of *Eucalyptus erythrocorys* on brown or yellow sand over limestone on mid to upper slopes

FCT22a(d): Disturbed FCT 22a

FCT22b: Heath of *Banksia lanata* and *Acacia spathulifolia*, with occasional emergent *Banksia prionotes* and *Eucalyptus todtiana*, on yellow sand over limestone on mid to upper slopes

FCT3b/19a: Mosaic of FCTs 3b and 19a

D: Areas of native vegetation too disturbed to be assigned an FCT

CL: Cleared areas

NV: Areas of native vegetation that could not be surveyed as access was denied by landowner

Tiwest Recording Site Location

Tiwest FCT Site Location

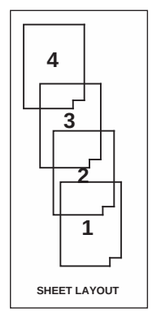
Iluka Recording Site Location

Iluka FCT Site Location

CODE	SPECIES NAME	PRIORITY
Acu	*Acacia cummingiana*	P3
Af	*Acacia flabellifolia*	P3
Ag	*Allocasuarina grevilleoides*	P3
Alc	*Acacia lasiocarpa* var. *lasiocarpa* Cockleshell Gully variant (E.A. Griffin 2039)	P2
All	*Acacia latipes* subsp. *licina*	P3
Ar	*Allocasuarina ramosissima*	P3
Aret	*Acacia retrorsa*	P2
Ate	*Acacia telmica*	P3
Av	*Acacia vittata*	P2
Arg	*Arnocrinum gracillimum*	P2
Ac	*Astroloma* sp. *Cataby* (E.A. Griffen 1022)	P4
BaBR	*Baeckea* sp. *Bunney Road* (S. Patrick 4059)	P2
Bsw	*Baeckea* sp. *Walkaway* (A.S. George 11249)	P3
Bc	*Banksia chamaephyton*	P4
Bcy	*Banksia cypholoba*	P3
Be	*Banksia elegans*	P4
Brfc	*Banksia fraseri* var. *crebra*	P3
Bkp	*Banksia kippistiana* var.*paenepeccata*	P3
Bap	*Banksia platycarpa*	P4
Basc	*Banksia scabrella*	P4
Bbi	*Beaufortia bicolor*	P3
Bg	*Beyeria gardneri*	P3
Bs	*Beyeria similis*	P2
Brl	*Boronia ramosa* subsp. *Iesueurana*	P2
Cp	*Calectasia palustris*	P1
Cc	*Calytrix chrysantha*	P4
Cee	*Calytrix ecalycata* subsp. *ecalycata*	P3
Ce	*Calytrix eneabbensis*	P4
Cs	*Calytrix superba*	P3
Caen	*Catacolea enodis*	P2
Chrs	*Chordifex reseminans*	P1
Cg	*Comesperma griffinii*	P2
Cr	*Comesperma rhadinocarpum*	P2
Cosc	*Conospermum scaposum*	P3
Cm	*Conostephium magnum*	P4
Crn	*Cryptandra nudiflora*	P3
Date	*Dampiera tephrea*	P2
Dbb	*Daviesia debilior* subsp. *debilior*	P2
Debi	*Desmocladus biformis*	P3
Del	*Desmocladus elongatus*	P3
Ea	*Eremaea acutifolia*	P2
Ermi	*Eremophila microtheca*	P4
Ec	*Eucalyptus crispata*	R
Ei	*Eucalyptus impensa*	R
Ej	*Eucalyptus johnsoniana*	R
Eulow	*Eucalyptus loxophleba x wandoo*	P4
Eme	*Eucalyptus macrocarpa* subsp.*elachantha*	P4
Emp	*Eucalyptus macrocarpa x pyriformis*	P3
Eupe	*Eucalyptus pendens*	P4
Eurhr	*Eucalyptus rhodantha* var. *rhodantha*	R
Es	*Eucalyptus suberea*	R
Ez	*Eucalyptus zopherophloia*	P4
Gc	*Gastrolobium callistachys*	P4
GeveK	*Geleznowia verrucosa* subsp. *Kalbarri* (L.M. Broadhurst 123)	P3
Gh	*Georgeantha hexandra*	P4
Gt	*Goodenia trichophylla*	P3
Gaal	*Grevillea althoferorum*	R
Gb	*Grevillea biformis* subsp. *cymbiformis*	P3
Gci	*Grevillea curviloba* subsp. *incurva*	R
Ge	*Grevillea erinacea*	P3
Gl	*Grevillea leptopoda*	P3
Gr	*Grevillea rudis*	P4
Gtp	*Grevillea thyrsoides* subsp. *pustulata*	P3
Gu	*Grevillea uniformis*	P3
Ga	*Guichenotia alba*	P3
Gq	*Guichenotia quasicalva*	P2
Hl	*Haemodorum loratum*	P3
Hlo	*Hakea longiflora*	P3
Hp	*Hakea megalosperma*	R
He	*Hemiandra* sp. *Eneabba* (H. Demarz 3687)	P3
Hs	*Hemigenia saligna*	P3
Hst	*Hensmania stoniella*	P3
Haan	*Hopkinsia anoectocolea*	P3
Hyle	*Hydrocotyle lemnoides*	P4
Hg	*Hypocalymma gardneri*	P3
Ht	*Hypocalymma tetrapterum*	P3
Jaan	*Jacksonia anthoclada*	P3
Koar	*Korthalsella arthroclada*	P1
Lali	*Lasiopetalum lineare*	P3
Log	*Lasiopetalum ogilvieanum*	P1
Lede	*Lepidobolus densus*	P3
Lq	*Lepidobolus quadratus*	P3
Lct	*Lepidosperma cf. tenue*	U
Lsy	*Lepidosperma* sp. *"Yuna scabrid"*	U
Lo	*Leucopogon obtectus*	R
LcE	*Leucopogon* sp. *ciliate Eneabba* (F. Obbens & C. Godden s.n. 3/7/2003)	R
Logi	*Loxocarya gigas*	P2
Msd	*Mesomelaena stygia* subsp. *deflexa*	P3
Mu	*Micromyrtus uniovula*	P2
Pd	*Paracaleana dixonii*	R
Pf	*Persoonia filiformis*	P2
Pr	*Persoonia rudis*	P3
Phpip	*Phlebocarya pilosissima* subsp. *pilosissima*	P3
Pv	*Pityrodia viscida*	P3
Sce	*Scaevola eneabba*	P2
Sg	*Schoenus griffinianus*	P3
SeE	*Schoenus* sp. *Eneabba* (F. Obbens & C. Godden I154)	P2
Sd	*Stawellia dimorphantha*	P4
Stli	*Stenanthemum limitatum*	P2
Sta	*Stylidium aeonioides*	P4
Scn	*Stylidium carnosum* subsp. *Narrow leaves* (J.A. Wege 490)	P1
Sdr	*Stylidium drummondianum*	P3
Si	*Stylidium inversiflorum*	P4
Sp	*Stylidium pseudocaespitosum*	P2
St	*Stylidium torticarpum*	P3
Sae	*Synaphea aephynsa*	P3
Sen	*Synaphea endothrix*	P2
So	*Synaphea oulopha*	P1
Ss	*Synaphea sparsiflora*	P2
Tn	*Tetratheca nephelioides*	R
Thst	*Thelymitra stellata*	R
Ts	*Thryptomene* sp. *Eneabba* (R.J. Cranfield 8433)	P2
Tg	*Thysanotus glaucus*	P4
TrWo	*Tricoryne* sp. *Wongan Hills* (B.H. Smith 794)	P2
Tp	*Triglochin protuberans*	P3
Veal	*Verticordia albida*	R
Vam	*Verticordia amphigia*	P3
Var	*Verticordia argentea*	P2
Vau	*Verticordia aurea*	P4
Veder	*Verticordia densiflora* var. *roseostella*	P3
Vf	*Verticordia fragrans*	P3
Vll	*Verticordia luteola* var. *luteola*	P3
Vlr	*Verticordia luteola* var. *rosea*	P1
Vemm	*Verticordia muelleriana* subsp. *muelleriana*	P3
Vp	*Verticordia penicillaris*	P4
Vru	*Verticordia rutilastra*	P3
Vc	*Villarsia congestiflora*	P4
We	*Walteranthus erectus*	P2
Xt	*Xanthosia tomentosa*	P4

