

Detailed Flora & Vegetation Survey and Targeted Flora Survey of the New Morning Project

Prepared For



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Glossary

Acronym	Description
ANCA	Australian Nature Conservation Agency.
BAM Act	Biosecurity and Agriculture Management Act 2007, WA Government.
BC	Botanica Consulting.
BoM	Bureau of Meteorology.
DAFWA	Department of Agriculture and Food (now DPIRD), WA Government.
DBCA	Department of Biodiversity, Conservation and Attractions (formerly DPaW), WA Government.
DEC	Department of Environment and Conservation (now DBCA), WA Government.
DER	Department of Environment Regulation (now DWER), WA Government.
DMIRS	Department of Mines, Industry Regulation and Safety (formerly DMP), WA Government
DMP	Department of Mines and Petroleum (now DMIRS), WA Government.
DotEE	Department of the Environment and Energy (formerly DSEWPaC), Australian Government.
DoW	Department of Water (now DWER), WA Government.
DPaW	Department of Parks and Wildlife (now DBCA), WA Government.
DPIRD	Department of Primary Industries and Regional Development, WA Government
DSEWPaC	Department of Sustainability, Environment, Water, Population and Communities (now DotEE,), Australian Government.
DWER	Department of Water and Environmental Regulation (formerly EPA, DER and DoW), WA Government
EP Act	Environmental Protection Act 1986, WA Government.
EP Regulations	Environmental Protection (Clearing of Native Vegetation) Regulations 2004, WA Government.
EPA	Environmental Protection Authority, WA Government.
EPBC Act	Environment Protection and Biodiversity Conservation Act 1999, Australian Government.
ESA	Environmentally Sensitive Area.
Ha	Hectare (10,000 square metres).
IBRA	Interim Biogeographic Regionalisation for Australia.
IUCN	International Union for the Conservation of Nature and Natural Resources – commonly known as the World Conservation Union.
Km	Kilometre
MVG	Major Vegetation Groups.
NSR	Northern Star Resources Limited.
NVIS	National Vegetation Information System.
OEPA	Office of the Environmental Protection Authority (now DWER), WA Government.
PEC	Priority Ecological Community.
SSC	Species Survival Commission, International.
Survey Area	New Morning Project.
TEC	Threatened Ecological Community.
WA	Western Australia.
WAHERB	Western Australian Herbarium.
WAM	Western Australian Museum, WA Government.
WC Act	Wildlife Conservation Act 1950, WA Government.

Executive Summary

Botanica Consulting (BC) was commissioned by Western Areas Limited (WSA) to undertake a Detailed flora and vegetation survey and targeted flora survey of the New Morning Project (referred to as the 'survey area'), which is located at the WSA Forrester Nickel Project, approximately 75 km east of Hyden, Western Australia. The survey was initially conducted in spring from the 26th to the 29th August 2018, covering an area of approximately 1,298 ha. Thirty-six quadrats (20m X 20m) were established during the survey.

Nine vegetation associations were identified within the survey area. These vegetation associations were located within four different landform types and comprised of three major vegetation groups, which were represented by a total of 38 Families, 98 Genera and 280 Taxa (including 12 annual taxa).

Species composition assessments indicate there was minimal heterogeneity in species composition across the survey area, with majority of vegetation associations (particularly the Eucalypt woodland associations) intermixed into floristic groups despite differences in dominant stratum taxa; however, two distinct supergroups were identified. The first supergroup comprised of a mix of vegetation associations identified in the field including quadrats from the clay-loam plain (Eucalypt Woodlands and sand-loam plain (Mallee Woodlands and Shrublands). The second supergroup comprised a mix of quadrats from the sandplains (Mallee Woodlands and Shrublands/ Heathlands) and stony rise (Mallee Woodlands and Shrublands) vegetation associations.

Two Threatened Flora species, *Eucalyptus steedmanii*, pursuant to subsection (2) of section 23F of the *Wildlife Conservation Act (1950)* and section 179 of the *Commonwealth Environment Protection and Biodiversity Conservation Act 1999* was identified within the survey area; *Eucalyptus steedmanii* and *Paragoodia crenulata*. Four Priority Flora species were recorded within the survey area; *Eremophila racemosa* (P4), *Eutaxia acanthoclada* (P3), *Microcorys* sp. Forresteria (V. English 2004) and *Stylidium sejunctum* (P3).

No Threatened Ecological Communities (TEC) pursuant to Commonwealth or State legislation were identified within the survey area. The survey area does not contain any world or national heritage places, wetlands of international importance (Ramsar Wetlands) or wetlands of national importance (Australian Nature Conservation Agency (ANCA) wetlands).

The survey area is located within the North Ironcap buffer of the *Ironcap Hills Vegetation Complexes* which is listed by the Department of Biodiversity, Conservation and Attractions (DBCA) as a Priority 3 Ecological Community.

Approximately 370ha of the north-east corner of survey area lies within the Lake Cronin Environmental Sensitive Area and is located approximately 500m west of the Lake Cronin 'A' Class Nature Reserve. According to the Environmental Protection Authority report (2009) *Advice on Conservation Values and Review of Nature Reserve Proposals in the Lake Cronin Region*, an area of 56,750ha within the mineralised greenstone belt in the Lake Cronin Region (encompassing the entire survey area) is proposed to be managed under Section 33(2) of the *Conservation Land Management Act 1984* but not formally reserved. A proposed 'C' Class Nature Reserve is also proposed in the surrounding area to protect the Lake Cronin catchment and areas of extensive sandplain and woodland vegetation located immediately east of the Wheatbelt, which represents vegetation communities and fauna habitats that have been extensively cleared and fragmented in the adjacent Wheatbelt. The North Ironcap Banded Ironstone Formation located approximately 8km north of the survey area is proposed to be reserved in a small 'A' Class Nature Reserve, covering an area of 42.5ha.

Based on the vegetation condition rating scale adapted from Keighery, 1994 and Trudgen, 1988 (ranging from 'pristine' to 'completely degraded'), two vegetation associates were rated as 'good' and the remaining seven vegetation associations had a vegetation condition rating of 'very good'. Four introduced species were identified within the survey area; *Dittrichia graveolens*, *Lysimachia arvensis*, *Sonchus olearaceus* and *Wahlenbergia capensis*. According to the Department of Primary Industries and Regional Development (DPIRD), none of these species are listed as a Declared Plant under the *Biosecurity and Agriculture Management (BAM) Act 2007*.

1 Introduction

1.1 Project Description

Botanica Consulting (BC) was commissioned by Western Areas Limited (WSA) to undertake a Detailed flora and vegetation survey and targeted flora survey of the New Morning Project (referred to as the 'survey area'), which is located at the WSA Forrestania Nickel Project, approximately 75 km east of Hyden, Western Australia (Figure 1-1). The survey was conducted in spring from the 26th to 29th August 2018, covering an area of approximately 1,298 ha. Thirty-six quadrats (20m X 20m) were established during the survey.

The New Morning deposit located within the survey area, it is a medium grade nickel deposit located between two of Western Areas existing operations Flying Fox and Spotted Quoll.

1.2 Objectives

The flora and vegetation survey was conducted in accordance with *Technical Guidance - Flora and Vegetation Surveys for Environmental Impact Assessment – December 2016* (EPA, 2016). The objectives of the detailed flora and vegetation survey were to:

- Define and map vegetation communities of the survey area to a scale appropriate for the bioregion and described according to the National Vegetation Information System (NVIS) classification (NVIS Level III– Vegetation Association);
- Record the species composition (abundance and diversity) of each vegetation community within the survey area and compile a species list for the survey area by vegetation type;
- Provide quadrat-based data from plots representative of each vegetation type (minimum of three quadrats per vegetation type) according to EPA guidelines;
- Assess the species composition of each quadrat using statistical analysis (PATN analysis);
- Determine the local and regional conservation significance of flora and vegetation within the survey area;
- Identify and record the locations of any conservation significant flora/vegetation within the survey area;
- Identify and record the locations of any introduced flora species (including Declared Plants) within the survey area;
- Provide a map showing the distribution of conservation significant flora/vegetation within the survey area;
- Define and map the condition of vegetation within the survey area in accordance with the vegetation condition rating scale adapted from Keighery, 1994 and Trudgen, 1988;
- Determine the State legislative context of environmental aspects required for the assessment;
- Assess Matters of National Environmental Significance (MNES) and indicate whether potential impacts on MNES as protected under the EPBC Act are likely to require referral of the project to the Commonwealth DotEE; and
- Determine the need for additional flora and vegetation surveys.

The objectives of the targeted flora and vegetation survey were to:

- Gather background information on flora and vegetation of conservation significance in the local area (literature review, database and map-based searches);

- Based on results of the desktop assessment, identify vegetation associations within the survey area that have the potential to contain flora/vegetation of conservation significance;
- Conduct a field survey to identify flora/vegetation of conservation significance within the project footprint; and
- Provide GPS record and spatial map showing the distribution of flora/vegetation of conservation significance within the survey area.



2 Regional Biophysical Environment

2.1 Regional Environment

Based on the Interim Biogeographic Regionalisation of Australia (IBRA), Version 7 (DotEE, 2012), the survey area is located on the border of the Coolgardie and Mallee Bioregions. The Coolgardie and Mallee Bioregions are further divided into subregions with the survey area located within the Western Mallee subregion (MAL2) of the Mallee Bioregion and the Southern Cross subregion (COO2) of the Coolgardie Bioregion (Figure 2-1)

The Coolgardie Bioregion forms part Southwestern Interzone of Western Australia in a region known as the Coolgardie Botanical District (Beard, 1990). The Coolgardie Bioregion is located within the Yilgarn Craton and is characterised by a granite basement which includes Archaean Greenstone intrusions in parallel belts. Drainage is occluded. The Southern Cross subregion comprises gently undulating uplands on granite strata and broad valleys with bands of low greenstone hills (McKenzie, J.E. May and S. McKenna, 2002).

The Mallee Bioregion also forms part of the South-West Province Australia in a region known as the Roe Botanical District. The Mallee Bioregion is located in the south-eastern part of Yilgarn Craton which is gently undulating, with partially occluded drainage. The Western Mallee subregion has more relief than its eastern counterpart. Its main surface-types comprise clays and silts underlain by kankar, exposed granite, sandplains, isolated uplands of laterite pavements and Salt Lake systems on a granite basement (McKenzie, J.E. May and S. McKenna, 2002).

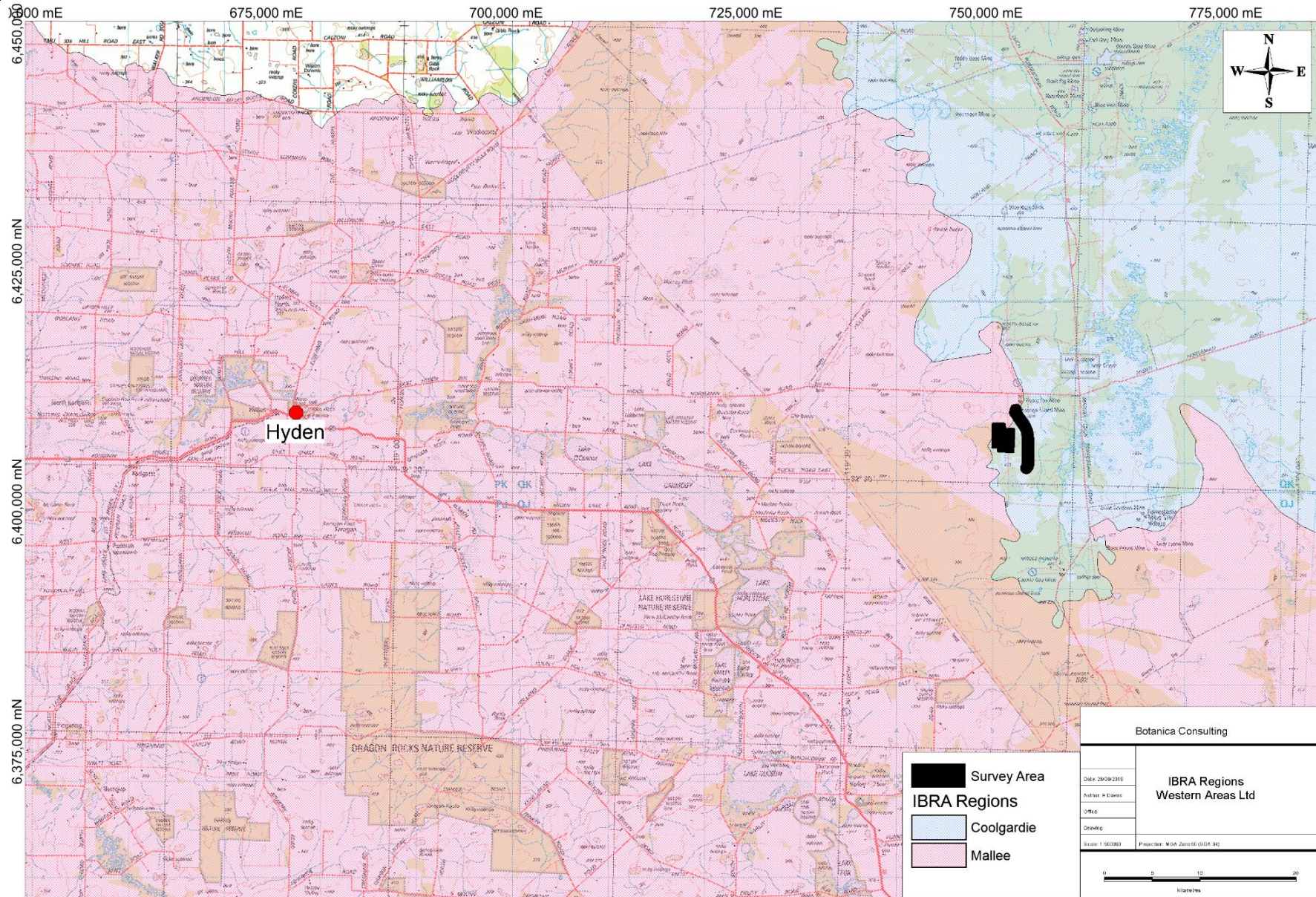


Figure 2-1: Map of IBRA Bioregions in relation to the New Morning Project survey area

2.2 Soils and Landscape Systems

Based on geographic information provided by DAFWA (2014), the survey area is located within the South-eastern Zone of Ancient Drainage (250) of the Avon Province (25) and the Southern Cross Zone (261) of the Kalgoorlie Province (26).

The Avon Province is characterised as a laterised plateau (dissected at fringes and with saline drainage lines inland) on deeply weathered mantle and alluvium over granitic rocks of the Yilgarn Craton (and Albany-Fraser Orogen). Soils are comprised of sandy duplexes soils and ironstone gravelly soils with loamy earths, loamy duplexes, sandy earths, deep sands and wet soils. Vegetation is dominated by York gum-wandoo-salmon gum-morrel gimlet woodland and jarrah-marri-karri-wandoo woodlands/forests (with some mallee scrub, tammar-wodjil thickets and scrub-heath). This Province is located in the south-west, between Nannup, Denmark, Jerramungup, Southern Cross, Lake Moore, Carnamah and the Perth Hills (Tille, 2006).

The Kalgoorlie Province is characterised by undulating plains (with some sandplains, hills and salt lakes) on the granitic rocks and greenstone of the Yilgarn Craton. Soils include calcareous loamy earths and red loamy earths with some Salt Lake soils, red deep sands, yellow sandy earths, shallow loams and loamy duplexes. Vegetation is dominated by Eucalypt woodlands with some Acacia-Casuarina thickets, mulga shrublands, halophytic shrublands and spinifex grasslands. This Province is located in the southern Goldfields between Paynes Find, Menzies, Southern Cross and Balladonia (Tille, 2006).

The South-western Zone of Ancient Drainage (250) is characterised by gently undulating terrain (with some salt lake chains and areas of prominent granitic outcrops) on deeply weathered mantle and alluvium over granitic rocks of the Yilgarn Craton. Soils include sandy duplexes (often alkaline) with ironstone gravelly soils and loamy earths (often calcareous) and some loamy duplexes, sandy earths, deep sands and saline wet soils. Mallee scrub and salmon gum-gimlet-morrel woodlands (and some scrub-heath). This zone is located in the southern Wheatbelt between Kondinin, Lake Grace, Gnowangerup, Frank Hann National Park and Mt Holland (Tille, 2006).

The Southern Cross Zone (261) is characterised by undulating plains and uplands (with some salt lake and low hills) on deeply weathered mantle, colluvium and alluvium over greenstone and granitic rocks of the Yilgarn Craton. Soils include calcareous loamy earths, red and yellow loamy earths and alkaline deep and shallow sandy duplexes with some yellow sandy earths, salt lake soils, yellow deep sands and red shallow loamy duplexes. Vegetation is dominated by Salmon gum-gimlet-morrel-York gum woodlands with Acacia/ Casuarina thickets (and some mallee, scrub-heath and halophytic shrublands). This zone is located in the eastern Wheatbelt/south western Goldfields between Bullfinch and Mt Holland. The South-western Zone of Ancient Drainage (259) and Southern Cross Zone (261) are further divided into soil landscape systems within the soil landscape systems of the survey area described in Table 2-1 and shown in Figure 2-2 (ASRIS, 2014).

Table 2-1: Soil Landscape Systems within the New Morning Project survey area

Zone	Landscape System/ Mapping Unit	Description
South-eastern Zone of Ancient Drainage (250)	Ms8	Gently undulating plains with broad shallow drainage depressions
	X17	Slopes and valleys
Southern Cross Zone (261)	Ya28	Sandy plains with some clay pans and small salt lakes, dunes, and lunettes

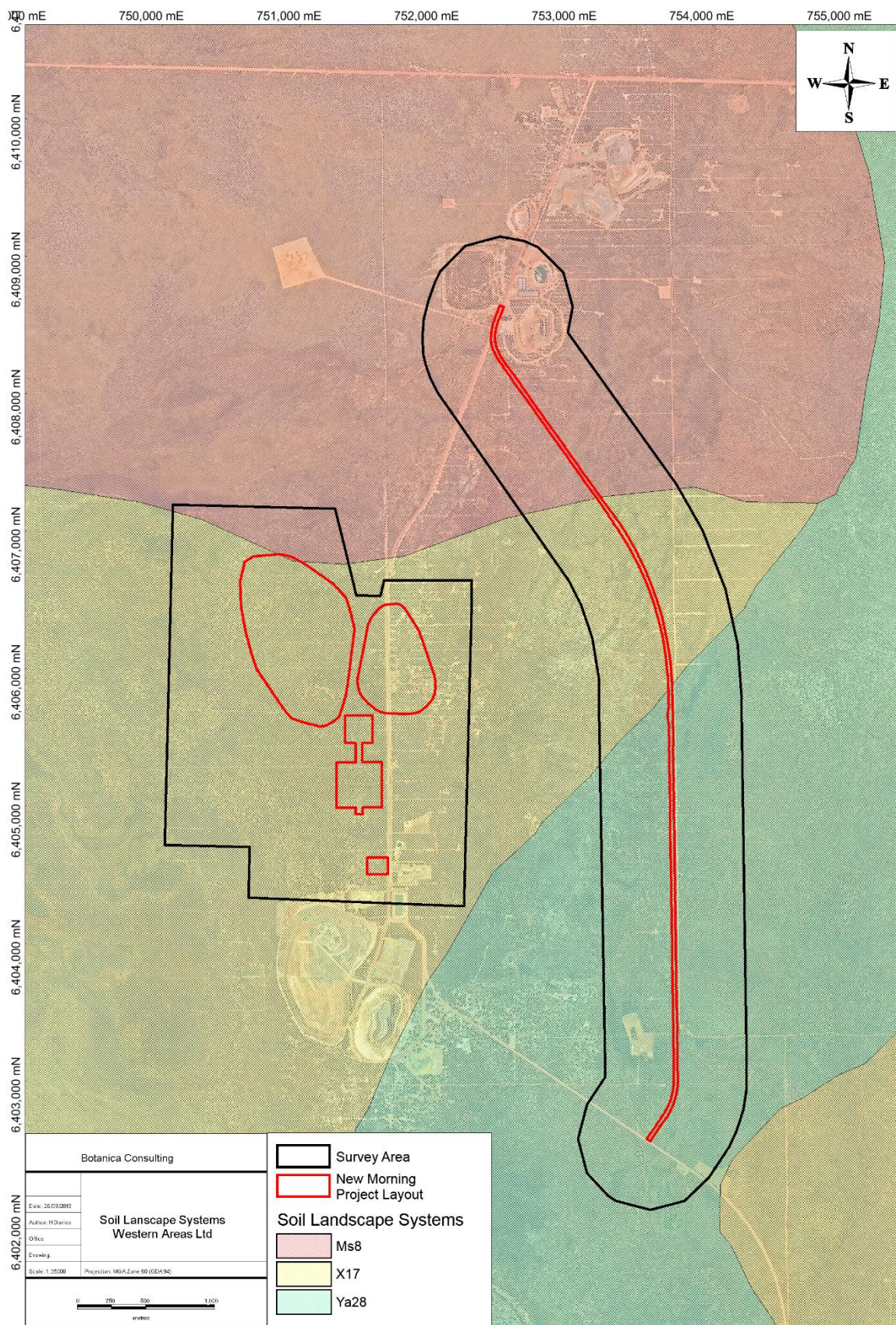


Figure 2-2: Map of Soil Landscape Systems within the New Morning Project survey area

2.3 Remnant Vegetation

The DAFWA GIS file (2011) indicates that the survey area is located within Pre-European Beard vegetation association Forrestania 511 (COO2), Forrestania 2048 (COO2 and MAL2). The extent of these vegetation associations as specified in the *2017 Statewide Vegetation Statistics* (DBCA, 2017) is provided in Table 2-2 and shown in Figure 2-3.

Areas retaining less than 30% of their pre-European vegetation extent generally experience exponentially accelerated species loss, while areas with less than 10% are considered “endangered” (EPA, 2000). Development within the survey area will not significantly reduce the extent of pre-European vegetation.

Table 2-2: Remaining Beard Vegetation Associations within Western Australia (DBCA, 2017)

IBRA Subregion	Vegetation association	Pre-European Extent (Ha)	Current Extent (Ha)	Pre-European extent remaining (%)	% of Current extent within DBCA managed lands	Vegetation Description (Beard, 1990)
COO2	Forrestania 511*	153,641.65	153,002.24	99.58	9.72	Medium woodland; salmon gum & morrel
	Forrestania 2048*	2,093.75	2,070.85	98.91	2.41	Shrublands; scrub-heath in the Mallee Region
MAL2	Forrestania 2048	5,735.92	5,595.69	97.56	0	Shrublands; scrub-heath in the Mallee Region

*Low Reservation Priority according to the International Union for Conservation of Nature (IUCN)

Vegetation of the Southern Cross subregion in the Coolgardie Botanical District is predominantly Eucalypt woodlands, Mallees, Acacia thickets and scrub-heaths on sandplains. Diverse Eucalypt woodlands occur around salt lakes, on the low greenstone hills, valley alluvials and broad plains of calcareous earths. Salt lakes support dwarf shrublands of samphire. The area is rich in endemic *Acacias* (Cowan, 2001). The Western Mallee subregion vegetation commonly includes Mallee over myrtaceous-proteaceous heaths, *Melaleuca* shrublands, Samphire low shrublands on saline depressions and mixed Eucalypt woodlands. Mallee communities of the Western Mallee subregion occur on a variety of surfaces; Eucalypt woodlands occur mainly on fine textured soils, with scrub-heath on sands and laterite (Beecham & Danks, 2001).

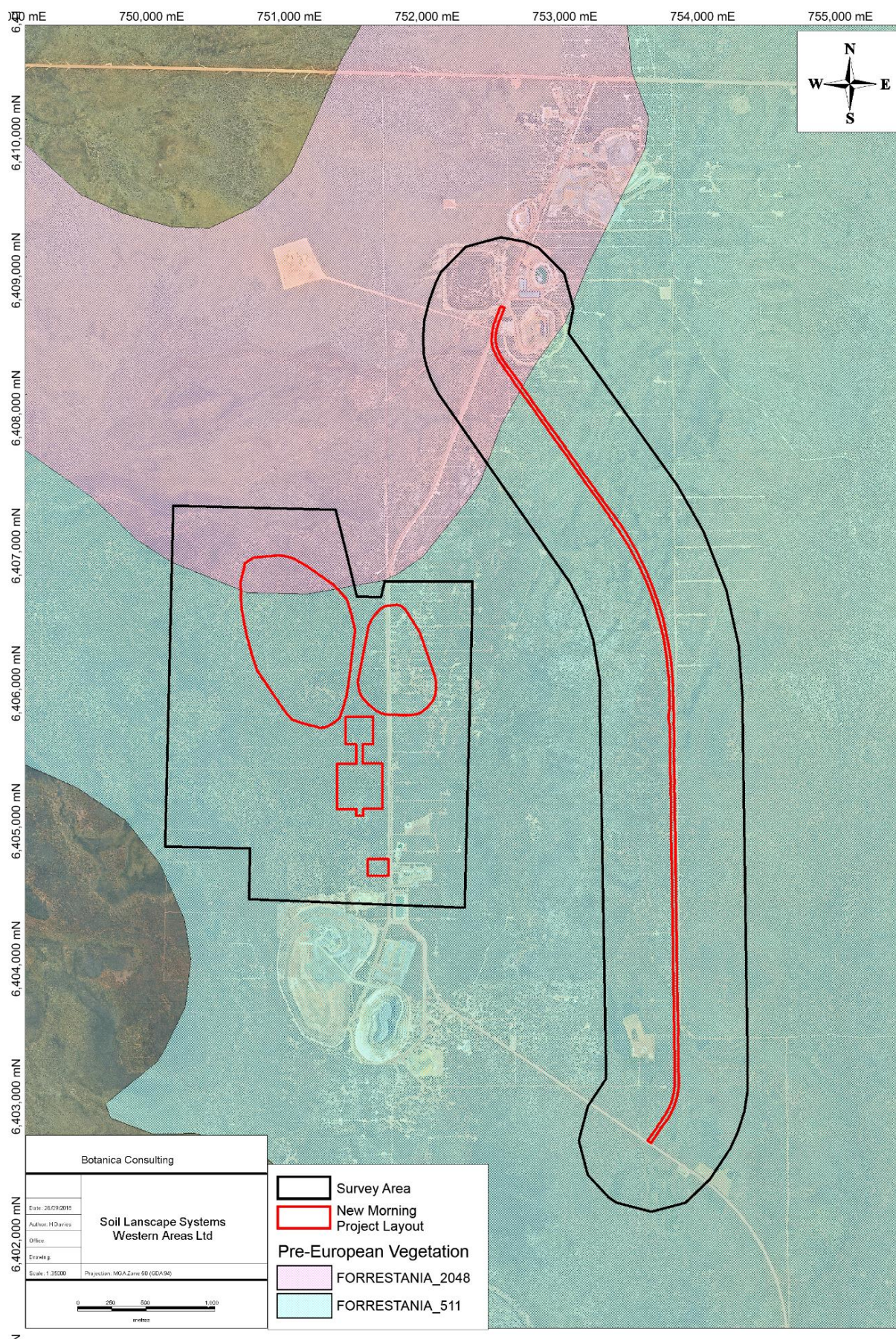


Figure 2-3: Pre-European Vegetation Associations within the New Morning Project survey area

2.4 Climate

The climate of the Southern Cross subregion is characterised as arid to semi-arid Mediterranean with an annual rainfall of 200-300mm (Beard, 1990; Cowan, 2001). The climate of the Western Mallee subregion is characterised as dry warm Mediterranean with an annual rainfall of 300-500mm (Beard, 1990; Beecham & Danks, 2001). Rainfall data for the Lake Carmody weather station (#10670) located approximately 30km south of the survey area is shown in Figure 2-4 and Figure 2-5 (BoM, 2018).

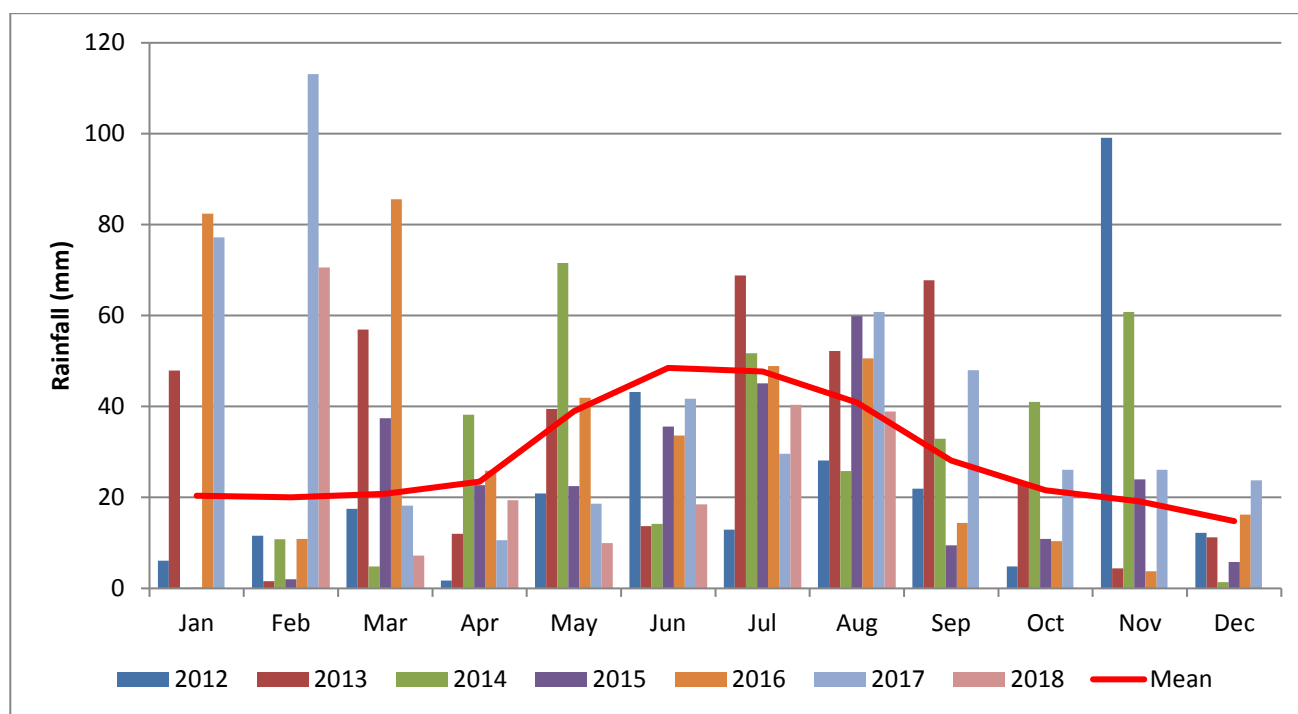


Figure 2-4: Monthly rainfall (January 2012 to August 2018) for the Lake Carmody weather station (#13030) (BoM, 2018a)