RARE AND PRIORITY SPECIES

Priority	DEC	Herbarium	WEC	Other	TEC
Rare	●	■	▲	▼	★
1	●	■	▲	▼	
2	●	■	▲	▼	
3	●	■	▲	▼	
4	●	■	▲	▼	
U	○	□	△	▽	



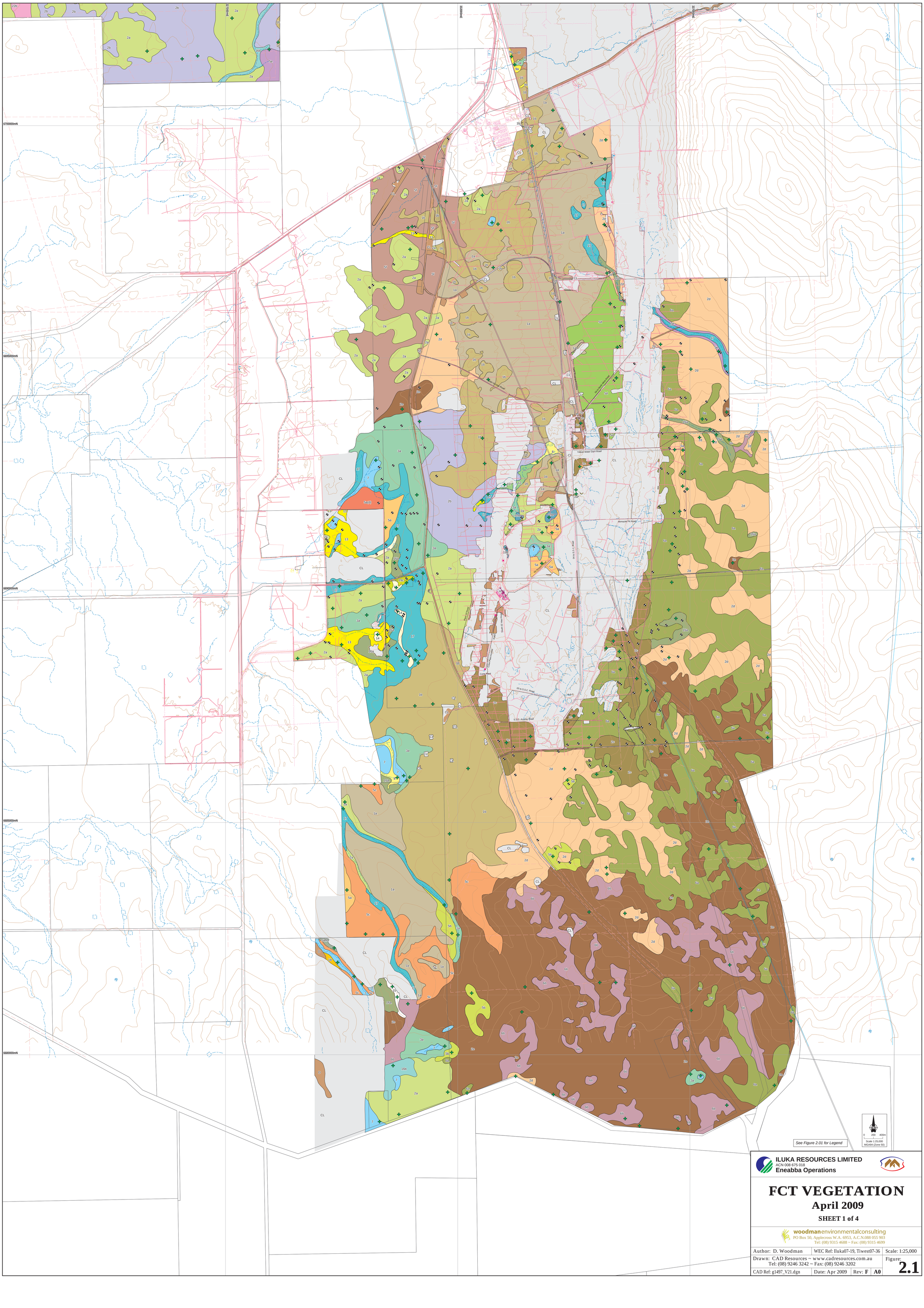
SHEET LAYOUT

ILUKA RESOURCES LIMITED
ACN 008 675 018
Eneabba Operations

FCT VEGETATION LEGEND

woodmanenvironmentalconsulting
PO Box 50, Applecross W.A. 6953, A.C.N.088 055 903
Tel: (08) 9315 4688 ~ Fax: (08) 9315 4699

Author: D. Woodman	WEC Ref: Iluka07-19,Tiwest07-36
Drawn: CAD Resources ~ www.cadresources.com.au Tel: (08) 9246 3242 ~ Fax: (08) 9246 3202	Figure: **2.01**
CAD Ref: g1497_V02_01.dgn	Date: Oct 2009 | Rev: **F** | **A3**



ILUKA RESOURCES LIMITED
ACN 008 675 018
Eneabba Operations

FCT VEGETATION
April 2009
SHEET 1 of 4

woodman environmentalconsulting
PO Box 50, Applecross W.A. 6953, A.C.N.088 055 903
Tel: (08) 9315 4688 ~ Fax: (08) 9315 4699

Author: D. Woodman	WEC Ref: Iluka07-19, Tiwest07-36	Scale: 1:25,000
Drawn: CAD Resources ~ www.cadresources.com.au Tel: (08) 9246 3242 ~ Fax: (08) 9246 3202		Figure: **2.1**
CAD Ref: g1497_V21.dgn	Date: Apr 2009	Rev: **F** **A0**

FCT VEGETATION
April 2009
SHEET 2 of 4

ILUKA RESOURCES LIMITED
ACN 008 675 018
Eneabba Operations

woodmanenvironmentalconsulting
PO Box 50, Applecross W.A. 6953, A.C.N.088 055 903
Tel: (08) 9315 4688 ~ Fax: (08) 9315 4699

Author: D. Woodman	WEC Ref: Iluka07-19, Tiwest07-36		Scale: 1:25,000
Drawn: CAD Resources ~ www.cadresources.com.au Tel: (08) 9246 3242 ~ Fax: (08) 9246 3202			Figure: 2.2
CAD Ref: g1497_V22.dgn	Date: Apr 2009	Rev: F	A0

317000mE
320000mE
323000mE
326000mE
6730000mN
6725000mN
6720000mN
6715000mN
6710000mN
AREA RECENTLY BURNT
(COULD NOT BE MAPPED)
See Figure 2.01 for Legend
0 200 400m
Scale 1:25,000
MGA84 (Zone 50)

ILUKA RESOURCES LIMITED
ACN 008 675 018
Eneabba Operations

FCT VEGETATION
April 2009
SHEET 3 of 4

woodmanenvironmentalconsulting
PO Box 50, Applecross W.A. 6953, A.C.N.088 055 903
Tel: (08) 9315 4688 ~ Fax: (08) 9315 4699

Author: D. Woodman	WEC Ref: Iluka07-19, Tiwest07-36	Scale: 1:25,000
Drawn: CAD Resources ~ www.cadresources.com.au Tel: (08) 9246 3242 ~ Fax: (08) 9246 3202		Figure: 2.3
CAD Ref: g1497_V23.dgn	Date: Apr 2009 Rev: F	A0