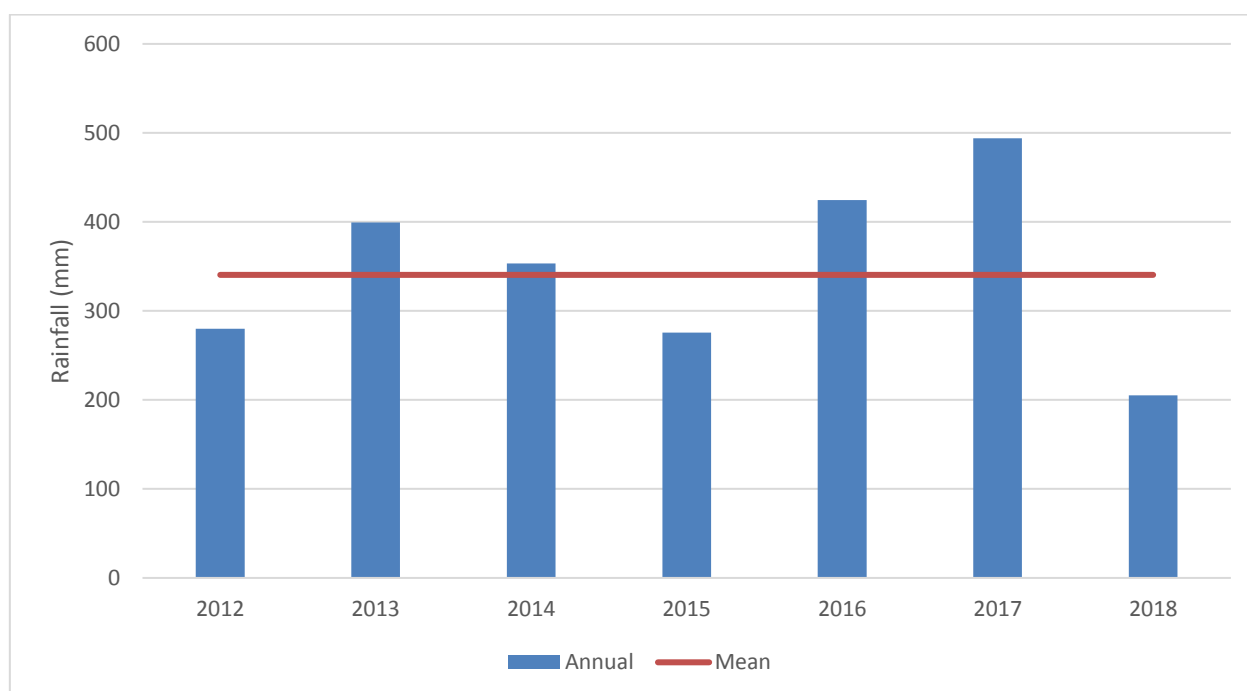


Figure 2-5: Monthly rainfall and mean monthly rainfall (January 2013 to August 2018) for the Lake Carmody weather station (#13030) (BoM, 2018a)

2.5 Hydrology

According to the Geoscience Australia database (2001) an intermittent (non-perennial) drainage line extend through the western region of the survey area. There are no inland water sources (lakes, playas etc.) within the survey area. The survey area is located approximately 4km east of the Camm paleochannel and 2km west of the Deborah paleochannel. According to the Bureau of Meteorology (2018b) *Groundwater Dependent Ecosystem Atlas*, there are no aquatic or terrestrial ecosystems within the assessment area. A map showing the regional hydrology and potential GDEs in the local region is provided in Figure 2-6.

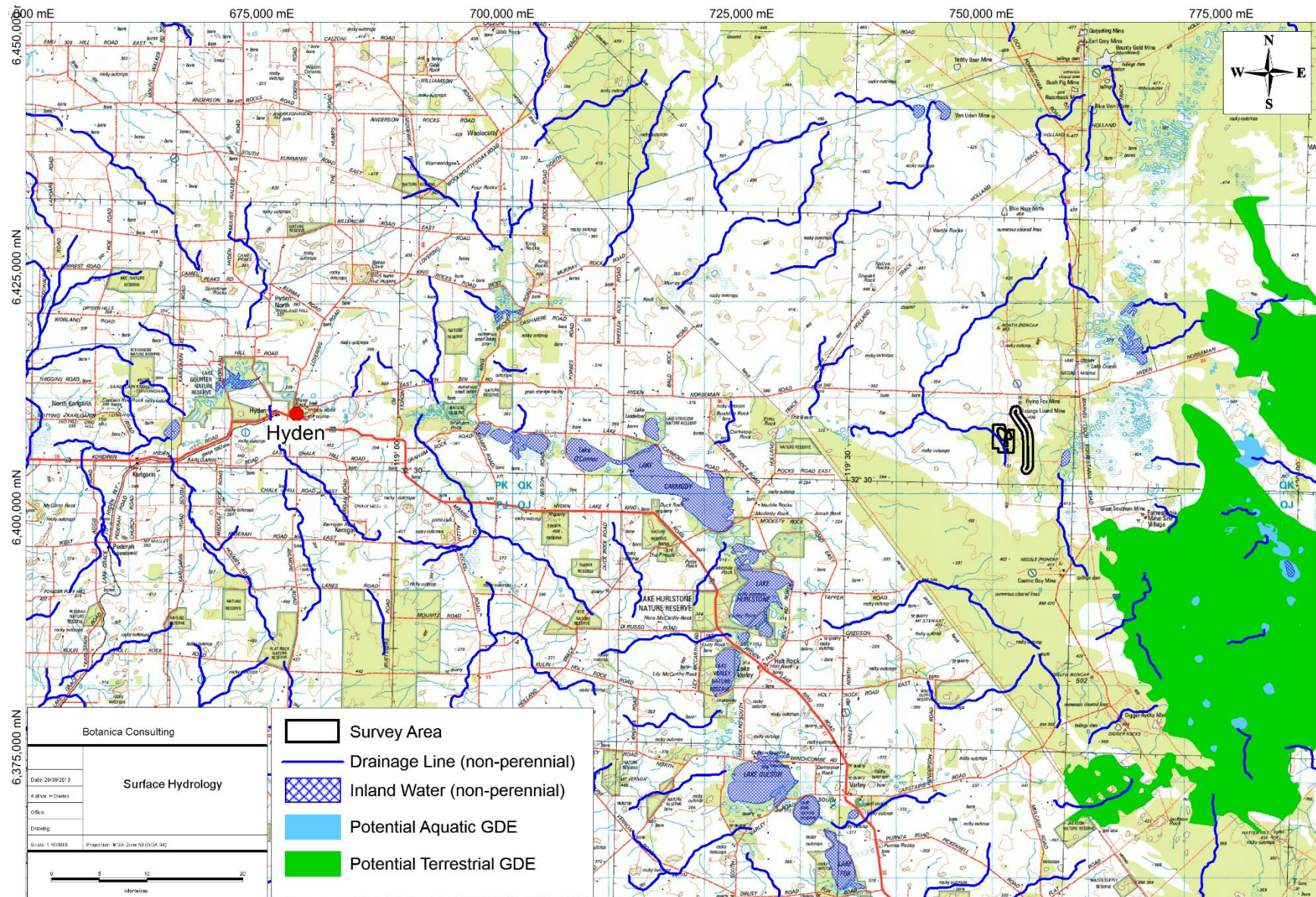


Figure 2-6: Hydrology of the New Morning Project survey area

2.6 Land Use

The dominant land uses of the Southern Cross subregion includes native pastures (17%), Conservation Reserves (11.53%), UCL & Crown Reserves (66.74%) and Cultivation – Dry Land agriculture (2.27%) (Cowan, 2001). The dominant land uses of the Western Mallee subregion includes Dry Land agriculture, UCL & Crown Reserves, roads and other easements.

The survey area also lies within the Great Western Woodlands. The Great Western Woodlands is considered by The Wilderness Society of WA to be of global biological and conservation importance as one of the largest and healthiest temperate woodlands on Earth, containing many endemic species. The region covers almost 16 million hectares, 160,000 square kilometers, from the southern edge of the Western Australian Wheatbelt to the pastoral lands of the Mulga country in the north, the inland deserts to the northeast, and the treeless Nullarbor Plain to the east (Figure 2-7).

The area provides an eastward connection between southwest forests and inland deserts (Gondwana Link) as well as linking the north-west passage to Shark Bay. The majority of the Great Western Woodlands is unallocated crown land (61.1%) with other interests including pastoral leases (20.4%), conservation reserves (15.4%) unallocated crown land ex pastoral managed by the DEC (2%) and private land (approximately 1%) (Watson *et. al.*, 2008).

No specific management strategy applies to the Great Western Woodlands, rather an approach to conservation which occurs across all land tenures and when different stakeholders work together with biodiversity in mind. The central component of this approach is to identify and conserve key large-scale, long term ecological processes that drive connectivity between ecosystems and species. The Great Western Woodlands currently includes towns, highways, roads, railways, private property, Crown Reserves, agricultural activities and mining tenements.

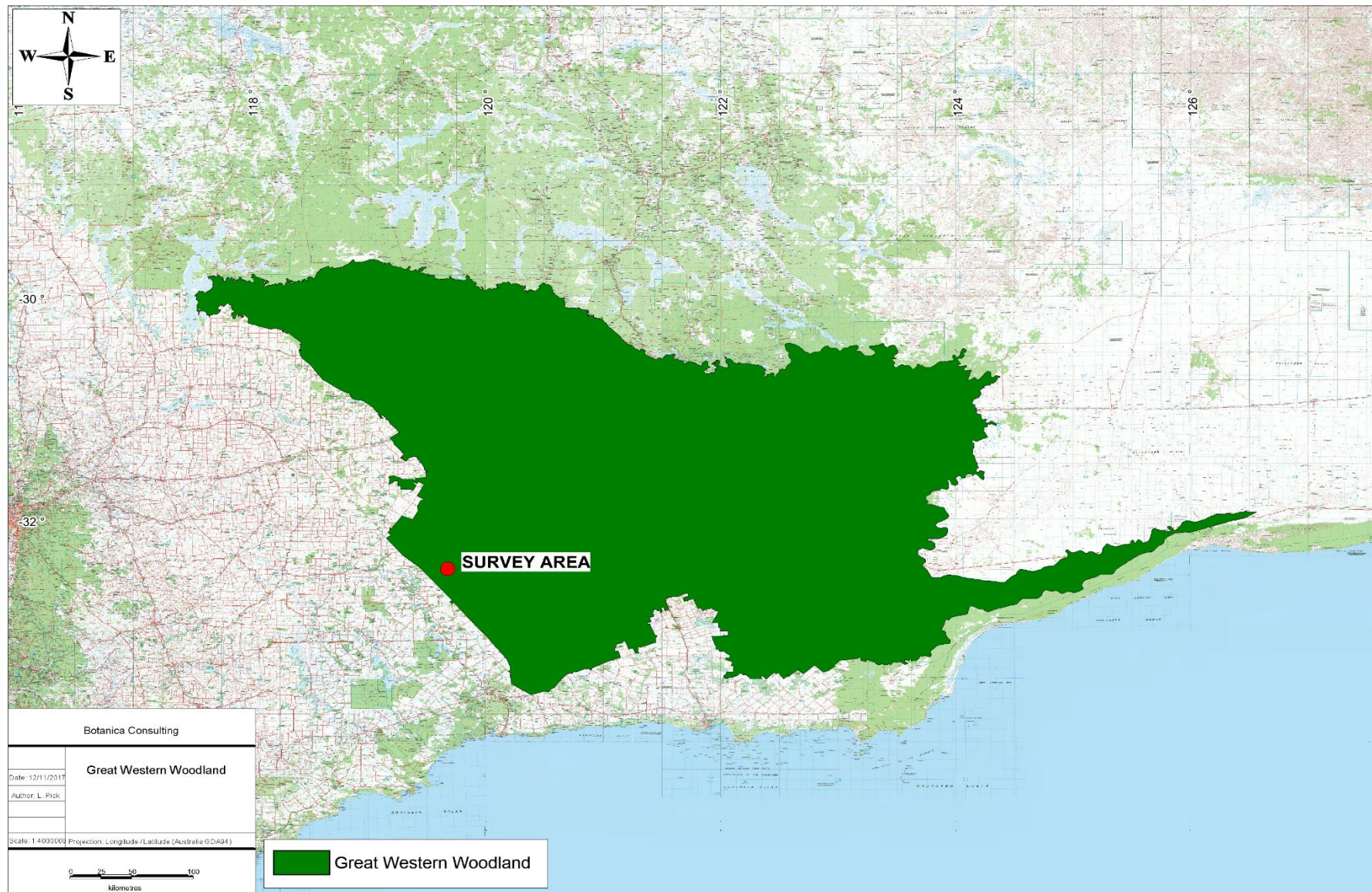


Figure 2-7: Location of survey area within the Great Western Woodlands (survey area no to scale)

3 Survey Methodology

3.1 Desktop Assessment

Prior to the field assessment a literature review was undertaken of previous flora and vegetation assessments conducted within the local region. Documents reviewed included:

- BC, (2006), Flora and Vegetation Survey of the Flying Fox North East Exploration Area for Western Areas, Botanica Consulting
- BC, (2007a), Vegetation Survey of a Proposed Extension to the Current Clearing Permit Number 691/1 at the Flying Fox mine site prepared for Western Areas, Botanica Consulting
- BC, (2007b), Flora and Vegetation Survey within the Greater Flying Fox mine site prepared for Western Areas, Botanica Consulting
- BC, (2008), Vegetation Survey of New Morning to Spotted Quoll Area within Tenements M77/583 and M77/545, Botanica Consulting
- BC, (2009), Flora and Vegetation Survey within the lounge Lizard/Flying Fox area, Proposed Gravel Pit, prepared for Western Areas, Botanica Consulting
- BC, (2010a), New Morning Flora and Vegetation Survey Prepared for Western Areas, Botanica Consulting
- BC, (2010b), New Morning Flora and Vegetation Survey Prepared for Western Areas, Botanica Consulting
- BC, (2011), Spotted Quoll/Cosmic Boy Haul Road Flora and Vegetation Survey, Prepared for Western Areas NL, Botanica Consulting
- BC (2017) Reconnaissance Flora & Vegetation Survey of the Greater New Morning/Spotted Quoll Area, Prepared for Western Areas Limited, Botanica Consulting
- How, R. A Newbey, K.R Dell, J. Muir, B.G & Hnatiuk, R.J, (1988), *The Biological survey of the Eastern Goldfields of Western Australia: Lake Johnston-Hyden*. Western Australian Museum Supplement No. 30.
- Gibson (2004) Flora and vegetation of the Eastern Goldfields Ranges: Part 7. Middle and South Ironcap, Digger Rock and Hatter Hill. Science Division, Department of Conservation and Land Management,
- JSWT, (2006a), *Vegetation Survey of the Exploration Drilling Program (M77/582 & E77/555), Prepared for Western Areas NL*, Botanica Consulting
- JSWT, (2006b), *North Flying Fox Drill Lines Flora Survey for Western Areas*, Jim's Seeds, Weeds & Trees
- JSWT, (2006c), *Vegetation Survey of three Proposed Monitoring Bores in the Flying Fox Area, Prepared for Western Areas*, Jim's Seeds, Weeds & Trees

Searches of the following databases were undertaken to aid in the compilation of a list of flora and fauna within the survey area:

- DBCA NatureMap Database (DBCA, 2018);
- DBCA's Threatened and Priority Flora search (DBCA, 2018b).
- DotEE Protected Matters search tool (DotEE, 2018).

The Naturemap and Protected Matters searches were conducted for an area encompassing a 20km radius of the centre coordinates; 32° 27' 45" S, 119° 40' 58" E.

It should be noted that these lists are based on observations from a broader area than the assessment area (20km radius) and therefore may include taxa not present. The databases also often included very old records that may be incorrect or in some cases the taxa in question have become locally or regionally extinct. Information from these sources should therefore be taken as indicative only and local knowledge and information also needs to be taken into consideration when determining what actual species may be present within the specific area being investigated.

The conservation significance of flora taxa was assessed using data from the following sources:

- *Environment Protection and Biodiversity and Conservation (EPBC) Act 1999*. Administered by the Australian Government (DotEE);
- *Wildlife Conservation (WC) Act 1950*¹. Administered by the WA Government (DBCA);
- Red List produced by the Species Survival Commission (SSC) of the World Conservation Union (also known as the IUCN Red List – the acronym derived from its former name of the International Union for Conservation of Nature and Natural Resources). The Red List has no legislative power in Australia but is used as a framework for State and Commonwealth categories and criteria; and
- Priority Flora list. A non-legislative list maintained by DBCA for management purposes (released 16th January 2018).

Table 3-1 provides the definitions of conservation significant flora under the WC Act and EPBC Act.

Table 3-1: Definitions of Conservation Significant Flora

Code	Category
State categories of threatened and priority species	
T	Threatened Flora “flora that has been declared to be ‘likely to become extinct or is rare, or otherwise in need of special protection’, pursuant to section 23F (2) of the Wildlife Conservation Act.”
Schedule 1	Critically Endangered – Flora that are considered likely to become extinct or rare, as critically endangered flora
Schedule 2	Endangered – Flora that are considered likely to become extinct or rare, as endangered flora
Schedule 3	Vulnerable – Flora that are considered likely to become extinct or rare, as vulnerable flora
Schedule 4	Extinct-Flora presumed to be extinct
P1	Priority One – Poorly Known Taxa “Taxa which are known from one or a few (generally <5) populations which are under threat, either due to small population size, or being on lands under immediate threat. Such taxa are under consideration for declaration as ‘rare flora’, but are in urgent need of further survey.”
P2	Priority Two – Poorly Known Taxa “Taxa which are known from one or a few (generally <5) populations, at least some of which are not believed to be under immediate threat (i.e. not currently endangered). Such taxa are under consideration for declaration as ‘rare flora’, but urgently need further survey.”

¹ The *Biodiversity Conservation Act 2016* received assent on 21 September 2016 with Parts of the Act coming into effect on 3 December 2016. Once fully enacted with enabling subsidiary regulations, it will replace the WC Act.

Code	Category
P3	<p>Priority Three – Poorly Known Taxa</p> <p>“Taxa which are known from several populations and the taxa are not believed to be under immediate threat (i.e. not currently endangered), either due to the number of known populations (generally >5), or known populations being large, and either widespread or protected. Such taxa are under consideration for declaration as ‘rare flora’ but needs further survey.”</p>
P4	<p>Priority Four – Rare Taxa</p> <p>“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.”</p>
Commonwealth categories of threatened species	
Extinct	Taxa where there is no reasonable doubt that the last member of the species has died.
Extinct in the wild	Taxa where it is known only to survive in cultivation, in captivity or as a naturalised population well outside its past range; or it has not been recorded in its known and/or expected habitat, at appropriate seasons, anywhere in its past range, despite exhaustive surveys over a time frame appropriate to its life cycle and form.
Critically endangered	Taxa that are facing an extremely high risk of extinction in the wild in the immediate future, as determined in accordance with the prescribed criteria.
Endangered	Taxa which are not critically endangered and is facing a very high risk of extinction in the wild in the near future, as determined in accordance with the prescribed criteria.
Vulnerable	Taxa which are not critically endangered or endangered and is facing a high risk of extinction in the wild in the medium-term future, as determined in accordance with the prescribed criteria.
Conservation dependent	<p>Taxa which are the focus of a specific conservation program the cessation of which would result in the species becoming vulnerable, endangered or critically endangered; or (b) the following subparagraphs are satisfied:</p> <ul style="list-style-type: none"> (i) the species is a species of fish; (ii) the species is the focus of a plan of management that provides for actions necessary to stop the decline of, and support the recovery of, the species so that its chances of long term survival in nature are maximised; (iii) the plan of management is in force under a law of the Commonwealth or of a State or Territory; (iv) cessation of the plan of management would adversely affect the conservation status of the species.

A search of the DBCA PEC and TEC database was also conducted within a 40km radius of the survey area (DPaW, 2012). Table 3-2 represents the definitions of Threatened and Priority Ecological Communities.

Table 3-2: Definitions of conservation significant communities

Category Code	Category
State categories of Threatened Ecological Communities (TEC)	
PTD	<p>Presumed Totally Destroyed</p> <p>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:</p>

Category Code	Category
	<p>records within the last 50 years have not been confirmed despite thorough searches or known likely habitats or;</p> <p>all occurrences recorded within the last 50 years have since been destroyed.</p>
CE	<p>Critically Endangered</p> <p>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, meeting any one of the following criteria:</p> <p>The estimated geographic range and distribution has been reduced by at least 90% and is either continuing to decline with total destruction imminent, or is unlikely to be substantially rehabilitated in the immediate future due to modification;</p> <p>The current distribution is limited i.e. highly restricted, having very few small or isolated occurrences, or covering a small area;</p> <p>The ecological community is highly modified with potential of being rehabilitated in the immediate future.</p>
E	<p>Endangered</p> <p>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. The ecological community must meet any one of the following criteria:</p> <p>The estimated geographic range and distribution has been reduced by at least 70% and is either continuing to decline with total destruction imminent in the short term future, or is unlikely to be substantially rehabilitated in the short term future due to modification;</p> <p>The current distribution is limited i.e. highly restricted, having very few small or isolated occurrences, or covering a small area;</p> <p>The ecological community is highly modified with potential of being rehabilitated in the short term future.</p>
V	<p>Vulnerable</p> <p>An ecological community will be listed as Vulnerable when it has been adequately surveyed and is not Critically Endangered or Endangered but is facing high risk of total destruction in the medium to long term future. The ecological community must meet any one of the following criteria:</p> <p>The ecological community exists largely as modified occurrences that are likely to be able to be substantially restored or rehabilitated;</p> <p>The ecological community may already be modified and would be vulnerable to threatening process, and restricted in range or distribution;</p> <p>The ecological community may be widespread but has potential to move to a higher threat category due to existing or impending threatening processes.</p>
Commonwealth categories of Threatened Ecological Communities (TEC)	
CE	<p>Critically Endangered</p> <p>If, at that time, an ecological community is facing an extremely high risk of extinction in the wild in the immediate future (indicative timeframe being the next 10 years).</p>

Category Code	Category
E	Endangered If, at that time, an ecological community is not critically endangered but is facing a very high risk of extinction in the wild in the near future (indicative timeframe being the next 20 years).
V	Vulnerable If, at that time, an ecological community is not critically endangered or endangered, but is facing a high risk of extinction in the wild in the medium-term future (indicative timeframe being the next 50 years).
Priority Ecological Communities (PEC)	
P1	Poorly-known ecological communities Ecological communities with apparently few, small occurrences, all or most not actively managed for conservation (e.g. within agricultural or pastoral lands, urban areas, active mineral leases) and for which current threats exist.
P2	Poorly-known ecological communities Communities that are known from few small occurrences, all or most of which are actively managed for conservation (e.g. within national parks, conservation parks, nature reserves, State forest, un-allocated Crown land, water reserves, etc.) and not under imminent threat of destruction or degradation.
P3	Poorly known ecological communities Communities that are known from several to many occurrences, a significant number or area of which are not under threat of habitat destruction or degradation or: Communities known from a few widespread occurrences, which are either large or within significant remaining areas of habitat in which other occurrences may occur, much of it not under imminent threat, or; Communities made up of large, and/or widespread occurrences, that may or not be represented in the reserve system, but are under threat of modification across much of their range from processes such as grazing and inappropriate fire regimes.
P4	Ecological communities that are adequately known, rare but not threatened or meet criteria for near threatened, or that have been recently removed from the threatened list. These communities require regular monitoring.
P5	Conservation Dependent ecological communities Ecological communities that are not threatened but are subject to a specific conservation program, the cessation of which would result in the community becoming threatened within five years.

3.2 Field Assessment

Botanica Consulting (BC) conducted a detailed flora and vegetation survey and targeted flora survey of the New Morning Project (referred to as the 'survey area') from the 26th to 29th August 2018. The detailed survey covered an area of approximately 1,298 ha. Thirty-six quadrats (20m X 20m) were established during the survey.

Prior to the commencement of field work, aerial photography was inspected and obvious differences in the vegetation assemblages were identified. The different vegetation communities identified were then inspected during the field survey to assess their validity. A handheld GPS unit was used to record the coordinates of the boundaries between vegetation communities. At each sample point, the following information was recorded:

- GPS location;
- Photograph of vegetation;
- Dominant taxa for each stratum;
- All vascular taxa (including annual taxa);
- Landform classification;
- Vegetation condition rating;
- Collection and documentation of unknown plant specimens; and
- GPS location, photograph and collection of flora of conservation significance if encountered.

Unknown specimens collected during the survey were identified with the aid of samples housed at the BC Herbarium and WAHERB. Vegetation associations were classified in accordance with the NVIS Vegetation Association (NVIS Level III) classification. Presence/absence data of taxa from sample sites were used to compile the representative floristic groups. The survey area was traversed by two people via 4WD, all-terrain vehicle, and on foot (Figure 3-1).

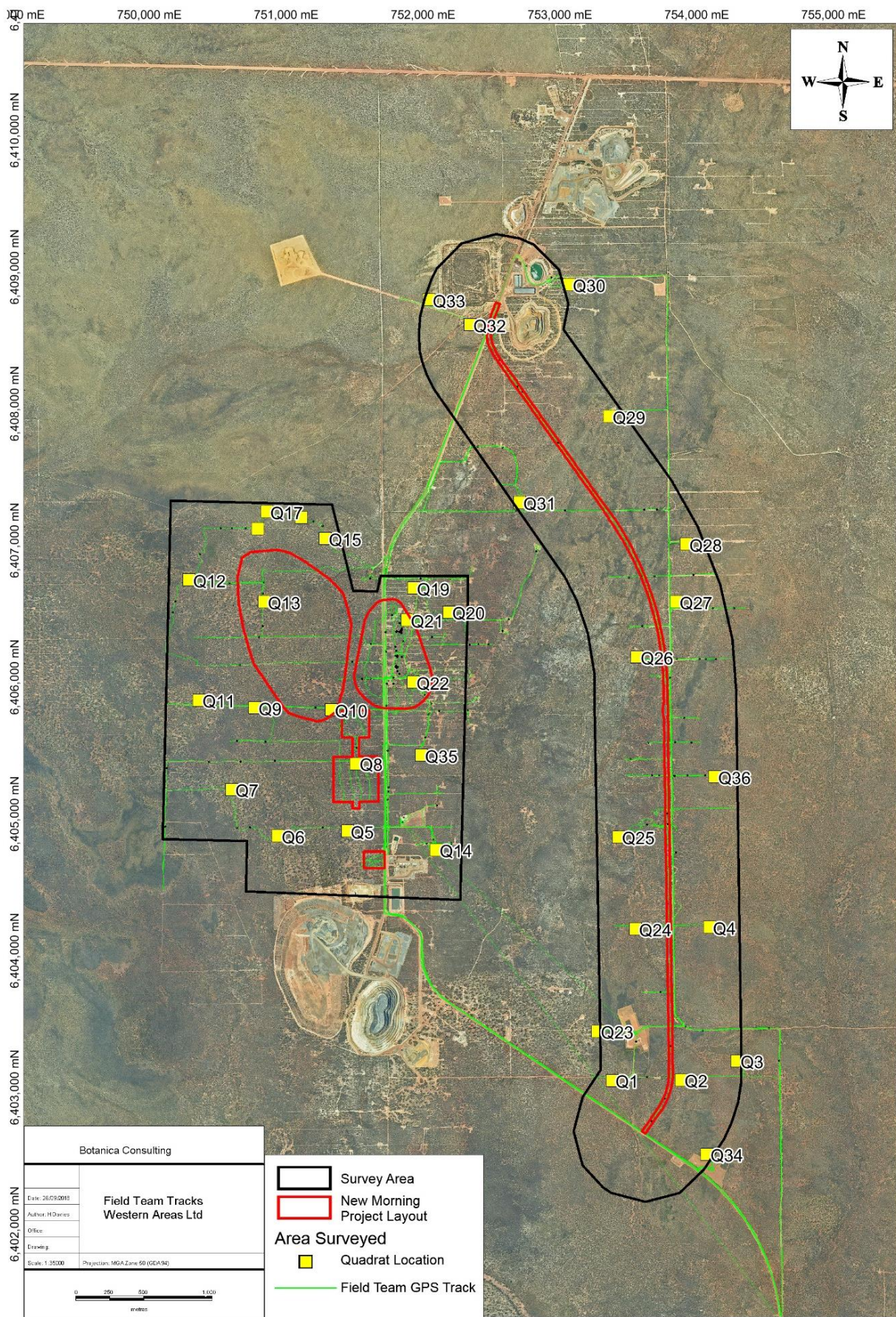


Figure 3-1: Quadrat locations, survey area boundary and GPS tracks traversed throughout the New Morning Project survey area

3.2.1 Sampling Quadrats

Thirty-six 20m x 20m quadrats were established within the survey area (Figure 3-1). The objective was to have at least three quadrats per vegetation type to capture the floristic variations within the survey area. The quadrats were established by inserting metal pickets into the NW corner, and measuring the length of the resultant boundaries to verify the quadrats were 20m x 20m (square quadrats).

Following their establishment and boundary verification, the location of each quadrat was recorded by GPS (Appendix 5) photographed (Appendix 7) and all vascular plants within the quadrat were recorded (Appendix 6). This included recording of dominant taxa from the upper, middle and lower stratum, and sampling of all unknown taxa. Unknown taxa were identified using BC's own reference herbarium and relevant taxonomical keys or by a taxonomic consultant. Data on level of disturbance, presence of coarse fragments on surface, topographical position, elevation, aspect, percentage litter, percentage bare ground, percentage surface rock (bedrock and surface deposits), soil types (colour, profile, field texture and surface type), and vegetation structure were collected from each quadrat (Appendix 6). Methods of recording data from these quadrats largely follow those outlined in CSIRO's *Australian Soil and Land Survey Field Handbook* (McDonald *et al.* 1998) and in accordance with EPA Guidelines (2016).