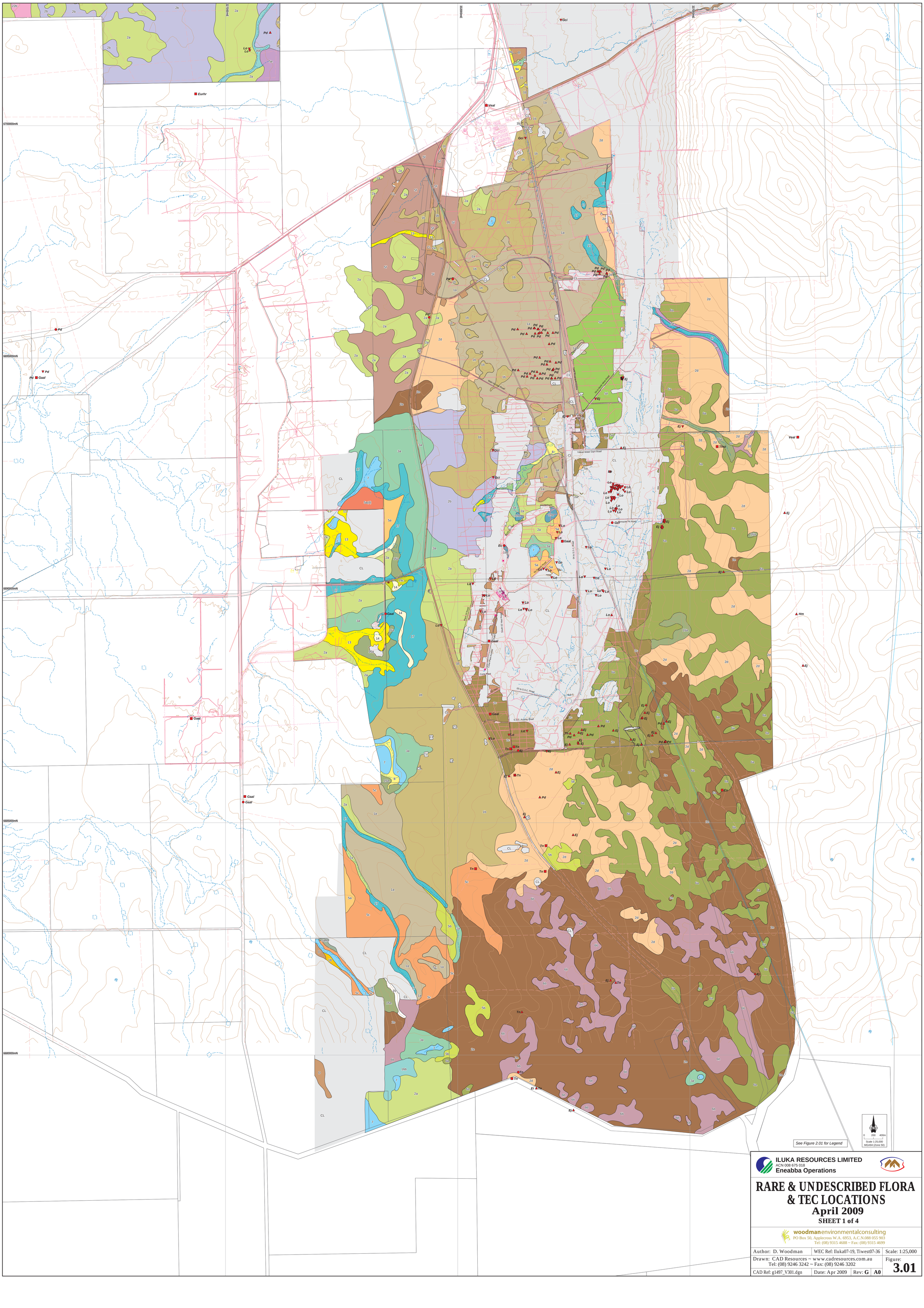
312000mE
317000mE
322000mE
327000mE
6750000mN
6745000mN
6740000mN
6735000mN
6730000mN
4b
3b
4b
22a
90:2
20
21a
4b
CL
E/W
YANDANOOKA
WEST
RD
MOUNT ADAMS
18
90:2
17
18
3b
4b
20
9a
18
18
19a
19a
3b
ADAMS
19a
19a
19a
19a
19a
19a
19a
19a
Tower
5e
E/W
21a
MT
22a
22a
19a
17
19a
21a
17
19a
12a
4a
TOWNRD
90:1
7
90:1
12:1
22a(d)
4b
3b
12:2
21b
3a
21a
9a
4b
4b
11
9a
9a
3a
3a
9a
9a
9a
3a
3b
22a(d)
22a(d)
21a
3b
17
17
20
4b
22a(d)
22a(d)
22a
20
22a(d)
21a(d)
20
20
22a(d)
20
22a(d)
90:2
4b
9a
3b
90:2
21a
19a
22a
22a
21a
2b
20
21a
12:1
ARROWSMITH LAKE
22a
CL
96:1
21b
21a
21b
3b
4b
DEWSBERY
2b
BRAND
E/W
ARROWSMITH
Underground Natural Gas Pipeline
Underground Natural Gas Pipeline
5e
CL
3b
16b
5e
16b
5e
CL
See Figure 2.01 for Legend
N
0 200 400m
Scale 1:25,000
MGA94 (Zone 50)

ILUKA RESOURCES LIMITED
ACN 008 675 018
Eneabba Operations

FCT VEGETATION
April 2009
SHEET 4 of 4

woodmanenvironmentalconsulting
PO Box 50, Applecross W.A. 6953, A.C.N.088 055 903
Tel: (08) 9315 4688 ~ Fax: (08) 9315 4699

Author: D. Woodman	WEC Ref: Iluka07-19, Tiwest07-36	Scale: 1:25,000
Drawn: CAD Resources ~ www.cadresources.com.au Tel: (08) 9246 3242 ~ Fax: (08) 9246 3202		Figure: 2.4
CAD Ref: g1497_V24.dgn	Date: Apr 2009 | Rev: F | A0	



ILUKA RESOURCES LIMITED
ACN 008 675 018
Eneabba Operations

RARE & UNDESCRIBED FLORA & TEC LOCATIONS
April 2009
SHEET 1 of 4

woodman environmental consulting
PO Box 50, Applecross W.A. 6953, A.C.N.088 055 903
Tel: (08) 9315 4688 ~ Fax: (08) 9315 4699

Author: D. Woodman	WEC Ref: Iluka07-19, Tiwest07-36	Scale: 1:25,000
Drawn: CAD Resources ~ www.cadresources.com.au Tel: (08) 9246 3242 ~ Fax: (08) 9246 3202		Figure: **3.01**
CAD Ref: g1497_V301.dgn	Date: Apr 2009	Rev: **G** **A0**

RARE & UNDESCRIBED FLORA & TEC LOCATIONS
April 2009
SHEET 2 of 4

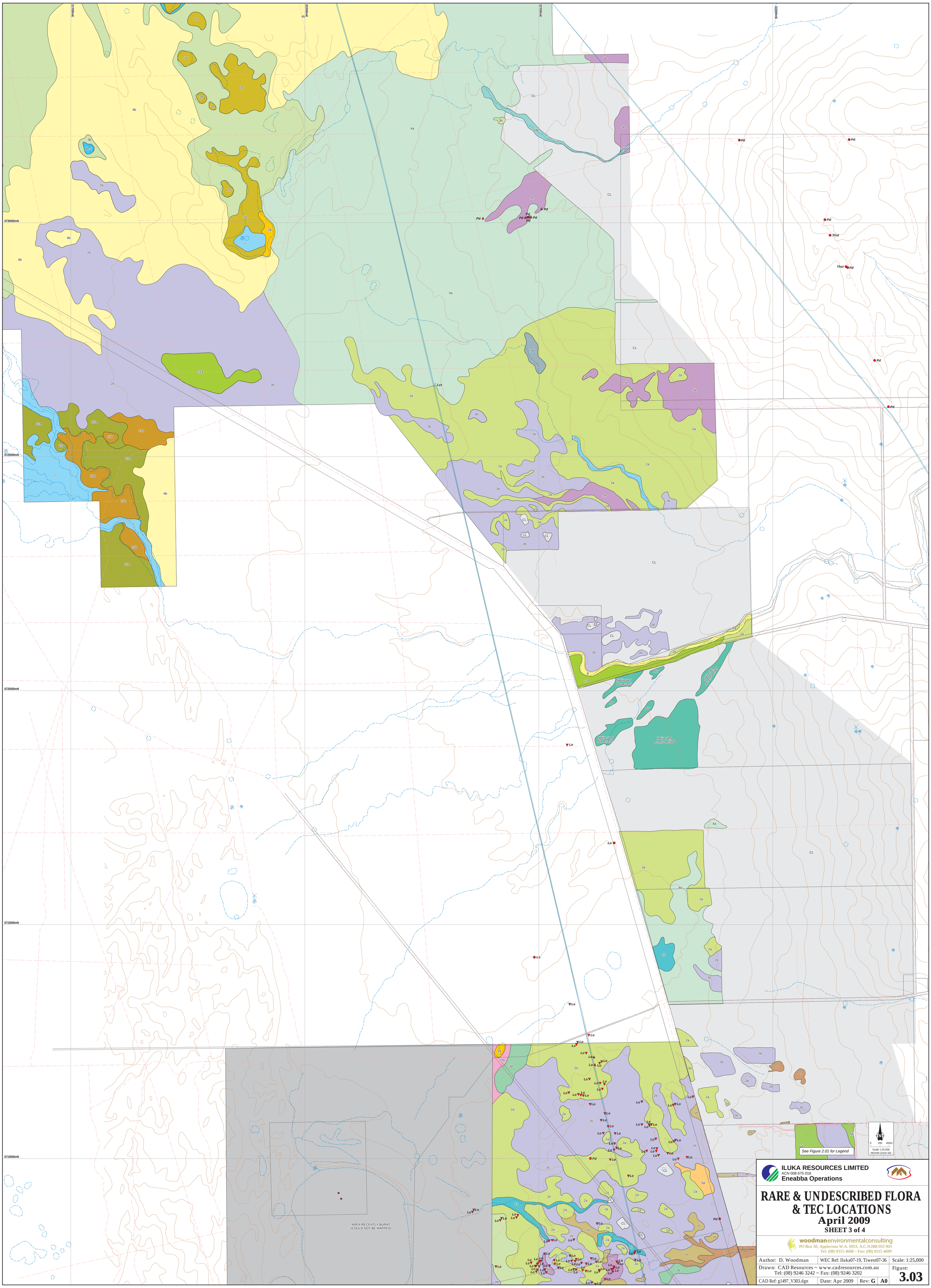
ILUKA RESOURCES LIMITED
ACN 008 675 018
Eneabba Operations

woodman environmentalconsulting
PO Box 50, Applecross W.A. 6953, A.C.N.088 055 903
Tel: (08) 9315 4688 ~ Fax: (08) 9315 4699