3.2.2 Targeted Flora Survey

A targeted search for flora of conservation significance (Priority and Threatened Flora) was conducted within the New Morning Project footprint (covering an area of ~147 ha). The footprint was systematically searched on foot by two Botanica staff members to identify and record the locations of Threatened and Priority Flora. All locations of Threatened and Priority Flora were recorded using a hand-held GPS and a simple plant count (not differentiated between juvenile/ mature plants, flowering or non-flowering plants) was conducted for each record.

3.2.3 Personnel involved

Jim Williams - Environmental Consultant/ Director (Diploma of Horticulture)
Lauren Pick - Environmental Consultant (BSc Zoology & Conservation Biology)

3.2.4 Scientific licences

Table 3-3: Scientific Licences of Botanica Staff coordinating the survey

Licensed staff	Permit Number	Valid Until
Jim Williams	SL012391 (Licence to flora for scientific purposes)	26/05/2018 to 27/05/2019
Lauren Pick	SL012392 (Licence to flora for scientific purposes)	26/05/2018 to 27/05/2019

3.3 Data Analysis Tools

Once the survey was completed the data obtained was analysed to generate a vegetation map. The statistical program PATN was used to assess species composition of the quadrats (Appendix 8).

3.3.1 PATN Analysis

The PATN software package was used to assess the similarities/ dissimilarities between quadrats based on presence/ absence of species. Annual taxa were removed from the data prior to analysis (total of seven annual taxa). Species reconciliation eliminated those sterile taxa that could not be fully

identified from the analysis (eleven taxa), and reconciled subsp. and/or variant taxa (two taxa). Singleton taxa were excluded from the analysis (56 taxa). Of the 167 taxa recorded within the quadrats, 93 taxa were used in the analysis.

The analysis produced a quantitative estimate of the relationship between species composition of each quadrat. The classifications were based upon a Bray-Curtis association matrix using a flexible Unweighted Pair Group Arithmetic Mean (UPGMA) method (with a beta value of -0.1) which standardises the data enabling the analysis to be completed. Semi-strong hybrid (SSH) ordination of the quadrat is then undertaken to show spatial relationships between groups and to elucidate possible environmental correlates with the classification.

The analysis also produced a stress value which is a measure of the 'strength' of the analysis (i.e. how well the quadrats are grouped together into the appropriate floristic groups). The lower the stress value the greater the strength of the analysis with a value of less than 0.3 showing that the analysis appropriately grouped quadrats. A stress value greater than 0.3 suggests that the analysis was unable to group quadrats appropriately due to extraneous variables (i.e. other factors influencing differences in floristic groups other than species composition e.g. fire, clearing disturbance etc.).

3.3.2 EstimateS

EstimateS software was used to estimate species richness present using the Chao2 richness estimator. For any number of samples, the estimator uses the existing pattern of species accumulation to estimate the true number of species at a site. The estimators tend to under-estimate species number when sample size is small, hence the estimated number of true species can be seen to increase with sample size. This software was also used to compute Coleman rarefaction curves estimates which were used to calculate species accumulation curves.

3.4 Flora survey limitations and constraints

It is important to note that flora surveys will entail limitations notwithstanding careful planning and design. Potential limitations are listed in Table 3-4.

Table 3-4: Limitations and constraints associated with the flora and vegetation survey

Variable	Potential Impact on Survey	Details
Access problems	Not a constraint	The survey was conducted via 4WD and on foot. Numerous tracks were located within the survey area, providing ease of access.
Competency/ Experience	Not a constraint	The BC personnel that conducted the survey were regarded as suitably qualified and experienced. Coordinating Botanist: Jim Williams Field Staff: Jim Williams, and Lauren Pick Data Interpretation: Jim Williams and Lauren Pick
Timing of survey, weather & season	Not a constraint	Fieldwork was conducted in late August 2018 consistent with the EPA recommended approximate timing (Spring). Majority of the flora was in flower, annual species were present and short-lived species such as Orchids were also present during the survey. Supplementary fieldwork should be scheduled after Autumn rains in accordance with EPA guidelines.

Variable	Potential Impact on Survey	Details
Area disturbance	Minor constraint	The majority of the survey area is in very good condition and comprised of native vegetation. Disturbance in the area was a result of exploration and access tracks.
Survey Effort/ Extent	Not a constraint	Survey intensity was appropriate for the size/significance of the area with a detailed survey completed to identify vegetation communities, and flora of conservation significance. A targeted search to identify all Priority Flora populations was conducted within the Project footprint.
Availability of contextual information at a regional and local scale	Minor constraint	Conservation significant flora database searches provided by the DBCA were used to identify any potential locations of Threatened/Priority Flora species. BoM, DWER, DPIRD, DBCA and DotEE databases were reviewed to obtain appropriate regional desktop information on the biophysical environment of the local region. Botanica have conducted a number of surveys within the Forrestania region and were also able to obtain information about the area from previous research conducted within the area. Results of previous flora assessments in the local area were reviewed to provide context on the local environment
Data Analysis	Minor constraint	BC staff conducting the PATN statistical analyses are not statistical analysts and have basic statistics training. These analyses are used to provide basic information on the relationships between vegetation communities delineated in the field.
Completeness	Not a constraint	In the opinion of BC, the survey area was covered sufficiently in order to identify vegetation assemblages. Survey work was conducted in optimal flowering period (Spring). Many of the plants during the survey were in flower and many annual species were present. It is estimated that approximately >90% of the flora within the survey area were able to be fully identified. The vegetation associations for this study were based on visual descriptions of locations in the field. The distribution of these vegetation associations outside the study area is not known, however vegetation associations identified were categorised via comparison to vegetation distributions throughout WA given on NVIS (DotEE, 2017).

4 Results

4.1 Desktop Assessment

4.1.1 Literature Review

Flora and vegetation surveys, assessments and reviews have been undertaken in nearby areas in the past, though not all are publicly available and some could not be referenced. The most significant of those available have been used as the primary reference material for the current vegetation assessment (Table 4-1).

Table 4-1: Previous Flora and Vegetation Surveys within the New Morning Project and surrounding area

Author & Year	Vegetation	Flora of Conservation Significance
Newbey & Hnatiuk, (1988)	<p>Between July 1979 and October 1981, a biological survey of the Lake Johnston-Hyden region covering approximately 20,300km² was conducted.</p> <p>Nine vegetation systems of the Study Area and, when broadly classified, represented 51 vegetation associations. Seven unique vegetation associations and a further five that were rare both within the Study Area and Eastern Goldfields were recorded. Specialised vegetation mosaics were recorded on the banded ironstone formation of Bremer Range, North Ironcap, Middle Ironcap and South Ironcap (the greenstone belt from Hatters Hill to Mt Holland), and on the granites of Peak Charles and Peak Eleanor. Woodlands (15-20 m) were scattered on Broad Valleys, Salt Lake Features and Sandplains. Low woodlands <15 m) dominated Undulating Plains (greenstone) and Broad Valleys. They were scattered on Hills (granite) and present on some of the larger Granite Exposures with substantial run-off. Mallees (3-6 m) were common on Sandplains and Broad Valleys, and scattered on Hills (granite), Salt Lake Features and larger Granite Exposures. Tall shrublands (> 1 m) dominated on Hills (granite), were common on Sandplains, and scattered on Salt Lake Features and Hills (banded ironstone formation). Salt Lake Features were the main areas for low shrublands <1 m) with scattered occurrences on Sandplains. Complexes were common on Breakaways, Granite Exposures, Hills (granite and banded ironstone formation) but rare on Undulating Plains (greenstone).</p> <p>The vascular flora comprised 1076 species, 17 subspecies and 29 varieties of flowering plants and six species of fern. Twenty new species, 79 rarely collected species, of which 39 were endemic to the area, and 14 major range extensions were recorded in the Study Area.</p>	<i>Banksia sphaerocarpa</i> var. <i>dolichostyla</i> (T)
Gibson (2004)	<p>Gibson conducted a study of the flora and plant communities of part of Forresteria greenstone belt between Middle Ironcap and Hatter Hill (some 80 km ESE of Hyden). The study recorded a total flora of 345 taxa of which 342 were native and three were introduced. Three species of threatened flora and 29 taxa being considered for listing were found. Ten species are considered to be endemic to the range and a further eight species are restricted to similar landforms within 100 km of the range.</p> <p>Four community types were identified;</p> <p>Community 1- Species-rich shrublands or mallee shrublands on skeletal soils derived from banded ironstone and the massive laterites</p> <p>Community 2- Mallee shrublands or <i>Allocasuarina</i> thickets primarily found on massive laterites.</p>	<i>Acacia heterochroa</i> subsp. <i>robertii</i> (P2) <i>Acacia singula</i> (P3) <i>Acacia tetraeneura</i> (P1) <i>Banksia rufa</i> subsp. <i>flavescens</i> (P3) <i>Banksia sphaerocarpa</i> var. <i>dolichostyla</i> (T) <i>Banksia viscida</i> (P3) <i>Bentleya diminuta</i> (P2) <i>Boronia revolute</i> (T) <i>Calamphoreus inflatus</i> (P4) <i>Eremophila racemosa</i> (P4) <i>Eucalyptus exigua</i> (P3)

Author & Year	Vegetation	Flora of Conservation Significance
	<p>Community 3- Eucalypt woodlands dominated or co-dominated by <i>Eucalyptus urna</i> and <i>E. salubris</i> occurring on the colluvial deposits on the flats below the outcrops or on the broad flat ridges along the range generally with an understorey dominated by <i>Melaleuca</i> spp.</p> <p>Community 4- species poor mallee community generally dominated by <i>Eucalyptus calycogona</i> with large emergent <i>Eucalyptus salmonophloia</i> on small colluvial flats</p>	<p><i>Eucalyptus georgei</i> subsp <i>fulgida</i> (P4)</p> <p><i>Eucalyptus rugulata</i> (P4)</p> <p><i>Eutaxia acanthoclada</i> (P3)</p> <p><i>Grevillea insignis</i> subsp <i>elliottii</i> (P3)</p> <p><i>Grevillea lullfitzii</i> (P1)</p> <p><i>Hibbertia axillibarba</i> (P1)</p> <p><i>Hibbertia carinata</i> (P1)</p> <p><i>Leucopogon marginatus</i> (T)</p> <p><i>Leucopogon</i> sp Ironcaps (N Gibson & K Brown 3070) (P3)</p> <p><i>Melaleuca agathosmoides</i> (P1)</p> <p><i>Microcybe pauciflora</i> subsp <i>grandis</i> (P1)</p> <p><i>Mirbelia densiflora</i> (P3)</p> <p><i>Orianthera exilis</i> (P2)</p> <p><i>Phebalium brachycalyx</i> (P3)</p> <p><i>Stenanthemum liberum</i> (P1)</p> <p><i>Stylidium sejunctum</i> (P3)</p>
JSWT (2006a)	<p>Jim's Seeds, Weeds and Trees (JSWT) was commissioned by WSA to undertake a Level 1 flora and vegetation survey of the North Flying Fox proposed drill lines, located approximately 80km east of Hyden. The survey was conducted on the 1st and 2nd February 2006, covering an area of approximately 17ha.</p> <p>Two vegetation communities were identified in the survey area; <i>Eucalyptus</i> mallee woodland and sandplain heath. These vegetation communities were represented by a total of 22 Families, 42 Genera and 81 Species (including sub-species and variants).</p>	No flora of conservation significance
JSWT (2006b)	<p>JSWT was commissioned by WSA to undertake a Level 1 flora and vegetation survey of the North Flying Fox proposed drill lines, located approximately 100km east of Hyden. The survey was conducted on the 12th April 2005, covering an area of approximately 4.2ha.</p> <p>Two vegetation communities were identified in the survey area; <i>Eucalyptus</i> mallee woodland and sandplain heath. These vegetation communities were represented by a total of 17 Families, 36 Genera and 69 Species (including sub-species and variants).</p>	<i>Verticordia mitodes</i> (P3)
JSWT (2006c)	<p>JSWT was commissioned by WSA to undertake a Level 1 flora and vegetation survey of three proposed monitoring bore sites, located approximately 80km east of Hyden. The survey was conducted on the 10th April 2006, covering an area of approximately 1.24ha.</p> <p>Two vegetation communities were identified in the survey area; <i>Eucalyptus salmonophloia</i> woodland and <i>Acacia</i> heath. These vegetation communities were represented by a total of 19 Families, 31 Genera and 53 Species (including sub-species and variants).</p>	<i>Microcorys</i> sp. Forrestania (V. English, 2004) (P4).
Botanica (2006)	<p>Botanica was commissioned by WSA to undertake a Level 1 flora and vegetation survey of the Flying Fox North East Area, located approximately 80km east of Hyden. The survey was conducted from the 29th to the 30th October 2006, covering an area of approximately 329.8ha.</p> <p>Four vegetation communities were identified in the survey area; <i>Eucalyptus salmonophloia</i> woodland, <i>Eucalyptus</i></p>	<p><i>Microcorys</i> sp. Forrestania (V. English, 2004) (P4)</p> <p><i>Boronia westringioides</i> (P2)</p> <p><i>Baeckea</i> sp. North Ironcap (P2) and</p> <p><i>Daviesia elongata</i> subsp. <i>implexa</i> (P3)</p>

Author & Year	Vegetation	Flora of Conservation Significance
	mallee woodlands, Sandplain Heath and Kwongan vegetation. These vegetation communities were represented by a total of 26 Families, 54 Genera and 132 Species (including sub-species and variants).	
Botanica (2007a)	<p>Botanica was commissioned by WSA to undertake a Level 1 flora and vegetation survey at the Flying Fox mine site, located approximately 80km east of Hyden. The survey was conducted on the 1st June 2007, covering an area of approximately 46ha.</p> <p>Two vegetation communities were identified in the survey area; <i>Eucalyptus</i> mallee woodland and sandplain heath. These vegetation communities were represented by a total of 20 Families, 24 Genera and 34 Species (including sub-species and variants).</p>	<i>Daviesia elongata</i> subsp. <i>implexa</i> (P3).
Botanica (2007b)	<p>Botanica was commissioned by WSA to undertake a Level 1 flora and vegetation survey at the Flying Fox mine site, located approximately 80km east of Hyden. The survey was conducted on the 8th October 2007, covering an area of approximately 247.83ha.</p> <p>Three vegetation communities were identified in the survey area; <i>Eucalyptus</i> mallee woodland, Sandplain Heath and Rehabilitation vegetation. These vegetation communities were represented by a total of 24 Families, 47 Genera and 106 Species (including sub-species and variants).</p>	<i>Microcorys</i> sp. <i>Forrestania</i> (V. English, 2004) (P4).
Botanica (2017)	<p>Botanica was commissioned by WSA to undertake a reconnaissance flora and vegetation survey of the Greater New Morning/Spotted Quoll area. The survey was conducted in October 2017 covering an area of 1,674 ha.</p> <p>A total of eleven vegetation types were identified within the survey area:</p> <ol style="list-style-type: none"> 1. Low woodland of <i>Eucalyptus flocktoniae</i>/<i>Eucalyptus salubris</i>/<i>Eucalyptus urna</i> over low scrub of mixed <i>Acacia</i> and <i>Melaleuca</i>; 2. Open shrub mallee of <i>Eucalyptus celastroides</i>/<i>Eucalyptus cylindrocarpa</i>/<i>Eucalyptus eremophila</i> over low scrub of mixed <i>Acacia</i> and <i>Melaleuca</i>; 3. Low woodland of <i>Eucalyptus salmonophloia</i> over low scrub of mixed <i>Melaleuca</i>; 4. Heath of mixed <i>Acacia</i>, <i>Allocasuarina</i> and <i>Melaleuca</i>; 5. Low woodland of <i>Eucalyptus calycogona</i>/<i>Eucalyptus pileata</i> over low scrub of <i>Acacia hemiteles</i>/<i>Melaleuca hamata</i> on rocky outcrop; 6. Mallee of <i>Eucalyptus eremophila</i>/<i>Eucalyptus steedmanii</i> over mixed dwarf scrub; 7. Heath of <i>Acacia steedmanii</i> subsp. <i>steedmanii</i>/<i>Melaleuca hamata</i> over mixed low scrub; 8. Low scrub of mixed <i>Allocasuarina</i> over mixed dwarf scrub; 9. Open tree mallee of <i>Eucalyptus eremophila</i> over scrub of <i>Melaleuca hamata</i> on stony rise; 10. Burnt open low woodland of <i>Eucalyptus salmonophloia</i> over shrub mallee of <i>Eucalyptus cylindrocarpa</i>/<i>Eucalyptus pileata</i> and mixed low heath (including sub-community Heath of <i>Melaleuca hamata</i>); and 11. Forest of <i>Eucalyptus urna</i> over low scrub of <i>Melaleuca pauperiflora</i> subsp. <i>pauperiflora</i>. <p>These eleven vegetation types were represented by a total of 29 Families, 74 Genera and 205 Species (including sub-species and variants).</p>	<p><i>Eucalyptus steedmanii</i> (T) <i>Eremophila racemosa</i> (P4) <i>Eutaxia acanthoclada</i> (P3) <i>Microcorys</i> sp. <i>Forrestania</i> (V. English 2004) <i>Stylidium sejunctum</i> (P3).</p>

The results of the literature review, combined search of the DBCA's Flora of Conservation Significance databases (DBCA, 2018b), NatureMap search and DotEE protected matters search recorded one Threatened Flora and four Priority Flora taxa within the survey area. An additional three Threatened Flora taxa and sixty-five Priority Flora taxa were listed as occurring within an 80 km radius of the survey area. These taxa were assessed and ranked for their likelihood of occurrence within the survey area (Table 4-2). The rankings and criteria used were:

- **Unlikely:** Area is outside of the currently documented distribution for the species/no suitable habitat (type, quality and extent) was identified as being present during the field/desktop assessment.
- **Possible:** Area is within the known distribution of the species in question and habitat of at least marginal quality was identified as being present during the field/desktop assessment, supported in some cases by recent records being documented from within or near the area.
- **Known to Occur:** The species in question was positively identified as being present during field surveys.

Table 4-2: Likelihood of occurrence for Flora of Conservation Significance within the survey area

Taxon	Conservation Code			Description (WAHERB, 2018)	Likelihood of Occurrence
	EPBC Act	WC Act	Priority Listing		
<i>Banksia sphaerocarpa</i> var. <i>dolichostyla</i>	VU	VU		Lignotuberous shrub, 1-3 m high. Fl. yellow-orange, Mar to May. Lateritic gravel, grey sand.	Possible
<i>Boronia revoluta</i>	EN	VU		Shrub, 0.4-0.8 m high. Fl. pink, Jul to Aug. Stony sandy loam or sand. Plains, hillsides & summits.	Unlikely
<i>Eucalyptus steedmanii</i>	VU	VU		Tree, 2-8(-12) m high, bark smooth. Fl. white, Jan to Mar. Gravelly loam over ironstone, sand. Low hills, undulating plains.	Known to occur
<i>Paragoodia crenulata</i>	CE	VU		No description available	Possible
<i>Acacia tetraneura</i>			P1	Low spreading shrub, 0.3-0.4 m high. Fl. yellow, May to Jul. Clay & lateritic gravel. Ridges & low rises.	Possible
<i>Austrostipa</i> sp. Mt Holland (W.A. Thompson & J. Allen 948)			P1	No description available	Possible
<i>Baeckea</i> sp. Blue Haze Mine (P. Armstrong 06/910)			P1	No description available	Possible
<i>Baeckea</i> sp. Crossroads (B.L. Rye & M.E. Trudgen 241186)			P1	No description available	Possible
<i>Baeckea</i> sp. Lake Cronin (K.R. Newbey 9191)			P1	Upright, spreading, moderately open shrub. Fl. white/pink, Oct. Well-drained gravelly sands. Moderately exposed, gently undulating plain.	Possible
<i>Baeckea</i> sp. North Ironcap (R.J. Cranfield 10580)			P1	Erect, open shrub, to 0.4 m high. Fl. white/pink, Oct. Red clay. Gently undulating sandplains.	Possible

Taxon	Conservation Code			Description (WAHERB, 2018)	Likelihood of Occurrence
	EPBC Act	WC Act	Priority Listing		
<i>Brachyloma nguba</i>			P1	Erect, compact to spreading, mid-dense shrub, to 0.8 m high, leaves discolorous, usually 2-3 mm long; style 0.2-0.25 mm long; disc truncate. Fl. red, Apr to May. White to brown sandy clay, shallow sandy loam. Open mallee woodland, mallee scrub, flat plains.	Possible
<i>Dampiera scaevolina</i>			P1	Erect to ascending perennial, herb or shrub, 0.2-0.5 m high. Fl. blue/white, Sep to Nov. Sandy & gravelly soils.	Possible
<i>Eucalyptus myriadena</i> subsp. <i>parviflora</i>			P1	Mallee or tree, 3-10 m high, bark rough, coarse & flaky on trunk, smooth above. Loam. Swamps, plains.	Unlikely
<i>Gastrolobium tenue</i>			P1	Low, bushy shrub, to 0.6 m high. Fl. Orange & red & purple, Sep to Oct. Yellow sand or sandy clay. Undulating dunes, stony outcrops.	Unlikely
<i>Gnephosis intonsa</i>			P1	Prostrate to ascending annual, herb, 0.01-0.04 m high. Fl. yellow-brown, Sep to Oct. Red/brown clay, stony saline loam.	Unlikely
<i>Hemigenia</i> sp. Newdegate (E. Bishop 75)			P1	Spindly, erect to spreading shrub, 0.2-0.45 m high, to 0.5 m wide. Fl. blue/purple, Sep to Oct. Clay loam. Disturbed sites.	Possible
<i>Hibbertia axillibarba</i>			P1	Shrub, to 0.7 m high. Fl. yellow, Sep to Oct. Lateritic soil. Ranges.	Possible
<i>Lepidosperma amantiferrum</i>			P1	Tufted rhizomatous, herb (sedge), leaves 0.15-0.42 m high, culms and leaves distichous. Yellow sandy loam with banded ironstone gravel and rocks. Gentle lower slopes.	Possible
<i>Lepidosperma ferriculmen</i>			P1	Tufted rhizomatous, perennial, herb (sedge), leaves 0.16-0.38 m high, culms and leaves distichous. Well-drained orange-red sandy loam with banded ironstone gravel and rocks. Stony slopes.	Possible
<i>Scaevola tortuosa</i>			P1	Ascending perennial, herb, 0.1-0.2 m high. Fl. blue-purple/pink, Oct. Sandy clay. Margins of salt lakes.	Unlikely
<i>Stenanthemum liberum</i>			P1	Dwarf shrub, ca 0.5 m high. Yellow sandy loam over laterite.	Possible
<i>Stylidium validum</i>			P1	Caespitose perennial, herb, 0.06-0.3 m high, Leaves tufted, oblanceolate, 1.5-10 cm long, 2.2-6 mm wide, apex acute to acuminate, margin entire, glabrous, glaucous. Scape glabrous. Inflorescence paniculate. Fl. white/pink, Sep to Oct. Clayey sand or loam, ironstone, greenstone gravel. Hillslopes and hilltops. Eucalypt woodland, mallee shrubland.	Possible
<i>Teucrium</i> sp. dwarf (R. Davis 8813)			P1	Compact, dwarf shrub, 0.1 m high, to 0.1 m wide. Fl. white, Apr. Hills, road verges.	Possible

Taxon	Conservation Code			Description (WAHERB, 2018)	Likelihood of Occurrence
	EPBC Act	WC Act	Priority Listing		
<i>Acacia asepala</i>			P2	Diffuse, much-branched shrub, 0.5-1.5 m high. Fl. yellow, Aug. Red-brown sandy loam. Undulating plains, along drainage lines.	Possible
<i>Acacia kerryana</i>			P2	Low, spreading, domed shrub, 0.3-1 m high. Fl. yellow, Oct to Dec or Jan to Feb. Granitic loamy sand, stony clayey loam or clayey sand. Low stony ridges, undulating plains.	Possible
<i>Bentleya diminuta</i>			P2	Rosetted rhizomatous, perennial, herb or shrub, 0.02-0.05 m high, growing in small colonies. Fl. white/yellow-green, Sep to Nov. Sandy clay or loam with calcareous nodules.	Unlikely
<i>Boronia westringioides</i>			P2	Erect shrub, 0.2-0.75 m high. Fl. pink, Jul to Sep. Loamy sand. Plains.	Possible
<i>Conospermum sigmoideum</i>			P2	Erect shrub, 0.2-0.5 m high. Fl. blue, Aug to Sep. Yellow sand.	Unlikely
<i>Guichenotia asteriskos</i>			P2	Erect, compact shrub, ca 0.35 m high. Fl. white, Sep to Oct. Sandy clay or loam with gravel.	Possible
<i>Olearia laciniifolia</i>			P2	Erect, few-stemmed shrub, 0.6-1.2 m high. Fl. blue/purple & white/yellow, May to Sep. White sand. Around playa lakes.	Unlikely
<i>Verticordia multiflora</i> subsp. <i>solox</i>			P2	Erect to spreading shrub, 0.2-0.6 m high. Fl. yellow, Oct to Dec or Jan. Yellow sand over gravel, sand over granite.	Unlikely
<i>Acacia rependa</i>			P3	Rounded to obconic, single-stemmed or much-branched shrub, 0.5-2 m high, bark 'minni-ritchi'. Fl. yellow, Jun to Aug. Loam, sandy or gravelly loam. Near granite outcrops.	Unlikely
<i>Baeckea</i> sp. Hatter Hill (K.R. Newbey 3284)			P3	Narrow, open, upright shrub, to 1.3 m high. Fl. pink, Jun to Oct. Yellow-orange coarse sandy loam with laterite gravel, red-brown sandy loam with quartz pebbles. Undulating plains.	Possible
<i>Baeckea</i> sp. Parker Range (M. Hislop & F. Hort MH 2968)			P3	Straggly, erect shrub, to 1.5 m high. Fl. pink, Jun. Yellow to orange sandy loam with laterite gravel. Gently undulating sandplains, low ridges, road verges.	Possible
<i>Banksia viscida</i>			P3	Densely branched, non-lignotuberous shrub, 0.4-1 m high. Fl. yellow-orange, Jul to Oct. Gravelly soils. Lateritic rises.	Possible
<i>Comesperma calcicola</i>			P3	Soft perennial, herb, to 0.3 m high. Fl. pink, Oct to Dec or Jan. Calcareous or semi-saline clay loams, limestone. Areas around saline water.	Unlikely
<i>Cryptandra polyclada</i> subsp. <i>polyclada</i>			P3	Mat-forming or upright shrub, 0.1-0.7 m high. Fl. white/cream, Jan to May or Aug or Oct. Sand. Sandplains.	Possible

Taxon	Conservation Code			Description (WAHERB, 2018)	Likelihood of Occurrence
	EPBC Act	WC Act	Priority Listing		
<i>Daviesia elongata</i> subsp. <i>implexa</i>			P3	Spreading or sprawling shrub, 0.4-1 m high. Fl. yellow/orange & red, Sep. Sand & laterite.	Possible
<i>Daviesia implexa</i>			P3	No description available	Possible
<i>Elatine macrocalyx</i>			P3	Prostrate, glabrous, mat-forming annual, herb, sepals 2-3mm long, fruit indehiscent. Fl. white, May to Oct (probably opportunistic). Shallow sands over clay. Margins of playa lakes and clay pans.	Unlikely
<i>Eucalyptus exigua</i>			P3	Mallee, 2-5 m high, bark smooth. Fl. white-cream, Mar. Sandy loam, white sand. Sandplains.	Unlikely
<i>Eutaxia acanthoclada</i>			P3	Compact, mat-forming, prostrate shrub, to 0.3 m high. Fl. yellow/orange/red, Oct to Nov. Light brown sandy clay, shallow sandy loam, red clay over banded ironstone, gravel. Gently undulating plains.	Known to occur
<i>Eutaxia nanophylla</i>			P3	Straggly, rounded shrub, to 0.35 m high. Fl. Yellow & orange & red, Oct to Nov. Clayey sand, red clay, stoney clayey loam. Low-lying areas, damp flats, slopes, undulating plains, low stony ridges.	Possible
<i>Eutaxia rubricarina</i>			P3	Straggling shrub, to 0.5 m high. Fl. Orange & yellow & brown, Aug or Oct. Gravelly sand, grey to pinkish-white sandy clay, red loam. Flats, slopes, valley floors, road verges.	Possible
<i>Frankenia drummondii</i>			P3	Prostrate shrub. Fl. white. Sand. Lake edges.	Unlikely
<i>Grevillea insignis</i> subsp. <i>elliotii</i>			P3	Erect, bushy, non-lignotuberos shrub, 1-2 m high. Fl. red/pink & cream & white, Oct. Gravelly sand or loam over ironstone. Hilltops or rises.	Possible
<i>Grevillea pilosa</i> subsp. <i>redacta</i>			P3	Spreading to prostrate, non-lignotuberos shrub, 0.4-1.2 m high. Fl. red, Feb or Oct or Dec. Sand, laterite.	Possible
<i>Hibbertia pachyphylla</i>			P3	Shrub, to 0.5 m high. Fl. yellow, Sep to Nov. White to yellow sand, brown sandy gravel, gravelly loam, laterite, granite, quartz. Undulating plains, low rises, valley floors.	Possible
<i>Isolepis australiensis</i>			P3	Annual, grass-like or herb (sedge), 0.03-0.055 m high, glumes 0.8-1.2 mm long; stamens 1(-2); style branches 3; nut with abaxial angle acute. Fl. Jun or Sep. Silty sand, sandy clay. Lake margins, pools.	Unlikely
<i>Keraudrenia adenogyna</i>			P3	Erect shrub, ca 0.4 m high. Fl. purple-blue, Sep. Heavy loamy clay, loamy gravelly soils. Low-lying area.	Unlikely
<i>Melaleuca macrorychia</i> subsp. <i>trygonoides</i>			P3	Multi-stemmed, spreading shrub, 1-4 m high, leaves broadly elliptic. Fl. red, Feb or Jul to Aug or Oct. Sandy soils. Granite outcrops.	Unlikely