Author: D. Woodman	WEC Ref: Iluka07-19, Tiwest07-36		Scale: 1:25,000
Drawn: CAD Resources ~ www.cadresources.com.au Tel: (08) 9246 3242 ~ Fax: (08) 9246 3202			Figure: **3.02**
CAD Ref: g1497_V302.dgn	Date: Apr 2009	Rev: G	A0

See Figure 2.01 for Legend

Scale 1:25,000 MGA94 (Zone 50)



ILUKA RESOURCES LIMITED
ACN 008 675 018
Eneabba Operations

RARE & UNDESCRIBED FLORA & TEC LOCATIONS
April 2009
SHEET 3 of 4

woodmanenvironmentalconsulting
PO Box 50, Applecross W.A. 6953, A.C.N.088 055 903
Tel: (08) 9315 4688 ~ Fax: (08) 9315 4699

Author: D. Woodman	WEC Ref: Iluka07-19, Tiwest07-36	Scale: 1:25,000
Drawn: CAD Resources ~ www.cadresources.com.au Tel: (08) 9246 3242 ~ Fax: (08) 9246 3202		Figure: **3.03**
CAD Ref: g1497_V303.dgn	Date: Apr 2009 Rev: **G** **A0**	

312000mE
317000mE
322000mE
327000mE
6750000mN
6745000mN
6740000mN
6735000mN
6730000mN
YANDANOOKA
WEST
RD
MOUNT ADAMS
ADAMS
Tower
MT
ARROWSMITH LAKE
ARROWSMITH
DEWSTER
TOWARD
Underground Natural Gas Pipeline
CL
E/W
4b
3b
4a
3a
2b
2a
4c
5e
16b
17
18
19a
19b
20
21a
21b
22a
22a(d)
9a
9b.1
9b.2
12.1
12.2
Laf
Lct
Lsy
Pd

See Figure 2.01 for Legend

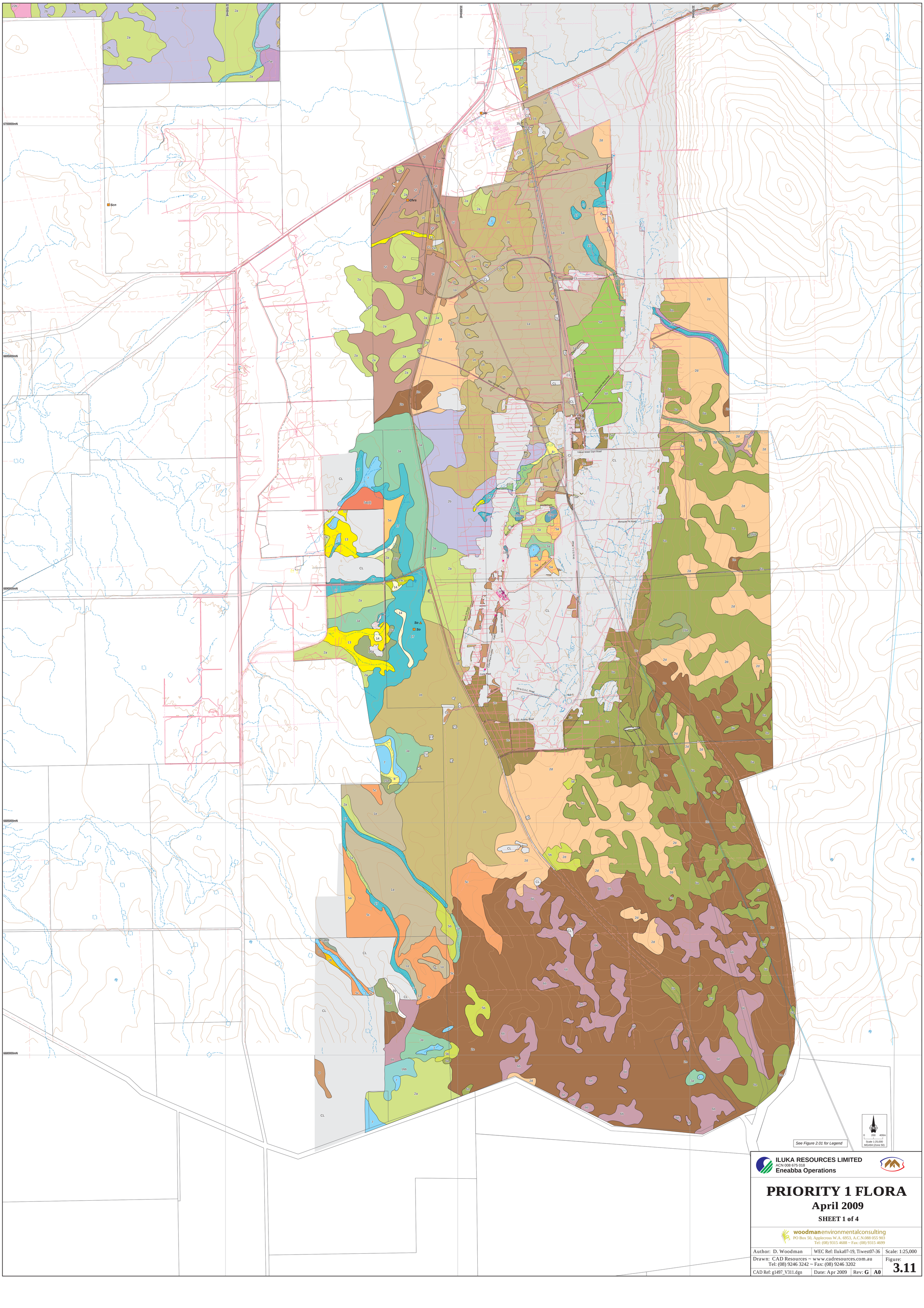
0 200 400m
Scale 1:25,000
MGA94 (Zone 50)

ILUKA RESOURCES LIMITED
ACN 008 675 018
Eneabba Operations

RARE & UNDESCRIBED FLORA & TEC LOCATIONS
April 2009
SHEET 4 of 4

woodman environmental consulting
PO Box 50, Applecross W.A. 6953, A.C.N.088 055 903
Tel: (08) 9315 4688 ~ Fax: (08) 9315 4699

Author: D. Woodman	WEC Ref: Iluka07-19, Tiwest07-36	Scale: 1:25,000
Drawn: CAD Resources ~ www.cadresources.com.au Tel: (08) 9246 3242 ~ Fax: (08) 9246 3202		Figure: 3.04
CAD Ref: g1497_V304.dgn	Date: Apr 2009 | Rev: G | A0	



ILUKA RESOURCES LIMITED
ACN 008 675 018
Eneabba Operations

PRIORITY 1 FLORA

April 2009

SHEET 1 of 4

woodman environmental consulting
PO Box 50, Applecross W.A. 6953, A.C.N.088 055 903
Tel: (08) 9315 4688 ~ Fax: (08) 9315 4699

Author: D. Woodman	WEC Ref: Iluka07-19, Tiwest07-36	Scale: 1:25,000
Drawn: CAD Resources ~ www.cadresources.com.au Tel: (08) 9246 3242 ~ Fax: (08) 9246 3202		Figure: **3.11**
CAD Ref: g1497_V311.dgn	Date: Apr 2009	Rev: **G** **A0**

PRIORITY 1 FLORA
April 2009
SHEET 2 of 4

ILUKA RESOURCES LIMITED
ACN 008 675 018
Eneabba Operations

woodman environmentalconsulting
PO Box 50, Applecross W.A. 6953, A.C.N.088 055 903
Tel: (08) 9315 4688 ~ Fax: (08) 9315 4699

Author: D. Woodman	WEC Ref: Iluka07-19, Tiwest07-36	Scale: 1:25,000
Drawn: CAD Resources ~ www.cadresources.com.au Tel: (08) 9246 3242 ~ Fax: (08) 9246 3202		Figure: **3.12**
CAD Ref: g1497_V312.dgn	Date: Apr 2009 | Rev: **G** | **A0**	

See Figure 2.01 for Legend

Scale 1:25,000
MGA94 (Zone 50)
0 200 400m

317000mE
321000mE
325000mE
329000mE
6730000mN
6725000mN
6720000mN
6715000mN
6710000mN
AREA RECENTLY BURNT
(COULD NOT BE MAPPED)
See Figure 2.01 for Legend
0 200 400m
Scale 1:25,000
MGA84 (Zone 50)

ILUKA RESOURCES LIMITED
ACN 008 675 018
Eneabba Operations

PRIORITY 1 FLORA
April 2009
SHEET 3 of 4

woodmanenvironmentalconsulting
PO Box 50, Applecross W.A. 6953, A.C.N.088 055 903
Tel: (08) 9315 4688 ~ Fax: (08) 9315 4699

Author: D. Woodman	WEC Ref: Iluka07-19, Tiwest07-36	Scale: 1:25,000
Drawn: CAD Resources ~ www.cadresources.com.au Tel: (08) 9246 3242 ~ Fax: (08) 9246 3202		Figure: 3.13
CAD Ref: g1497_V313.dgn	Date: Apr 2009 Rev: G A0	

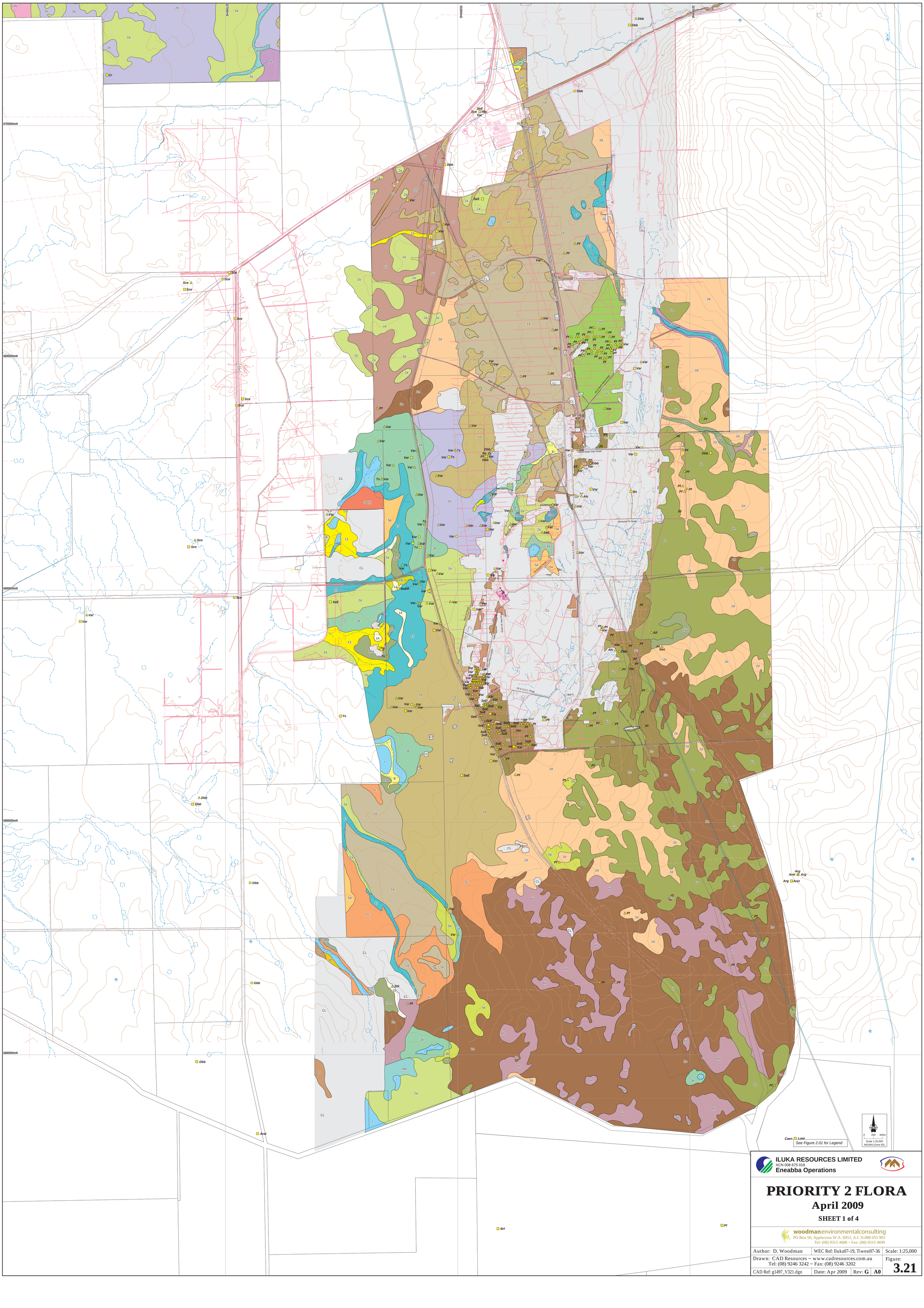
312000mE
317000mE
322000mE
327000mE
6750000mN
6745000mN
6740000mN
6735000mN
6730000mN
YANDANOOKA
WEST
E/W
RD
MOUNT ADAMS
Log
CL
ADAMS
Tower
MT
TOWNRD
ARROWSMITH LAKE
ARROWSMITH
DEWSTER
Cp
Scn
Vir
Underground Optical Fibre Cable
See Figure 2.01 for Legend
0 200 400m
Scale 1:25,000
MGA94 (Zone 50)

ILUKA RESOURCES LIMITED
ACN 008 675 018
Eneabba Operations

PRIORITY 1 FLORA
April 2009
SHEET 4 of 4

woodmanenvironmentalconsulting
PO Box 50, Applecross W.A. 6953, A.C.N.088 055 903
Tel: (08) 9315 4688 ~ Fax: (08) 9315 4699

Author: D. Woodman	WEC Ref: Iluka07-19, Tiwest07-36	Scale: 1:25,000
Drawn: CAD Resources ~ www.cadresources.com.au Tel: (08) 9246 3242 ~ Fax: (08) 9246 3202		Figure: **3.14**
CAD Ref: g1497_V314.dgn	Date: Apr 2009 | Rev: **G** | **A0**	


327000mE
332000mE
337000mE
6700000mN
6695000mN
6690000mN
6685000mN
6680000mN
Dbb
Cr
SeE
Sce
Var
Pf
Ts
Bs
All
Alc
Sen
Arg
Aret
Brl
Caen
Logi
BaBR
Stli
Cg
Main Access Road
Wodjina Pit Road
Monazite Pit Road
03 to S.S.C. Road
S.S.C. Access Road
Mackenzie Road
Ellis Road
Cooke Plains Access
Road 19
South 02 Haul Road
Old Mine Water Dam Road
See Figure 2.01 for Legend
Scale 1:25,000
MGA94 (Zone 50)
0 200 400m
ILUKA RESOURCES LIMITED
ACN 008 675 018
Eneabba Operations
PRIORITY 2 FLORA
April 2009
SHEET 1 of 4
woodman environmental consulting
PO Box 50, Applecross W.A. 6953, A.C.N.088 055 903
Tel: (08) 9315 4688 ~ Fax: (08) 9315 4699
Author: D. Woodman
WEC Ref: Iluka07-19, Tiwest07-36
Scale: 1:25,000
Drawn: CAD Resources ~ www.cadresources.com.au
Tel: (08) 9246 3242 ~ Fax: (08) 9246 3202
Figure: 3.21
CAD Ref: g1497_V321.dgn
Date: Apr 2009
Rev: G
A0

PRIORITY 2 FLORA
April 2009
SHEET 2 of 4

ILUKA RESOURCES LIMITED
ACN 008 675 018
Eneabba Operations

woodman environmental consulting
PO Box 50, Applecross W.A. 6953, A.C.N.088 055 903
Tel: (08) 9315 4688 ~ Fax: (08) 9315 4699