Taxon	Conservation Code			Description (WAHERB, 2018)	Likelihood of Occurrence
	EPBC Act	WC Act	Priority Listing		
<i>Mirbelia densiflora</i>			P3	Erect or straggling shrub, 0.2-1 m high. Fl. yellow-orange, Oct or Jan. Stony loam, loamy sand. Small ridges, breakaways, undulating plains.	Unlikely
<i>Notisia intonsa</i>			P3	No description available	Possible
<i>Oxymyrrhine plicata</i>			P3	No description available	Possible
<i>Pityrodia scabra</i> subsp. <i>dendrotricha</i>			P3	No description available	Possible
<i>Pityrodia</i> sp. Yilgarn (A.P. Brown 2679)			P3	No description available	Possible
<i>Pultenaea daena</i>			P3	Dense, prostrate, domed shrub, to 0.07 m high. Fl. yellow, Mar. White to yellow sand or sandy loam, sandy or loamy clay, gravel, limestone, dolomite, laterite. Gently undulating plains, adjacent to salt lakes, in disturbed areas.	Unlikely
<i>Rinzia torquata</i>			P3	No description available	Possible
<i>Rinzia triplex</i>			P3	No description available	Possible
<i>Seringia adenogyna</i>			P3	No description available	Possible
<i>Stylidium sejunctum</i>			P3	Caespitose perennial, herb, 0.25-0.45 m high, Leaves tufted, linear to narrowly oblanceolate, 10-30 cm long, 0.8-4 mm wide, apex acute to mucronate, margin involute, glabrous to scabrous. Membraneous scale leaves present at base of mature leaves. Scape glandular throughout. Inflorescence paniculate. Fl. white/pink-purple, Sep to Nov. Clayey sand or loam, laterite. Outcrops, upper slopes, breakaways. Mallee and Allocasuarina shrubland.	Known to occur
<i>Verticordia gracilis</i>			P3	Low, slender shrub, 0.15-0.6 m high. Fl. pink, Oct to Nov. Yellow sand, gravelly sand, sandy loam.	Possible
<i>Verticordia stenopetala</i>			P3	Shrub, 0.2-0.6(-1.3) m high. Fl. pink/pink-purple-red, Oct to Dec or Jan. Yellow sand, sometimes with gravel. Undulating plains.	Possible
<i>Calamphoreus inflatus</i>			P4	Erect, spreading shrub, 0.4-1.6 m high, to 2 m wide. Fl. blue-purple/green, Oct to Dec or Feb to Mar. Clay loam with ironstone gravel. Flats, disturbed sites.	Possible
<i>Eremophila biserrata</i>			P4	Prostrate shrub, to 3 m wide. Fl. green/yellow-green, Sep to Nov or Mar. Sandy or sandy clay soils. Alluvial flats, salt flats & lakes.	Unlikely
<i>Eremophila racemosa</i>			P4	Erect shrub, 0.5-1.7 m high. Fl. purple-pink-red/white, Mar or Aug to Dec. Sandy or stony loam, clay loam. Undulating plains, roadsides.	Known to occur
<i>Eucalyptus cerasiformis</i>			P4	Mallee, 2-3.5 m high, bark smooth, grey to brown. Fl. yellow, Dec or Jan to Mar. Red loamy soils.	Possible
<i>Eucalyptus georgei</i> subsp. <i>fulgida</i>			P4	Tree, 4-20 m high, bark smooth, often hanging in ribbons. Fl. cream-	Unlikely

Taxon	Conservation Code			Description (WAHERB, 2018)	Likelihood of Occurrence
	EPBC Act	WC Act	Priority Listing		
				white. Sandy loam, clayey sand. Slight depressions.	
<i>Grevillea prostrata</i>			P4	Loose, prostrate shrub, 0.04-0.1 m high, 0.8-1.2 m wide. Fl. cream-white/pink-red, Aug to Dec or Jan. White, grey or yellow sand, gravel. Sandplains.	Possible
<i>Gyrostemon ditrigynus</i>			P4	Shrub, 0.4-1.5 m high. Sand, sandy clay, loam. Plains, low ironstone ridges.	Possible
<i>Haegiela tatei</i>			P4	Ascending to erect annual, herb, 0.02-0.08(-0.2) m high. Fl. white-yellow, Aug to Nov. Clay, sandy loam, gypsum. Saline habitats.	Unlikely
<i>Lepidosperma lyonsii</i>			P4	Tufted rhizomatous, perennial, herb (sedge), leaves 0.31-0.53 m high, culms and leaves distichous. Pale orange skeletal sandy loam with banded ironstone gravel & rock, well-drained shallow stony loamy with quartz. Gentle hill slopes, upper slopes of large hill.	Possible
<i>Microcorys</i> sp. Forrestania (V. English 2004)			P4	Prostrate or erect shrub, 0.35-0.4 m high. Fl. white/purple, Jan or Apr. Yellow sandy clay or red-brown clay. Open woodland or cleared areas.	Known to occur

4.2 Field Assessment

4.2.1 Vegetation Associations

Nine vegetation associations were identified within the survey area. These vegetation associations were located within four different landform types and comprised three major vegetation groups, and were represented by a total of 38 Families, 98 Genera and 280 Taxa (including 12 annual taxa)

(Appendix 2). A map showing the vegetation associations present in the survey area is located in

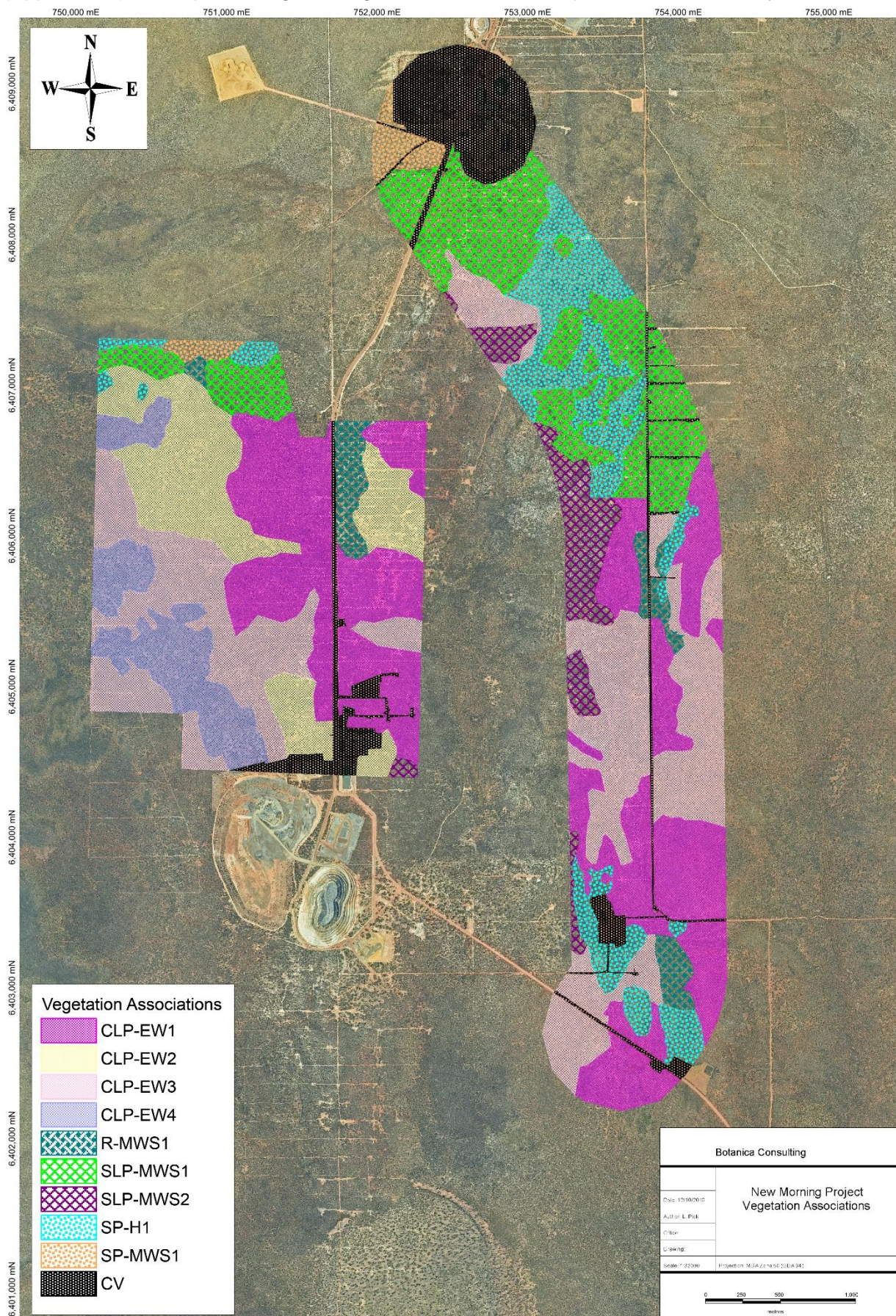


Figure 4-1 and a summary of vegetation associations is presented in Table 4-3.

Table 4-3: Summary of vegetation associations within the New Morning Project survey area

Landform	Major Vegetation Group	Vegetation Association	Vegetation Code	Area (ha)	Area (%)
Clay-Loam Plain	Eucalyptus Woodland (MVG 5)	Low open forest of <i>Eucalyptus flocktoniae</i> / <i>E. salubris</i> / <i>E. urna</i> on clay-loam plain	CLP-EW1	322	24.8
		Mid open woodland of <i>Eucalyptus salmonophloia</i> on clay-loam plain	CLP-EW2	121	9.3
		Burnt open low woodland of <i>Eucalyptus salmonophloia</i> over mallee shrubland of <i>E. pileata</i> / <i>E. tephroclada</i> / <i>E. celastrioides</i> on clay-loam plain	CLP-EW3	281	21.6
		Mid woodland of <i>Eucalyptus longicornis</i> on clay-loam plain	CLP-EW4	75	5.8
Stony rise	Mallee Woodland and Shrubland (MVG 14)	Mid mallee shrubland of <i>Eucalyptus tephroclada</i> / <i>E. pileata</i> on stony rise	R-MWS1	36	2.8
Sand-Loam Plain	Mallee Woodland and Shrubland (MVG 14)	Mid mallee shrubland of <i>Eucalyptus tephroclada</i> / <i>E. pileata</i> / <i>E. transcontinentalis</i> on sand-loam plain	SLP-MWS1	177	13.6
		Mid mallee shrubland of <i>Eucalyptus steedmanii</i> on sand-loam plain	SLP-MWS2	51	3.9
Sandplain	Heathlands (MVG 18)	Mid heathland of <i>Allocasuarina corniculata</i> / <i>Acacia acuminata</i> on sandplain	SP-H1	112	8.6
	Mallee Woodland and Shrubland (MVG 14)	Low open mallee shrubland of <i>Eucalyptus platycorys</i> / <i>E. horistes</i> on sandplain	SP-MWS1	19	1.5
N/A	N/A	Cleared Vegetation	CV	104	8.0
Total				1298	100

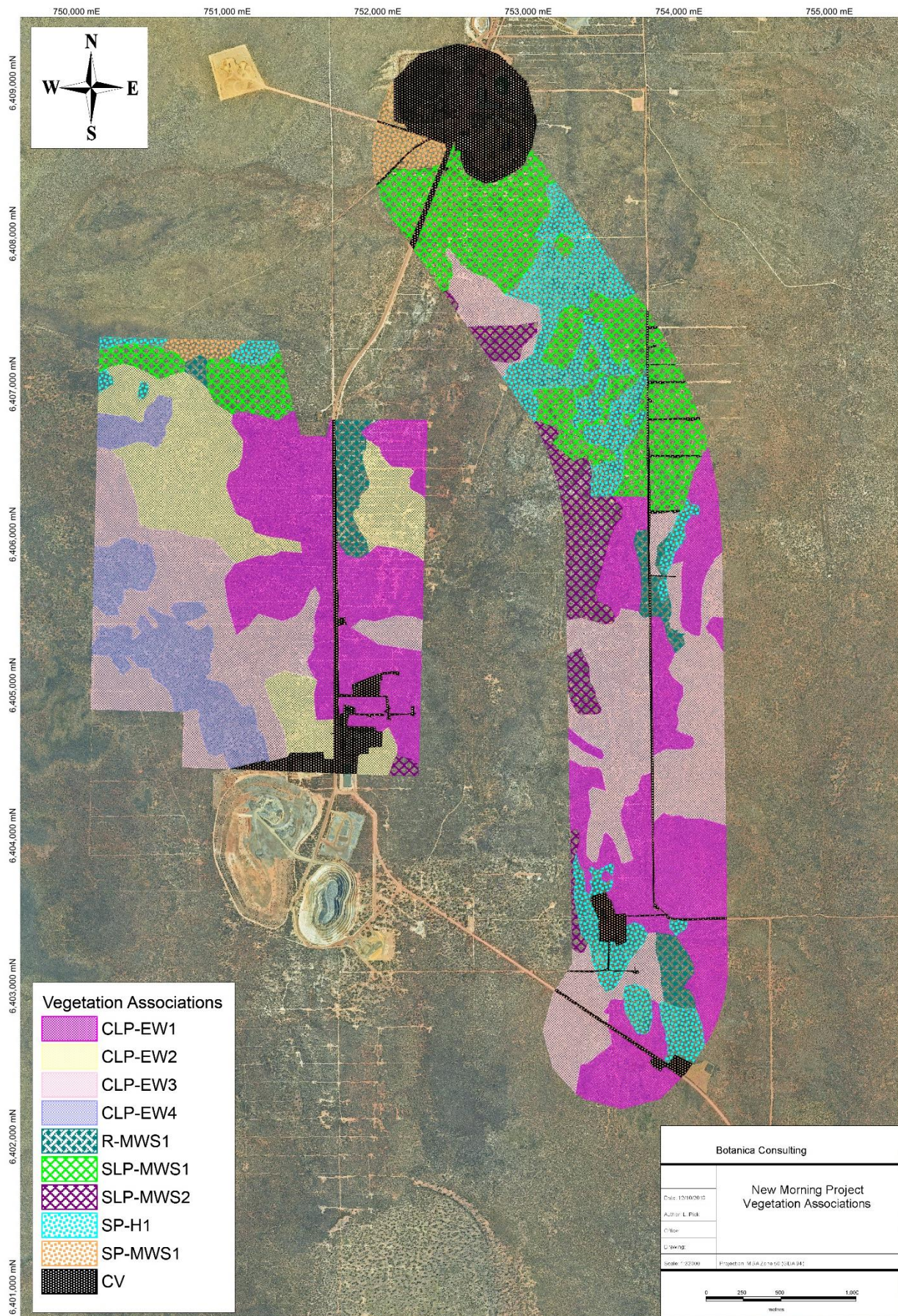


Figure 4-1: Vegetation associations within the survey area

Clay-Loam Plain: Eucalyptus Woodlands

4.2.1.1 Low open forest of *Eucalyptus flocktoniae*/ *E. salubris*/ *E. urna* on clay-loam plain (CLP-EW1)

The total flora recorded within this vegetation association was represented by a total of 24 Families, 43 Genera and 101 Taxa (Plate 1). Dominant taxa from the vegetation assemblage are shown in Table 4-4. According to the NVIS, this community is best represented by the MVG5- Eucalypt Woodlands (DotEE, 2017).