Author: D. Woodman	WEC Ref: Iluka07-19, Tiwest07-36		Scale: 1:25,000
Drawn: CAD Resources ~ www.cadresources.com.au Tel: (08) 9246 3242 ~ Fax: (08) 9246 3202			Figure: **3.22**
CAD Ref: g1497_V322.dgn	Date: Apr 2009	Rev: **G**	**A0**

See Figure 2.01 for Legend

Scale 1:25,000 MGA94 (Zone 50)

317000mE
321000mE
325000mE
329000mE
6730000mN
6725000mN
6720000mN
6715000mN
6710000mN
Sp
Gq
Date
Pf
TrWo
CL
Native veg No access
Native veg access Denied
AREA RECENTLY BURNT (COULD NOT BE MAPPED)
See Figure 2.01 for Legend
0 200 400m
Scale 1:25,000 MGA84 (Zone 50)

ILUKA RESOURCES LIMITED
ACN 008 675 018
Eneabba Operations

PRIORITY 2 FLORA
April 2009
SHEET 3 of 4

woodmanenvironmentalconsulting
PO Box 50, Applecross W.A. 6953, A.C.N.088 055 903
Tel: (08) 9315 4688 ~ Fax: (08) 9315 4699

Author: D. Woodman	WEC Ref: Iluka07-19, Tiwest07-36	Scale: 1:25,000
Drawn: CAD Resources ~ www.cadresources.com.au Tel: (08) 9246 3242 ~ Fax: (08) 9246 3202		Figure: 3.23
CAD Ref: g1497_V323.dgn	Date: Apr 2009	Rev: G A0

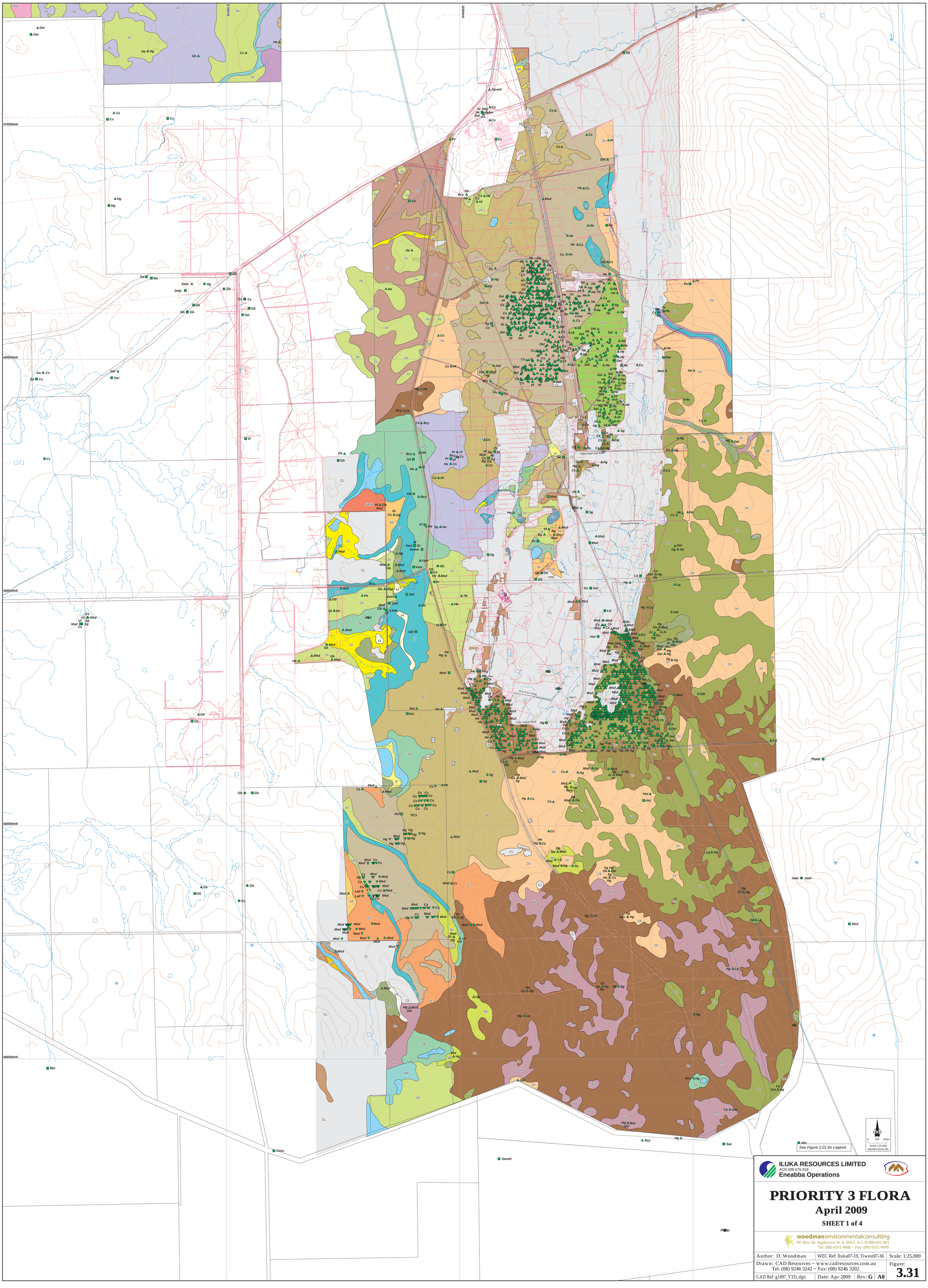
312000mE
317000mE
322000mE
327000mE
6750000mN
6745000mN
6740000mN
6735000mN
6730000mN
YANDANOOKA
WEST
MOUNT ADAMS
ADAMS
ARROWSMITH LAKE
ARROWSMITH
TOWNRD
Underground Natural Gas Pipeline
See Figure 2.01 for Legend
0 200 400m
Scale 1:25,000
MGA94 (Zone 50)

ILUKA RESOURCES LIMITED
ACN 008 675 018
Eneabba Operations

PRIORITY 2 FLORA
April 2009
SHEET 4 of 4

woodmanenvironmentalconsulting
PO Box 50, Applecross W.A. 6953, A.C.N.088 055 903
Tel: (08) 9315 4688 ~ Fax: (08) 9315 4699

Author: D. Woodman	WEC Ref: Iluka07-19, Tiwest07-36	Scale: 1:25,000
Drawn: CAD Resources ~ www.cadresources.com.au Tel: (08) 9246 3242 ~ Fax: (08) 9246 3202		Figure: 3.24
CAD Ref: g1497_V324.dgn	Date: Apr 2009 Rev: G A0	



ILUKA RESOURCES LIMITED
ACN 008 675 018
Eneabba Operations

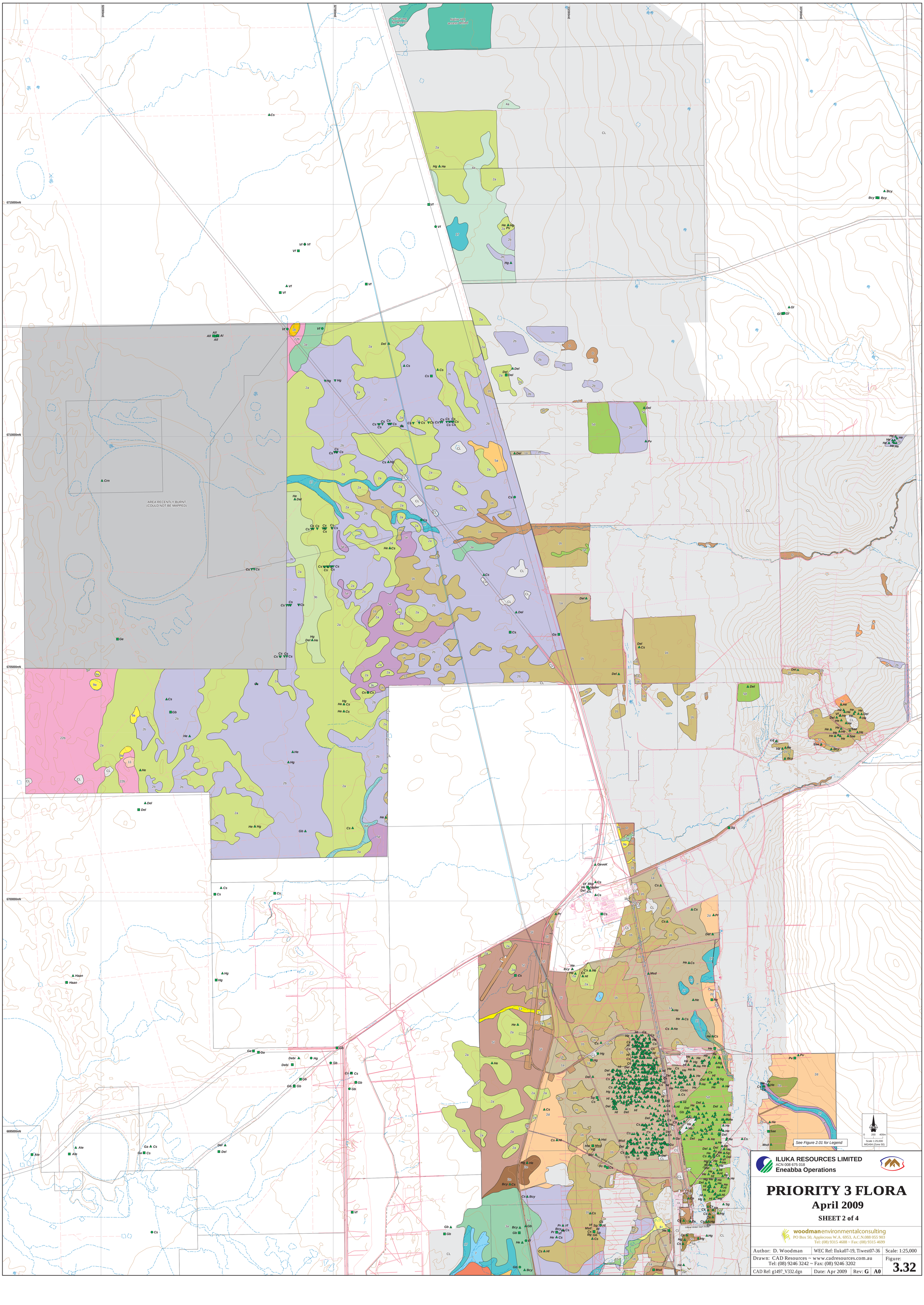
PRIORITY 3 FLORA

April 2009

SHEET 1 of 4

woodmanenvironmentalconsulting
PO Box 50, Applecross W.A. 6953, A.C.N.088 055 903
Tel: (08) 9315 4688 ~ Fax: (08) 9315 4699

Author: D. Woodman	WEC Ref: Iluka07-19, Tiwest07-36	Scale: 1:25,000
Drawn: CAD Resources ~ www.cadresources.com.au Tel: (08) 9246 3242 ~ Fax: (08) 9246 3202		Figure: **3.31**
CAD Ref: g1497_V331.dgn	Date: Apr 2009 / Rev: **G** / **A0**	



ILUKA RESOURCES LIMITED
ACN 008 675 018
Eneabba Operations

PRIORITY 3 FLORA

April 2009

SHEET 2 of 4

woodman environmentalconsulting
PO Box 50, Applecross W.A. 6953, A.C.N.088 055 903
Tel: (08) 9315 4688 ~ Fax: (08) 9315 4699

Author: D. Woodman	WEC Ref: Iluka07-19, Tiwest07-36		Scale: 1:25,000
Drawn: CAD Resources ~ www.cadresources.com.au Tel: (08) 9246 3242 ~ Fax: (08) 9246 3202			Figure: **3.32**
CAD Ref: g1497_V332.dgn	Date: Apr 2009	Rev: **G**	**A0**

317000mE
321000mE
325000mE
329000mE
6730000mN
6725000mN
6720000mN
6715000mN
6710000mN

AREA RECENTLY BURNT
(COULD NOT BE MAPPED)

See Figure 2.01 for Legend

0 200 400m
Scale 1:25,000
MGA84 (Zone 50)

ILUKA RESOURCES LIMITED
ACN 008 675 018
Eneabba Operations

PRIORITY 3 FLORA
April 2009
SHEET 3 of 4

woodmanenvironmentalconsulting
PO Box 50, Applecross W.A. 6953, A.C.N.088 055 903
Tel: (08) 9315 4688 ~ Fax: (08) 9315 4699

Author: D. Woodman	WEC Ref: Iluka07-19, Tiwest07-36	Scale: 1:25,000
Drawn: CAD Resources ~ www.cadresources.com.au Tel: (08) 9246 3242 ~ Fax: (08) 9246 3202		Figure: 3.33
CAD Ref: g1497_V333.dgn	Date: Apr 2009 Rev: G A0	

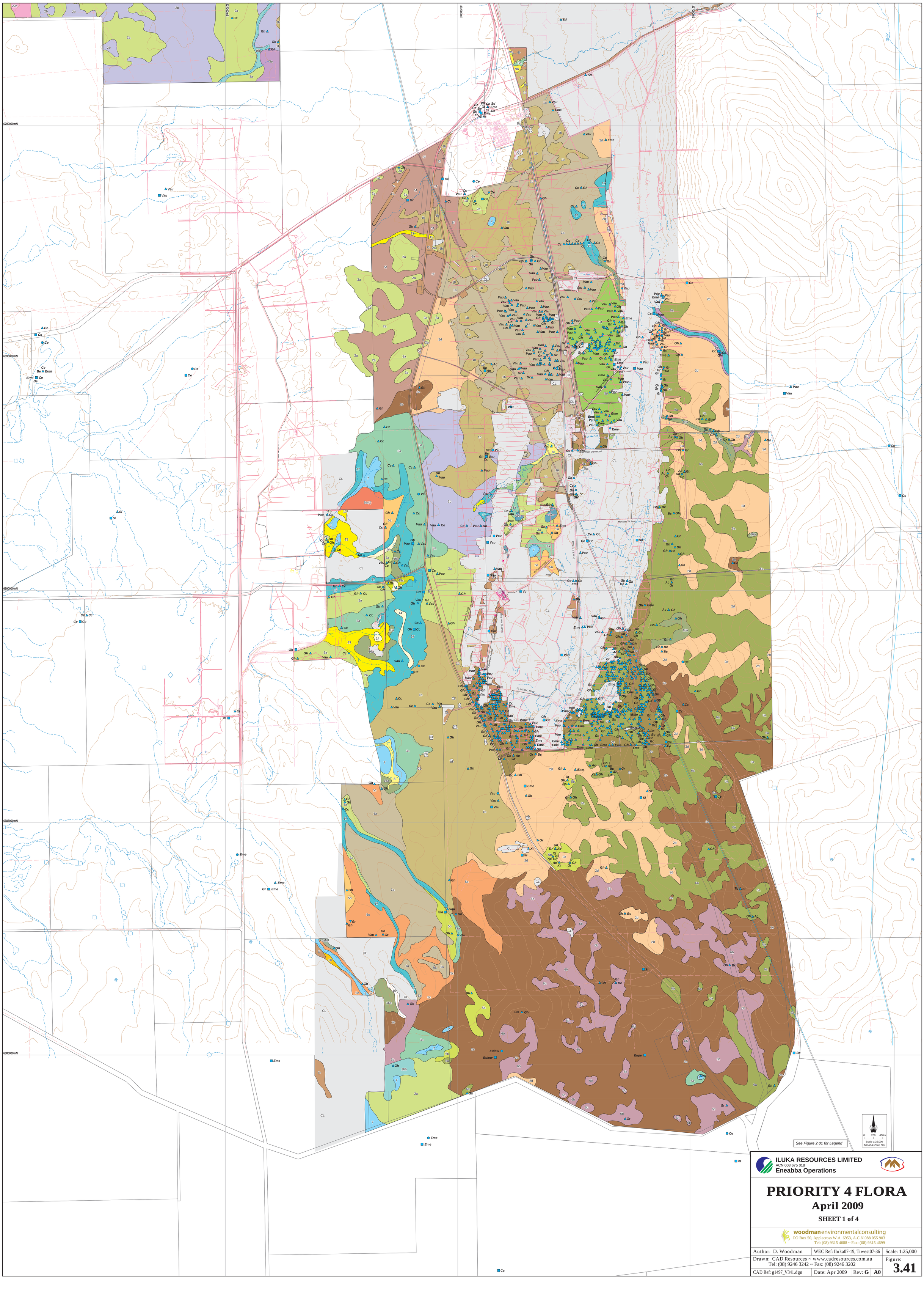
312000mE
317000mE
322000mE
327000mE
6750000mN
6745000mN
6740000mN
6735000mN
6730000mN
YANDANOOKA
WEST
MOUNT ADAMS
ADAMS
ARROWSMITH LAKE
ARROWSMITH
DEWSTER
TOWNRD
Underground Natural Gas Pipeline
See Figure 2.01 for Legend
Scale 1:25,000
MGA94 (Zone 50)
0 200 400m

ILUKA RESOURCES LIMITED
ACN 008 675 018
Eneabba Operations

PRIORITY 3 FLORA
April 2009
SHEET 4 of 4

woodmanenvironmentalconsulting
PO Box 50, Applecross W.A. 6953, A.C.N.088 055 903
Tel: (08) 9315 4688 ~ Fax: (08) 9315 4699

Author: D. Woodman	WEC Ref: Iluka07-19, Tiwest07-36	Scale: 1:25,000
Drawn: CAD Resources ~ www.cadresources.com.au Tel: (08) 9246 3242 ~ Fax: (08) 9246 3202		Figure: 3.34
CAD Ref: g1497_V334.dgn	Date: Apr 2009 | Rev: G | A0	

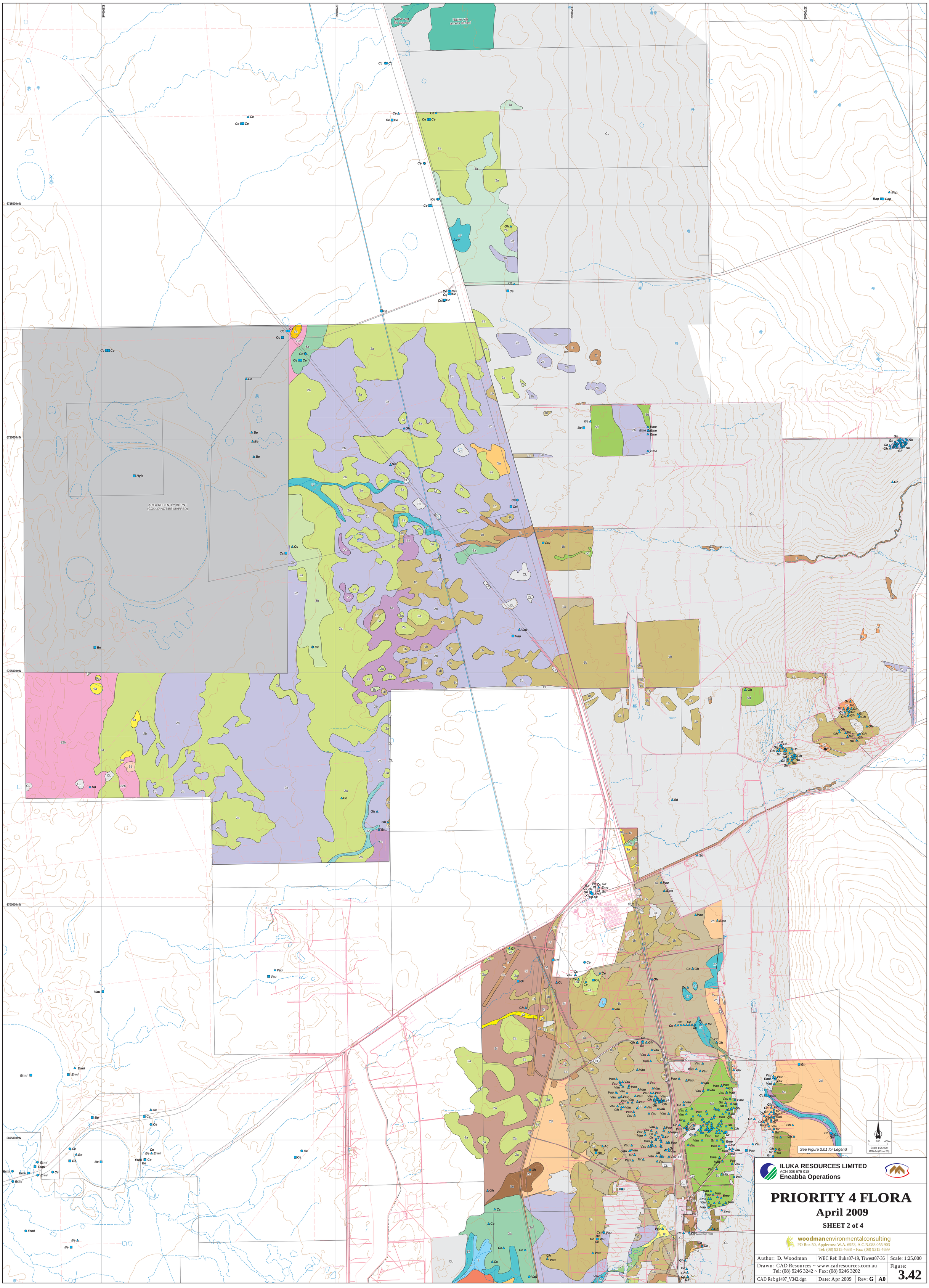


ILUKA RESOURCES LIMITED
ACN 008 675 018
Eneabba Operations

PRIORITY 4 FLORA
April 2009
SHEET 1 of 4

woodman environmental consulting
PO Box 50, Applecross W.A. 6953, A.C.N.088 055 903
Tel: (08) 9315 4688 ~ Fax: (08) 9315 4699

Author: D. Woodman	WEC Ref: Iluka07-19, Tiwest07-36	Scale: 1:25,000
Drawn: CAD Resources ~ www.cadresources.com.au Tel: (08) 9246 3242 ~ Fax: (08) 9246 3202		Figure: **3.41**
CAD Ref: g1497_V341.dgn	Date: Apr 2009 | Rev: **G** | **A0**	



ILUKA RESOURCES LIMITED
ACN 008 675 018
Eneabba Operations

PRIORITY 4 FLORA

April 2009

SHEET 2 of 4

woodman environmental consulting
PO Box 50, Applecross W.A. 6953, A.C.N.088 055 903
Tel: (08) 9315 4688 ~ Fax: (08) 9315 4699

Author: D. Woodman	WEC Ref: Iluka07-19, Tiwest07-36		Scale: 1:25,000
Drawn: CAD Resources ~ www.cadresources.com.au Tel: (08) 9246 3242 ~ Fax: (08) 9246 3202			Figure: **3.42**
CAD Ref: g1497_V342.dgn	Date: Apr 2009	Rev: **G**	**A0**

ILUKA RESOURCES LIMITED
ACN 008 675 018
Eneabba Operations

PRIORITY 4 FLORA
April 2009
SHEET 3 of 4

woodman environmental consulting
PO Box 50, Applecross W.A. 6953, A.C.N.088 055 903
Tel: (08) 9315 4688 ~ Fax: (08) 9315 4699

Author: D. Woodman	WEC Ref: Iluka07-19, Tiwest07-36		Scale: 1:25,000
Drawn: CAD Resources ~ www.cadresources.com.au Tel: (08) 9246 3242 ~ Fax: (08) 9246 3202			Figure: 3.43
CAD Ref: g1497_V343.dgn	Date: Apr 2009	Rev: G A0	

See Figure 2.01 for Legend

Scale 1:25,000 MGA84 (Zone 50)

AREA RECENTLY BURNT (COULD NOT BE MAPPED)

Native veg No access

Native veg access Denied

312000mE
317000mE
322000mE
327000mE
6750000mN
6745000mN
6740000mN
6735000mN
6730000mN
YANDANOOKA
WEST
MOUNT ADAMS
ADAMS
ARROWSMITH LAKE
ARROWSMITH
DEWSTER
TOWNAGE
Tower
CL
E/W
MT
RD
See Figure 2.01 for Legend
N
0 200 400m
Scale 1:25,000
MGA94 (Zone 50)

ILUKA RESOURCES LIMITED
ACN 008 675 018
Eneabba Operations

PRIORITY 4 FLORA
April 2009
SHEET 4 of 4

woodmanenvironmentalconsulting
PO Box 50, Applecross W.A. 6953, A.C.N.088 055 903
Tel: (08) 9315 4688 ~ Fax: (08) 9315 4699

Author: D. Woodman	WEC Ref: Iluka07-19, Tiwest07-36	Scale: 1:25,000
Drawn: CAD Resources ~ www.cadresources.com.au Tel: (08) 9246 3242 ~ Fax: (08) 9246 3202		Figure: 3.44
CAD Ref: g1497_V344.dgn	Date: Apr 2009 | Rev: G | A0	