Table 4-4: Vegetation assemblage for Low open forest of *Eucalyptus flocktoniae*/ *E. salubris*/ *E. urna* on clay-loam plain

Life Form/Height Class	Canopy Cover	Dominant Taxa
Tree <10m	30-70%	<i>Eucalyptus flocktoniae</i> subsp. <i>flocktoniae</i> <i>Eucalyptus salubris</i> <i>Eucalyptus urna</i>
Shrub >2m	30-70%	<i>Melaleuca 38ntric</i> <i>Melaleuca 38ntricate</i> <i>Melaleuca pauperiflora</i> subsp. <i>pauperiflora</i>
Shrub 1-2m	30-70%	<i>Acacia merrallii</i> <i>Dodonaea stenozyga</i> <i>Grevillea obliquistigma</i>
Shrub <1m	30-70%	<i>Acacia 38ntricate</i> <i>Gompholobium gompholobioides</i> <i>Grevillea acuaria</i> <i>Eremophila densiflora</i> <i>Melaleuca cardiophylla</i> <i>Microcybe multiflora</i> <i>Wilsonia humilis</i>



Plate 1: Low open forest of *Eucalyptus flocktoniae*/ *E. salubris*/ *E. urna* on clay-loam plain

4.2.1.2 Mid open woodland of *Eucalyptus salmonophloia* on clay-loam plain (CLP-EW2)

The total flora recorded within this vegetation type was represented by a total of 19 Families, 33 Genera and 60 Taxa (Plate 2). Dominant taxa from the vegetation assemblage are shown in Table 4-5. According to the NVIS, this community is best represented by the MVG5- Eucalypt Woodlands (DotEE, 2017).

Table 4-5: Vegetation assemblage for Mid open woodland of *Eucalyptus salmonophloia* on clay-loam plain

Life Form/Height Class	Canopy Cover	Dominant Taxa
Tree >10m	10-30%	<i>Eucalyptus salmonophloia</i> <i>Eucalyptus salubris</i>
Shrub >2m	10-30%	<i>Melaleuca adnata</i> <i>Melaleuca pauperiflora</i> subsp. <i>pauperiflora</i>
Shrub 1-2m	30-70%	<i>Acacia merrallii</i> <i>Daviesia nematophylla</i> <i>Dodonaea stenozyga</i> <i>Exocarpos aphyllus</i>
Shrub <1m	30-70%	<i>Acacia deficiens</i> <i>Acacia intricata</i> <i>Acacia sphacelata</i> subsp. <i>sphacelata</i> <i>Daviesia benthamii</i> <i>Dodonaea stenozyga</i> <i>Eremophila maculata</i> <i>Grevillea acuaria</i> <i>Wilsonia humilis</i>



Plate 2: Mid open woodland of *Eucalyptus salmonophloia* on clay-loam plain

4.2.1.3 Burnt open low woodland of *Eucalyptus salmonophloia* over mallee shrubland of *E. pileata*/ *E. tephroclada*/ *E. celastrioides* on clay-loam plain (CLP-EW3)

The total flora recorded within this vegetation type was represented by a total of 17 Families, 25 Genera and 65 Taxa (Plate 3). Dominant taxa from the vegetation assemblage are shown in Table 4-6. According to the NVIS, this community is best represented by the MVG5- Eucalypt Woodlands (DotEE, 2017).

Table 4-6: Vegetation assemblage for Burnt open low woodland of *Eucalyptus salmonophloia* over mallee shrubland of *E. pileata*/ *E. tephroclada*/ *E. celastrioides* on clay-loam plain

Life Form/Height Class	Canopy Cover	Dominant Taxa
Tree >10m	10-30%	<i>Eucalyptus salmonophloia</i>
Shrub Mallee 3-10m	30-70%	<i>Eucalyptus celastrioides</i> <i>Eucalyptus cylindrocarpa</i> <i>Eucalyptus pileata</i> <i>Eucalyptus tephroclada</i> <i>Eucalyptus urna</i>
Shrub >2m	10-30%	<i>Melaleuca pauperiflora</i> subsp. <i>fastigiata</i>
Shrub 1-2m	10-30%	<i>Acacia hemiteles</i> <i>Daviesia nematophylla</i> <i>Dodonaea stenozyga</i>
Shrub <1m	30-70%	<i>Acacia deficiens</i> <i>Acacia erinacea</i> <i>Acacia intricata</i> <i>Eremophila drummondii</i> <i>Grevillea acuaria</i> <i>Olearia muelleri</i> <i>Templetonia sulcata</i> <i>Wilsonia humilis</i>



Plate 3: Burnt open low woodland of *Eucalyptus salmonophloia* over mallee shrubland of *E. pileata*/ *E. tephroclada*/ *E. celastrioides* on clay-loam plain

4.2.1.4 Mid woodland of *Eucalyptus longicornis* on clay-loam plain (CLP-EW4)

The total flora recorded within this vegetation type was represented by a total of 10 Families, 15 Genera and 21 Taxa (Plate 4). Dominant taxa from the vegetation assemblage are shown in Table 4-7: Vegetation assemblage for . According to the NVIS, this community is best represented by the MVG5- Eucalypt Woodlands (DotEE, 2017).

Table 4-7: Vegetation assemblage for Mid woodland of *Eucalyptus longicornis* on clay-loam plain

Life Form/Height Class	Canopy Cover	Dominant Taxa
Tree >10m	10-30%	<i>Eucalyptus longicornis</i>
Shrub >2m	10-30%	<i>Melaleuca pauperiflora</i> subsp. <i>fastigiata</i> <i>Melaleuca pauperiflora</i> subsp. <i>pauperiflora</i> <i>Melaleuca quadrifaria</i>
Shrub 1-2m	10-30%	<i>Acacia merrallii</i>
Shrub <1m	10-30%	<i>Atriplex stipitata</i> <i>Olearia muelleri</i>



Plate 4: Mid woodland of *Eucalyptus longicornis* on clay-loam plain

Stony Rise: Mallee Woodlands and Shrublands

4.2.1.5 Mid mallee shrubland of *Eucalyptus tephroclada*/ *E. pileata* on stony rise (R-MWS1)

The total flora recorded within this vegetation type was represented by a total of 22 Families, 43 Genera and 80 Taxa (Plate 5). Dominant taxa from the vegetation assemblage are shown in Table 4-8. According to the NVIS, this community is best represented by the MVG14- Mallee Woodlands and Shrublands (DotEE, 2017).

Table 4-8: Vegetation assemblage for Mid mallee shrubland of *Eucalyptus tephroclada*/ *E. pileata* on stony rise

Life Form/Height Class	Canopy Cover	Dominant Taxa
Shrub Mallee 3-10m	30-70%	<i>Eucalyptus tephroclada</i> <i>Eucalyptus pileata</i>
Shrub >2m	30-70%	<i>Melaleuca hamata</i>
Shrub <1m	30-70%	<i>Acacia castanostegia</i> <i>Acacia deficiens</i> <i>Dodonaea bursariifolia</i> <i>Westringia cephalantha</i> var. <i>caterva</i> <i>Darwinia</i> sp. Lake Cobham (K. Newbey 3262)
Sedge <1m	10-30%	<i>Lepidosperma sanguinolentum</i>



Plate 5: Mid mallee shrubland of *Eucalyptus tephroclada*/ *E. pileata* on stony rise

Sand-Loam Plain: Mallee Woodlands and Shrublands

4.2.1.6 Mid mallee shrubland of *Eucalyptus tephroclada*/ *E. pileata*/ *E. transcontinentalis* on sand-loam plain (SLP-MWS1)

The total flora recorded within this vegetation type was represented by a total of 23 Families, 42 Genera and 109 Taxa (Plate 6). Dominant taxa from the vegetation assemblage are shown in Table 4-9. According to the NVIS, this community is best represented by the MVG14- Mallee Woodlands and Shrublands (DotEE, 2017).

Table 4-9: Vegetation assemblage for Mid mallee shrubland of *Eucalyptus tephroclada*/ *E. pileata*/ *E. transcontinentalis* on sand-loam plain

Life Form/Height Class	Canopy Cover	Dominant Taxa
Shrub Mallee 3-10m	10-30%	<i>Eucalyptus celastroides</i> <i>Eucalyptus cylindrocarpa</i> <i>Eucalyptus pileata</i> <i>Eucalyptus tephroclada</i> <i>Eucalyptus transcontinentalis</i>
Shrub 1-2m	10-30%	<i>Acacia coolgardiensis</i> <i>Melaleuca calyptrioides</i> <i>Melaleuca hamata</i> <i>Melaleuca lateriflora</i> <i>Melaleuca pauperiflora</i> subsp. <i>pauperiflora</i>
Shrub <1m	10-30%	<i>Acacia deficiens</i> <i>Acacia hemiteles</i> <i>Acacia hystrix</i> subsp. <i>hystrix</i> <i>Baeckea crispiflora</i> <i>Dodonaea bursariifolia</i> , <i>Grevillea acuaria</i> <i>Melaleuca cordata</i> <i>Phebalium tuberculosum</i> <i>Westringia cephalantha</i> var. <i>caterva</i>



Plate 6: Mid mallee shrubland of *Eucalyptus tephroclada*/ *E. pileata*/ *E. transcontinentalis* on sand-loam plain

4.2.1.7 Mid mallee shrubland of *Eucalyptus steedmanii* on sand-loam plain (SLP-MWS2)

The total flora recorded within this vegetation type was represented by a total of 20 Families, 36 Genera and 68 Taxa (Plate 7). Dominant taxa from the vegetation assemblage are shown in Table 4-10. According to the NVIS, this community is best represented by the MVG14- Mallee Woodlands and Shrublands (DotEE, 2017).

Table 4-10: Vegetation assemblage for Mid mallee shrubland of *Eucalyptus steedmanii* on sand-loam plain

Life Form/Height Class	Canopy Cover	Dominant Taxa
Shrub Mallee 3-10m	30-70%	<i>Eucalyptus steedmanii</i> (T)
Shrub 1-2m	30-70%	<i>Exocarpos aphyllus</i> <i>Melaleuca calyptrioides</i> <i>Melaleuca eleuterostachya</i>
Shrub <1m	10-30%	<i>Eremophila drummondii</i> <i>Dodonaea stenozyga</i> <i>Euryomyrtus maidenii</i> <i>Olearia muelleri</i> <i>Phebalium filifolium</i>



Plate 7: Mid mallee shrubland of *Eucalyptus steedmanii* on sand-loam plain

Sandplain: Heathlands

4.2.1.8 Mid heathland of *Allocasuarina corniculata*/ *Acacia acuminata* on sandplain (SP-H1)

The total flora recorded within this vegetation type was represented by a total of 23 Families, 58 Genera and 131 Taxa (Plate 8). Dominant taxa from the vegetation assemblage are shown in Table 4-11. According to the NVIS, this community is best represented by the MVG18- Heathlands (DotEE, 2017).

Table 4-11: Vegetation assemblage for Mid heathland of *Allocasuarina corniculata*/ *Acacia acuminata* on sandplain

Life Form/Height Class	Canopy Cover	Dominant Taxa
Heath Shrub >2m	30-70%	<i>Allocasuarina acutivalvis</i> <i>Allocasuarina campestris</i> <i>Allocasuarina corniculata</i>
Heath Shrub 1-2m	30-70%	<i>Acacia acuminata</i> <i>Acacia fragilis</i> <i>Acacia steedmanii</i> subsp. <i>steedmanii</i> <i>Leptospermum erubescens</i> <i>Melaleuca hamata</i> <i>Melaleuca uncinata</i> <i>Thryptomene kochii</i>
Shrub <1m	30-70%	<i>Acacia sphacelata</i> subsp. <i>sphacelata</i> <i>Euryomyrtus maidenii</i> <i>Leptosema daviesioides</i> <i>Phebalium filifolium</i> <i>Verticordia chrysanthella</i>
Sedges <1m	30-70%	<i>Lepidosperma sanguinolentum</i> <i>Lepidosperma drummondii</i>



Plate 8: Mid heathland of *Allocasuarina corniculata*/ *Acacia acuminata* on sandplain

Sandplain: Mallee Woodlands and Shrublands

4.2.1.9 Low open mallee shrubland of *Eucalyptus platycorys*/ *E. horistes* on sandplain (SP-MWS1)

The total flora recorded within this vegetation type was represented by a total of 13 Families, 37 Genera and 68 Taxa (Plate 9). Dominant taxa from the vegetation assemblage are shown in Table 4-12. According to the NVIS, this community is best represented by the MVG14- Mallee Woodlands and Shrublands (DotEE, 2017).

Table 4-12: Vegetation assemblage for Low open mallee shrubland of *Eucalyptus platycorys*/ *E. horistes* on sandplain

Life Form/Height Class	Canopy Cover	Dominant Taxa
Shrub Mallee <3m	10-30%	<i>Eucalyptus horistes</i> <i>Eucalyptus platycorys</i>
Shrub <1m	30-70%	<i>Banksia laevigata</i> subsp. <i>fuscolutea</i> <i>Beaufortia micrantha</i> <i>Isopogon scabriusculus</i> <i>Melaleuca glaberrima</i> <i>Melaleuca hamata</i> <i>Petrophile merrallii</i> <i>Phebalium lepidotum</i>
Sedge <1m	10-30%	<i>Lepidosperma sanguinolentum</i>



Plate 9: Low open mallee shrubland of *Eucalyptus platycorys*/ *E. horistes* on sandplain

4.2.2 Vegetation Condition

Based on the vegetation condition rating scale adapted from Keighery, 1994 and Trudgen, 1988 (Appendix 3), two vegetation associations were rated as 'good' and the remaining seven vegetation associations had a vegetation condition rating of 'very good' (Table 4-13). A map of the vegetation

condition within the survey area is provided in



Figure 4-2.

‘Good’ condition depicts that vegetation structure has been significantly altered by very obvious signs of multiple disturbances, however it retains its basic vegetation structure or has ability to regenerate it. Disturbance to vegetation structure may be caused by very frequent fires, the presence of very aggressive weeds, partial clearing, dieback and grazing.

‘Very Good’ condition depicts that vegetation structure has been altered by obvious signs of disturbance. Disturbance to vegetation structure may be caused by repeated fires, the presence of some more aggressive weeds, dieback, logging and grazing.

Table 4-13: Vegetation Condition Rating for Vegetation associations of the New Morning Project survey area

Landform	Major Vegetation Group	Vegetation Association	Vegetation Code	Vegetation Condition
Clay-Loam Plain	Eucalyptus Woodland (MVG 5)	Low open forest of <i>Eucalyptus flocktoniae</i> / <i>E. salubris</i> / <i>E. urna</i> on clay-loam plain	CLP-EW1	Good
		Mid open woodland of <i>Eucalyptus salmonophloia</i> on clay-loam plain	CLP-EW2	Very Good
		Burnt open low woodland of <i>Eucalyptus salmonophloia</i> over mallee shrubland of <i>E. pileata</i> / <i>E. tephroclada</i> / <i>E. celastrioides</i> on clay-loam plain	CLP-EW3	Good
		Mid woodland of <i>Eucalyptus longicornis</i> on clay-loam plain	CLP-EW4	Very Good
Stony rise	Mallee Woodland and Shrubland (MVG 14)	Mid mallee shrubland of <i>Eucalyptus tephroclada</i> / <i>E. pileata</i> on stony rise	R-MWS1	Very Good
Sand-Loam Plain	Mallee Woodland and Shrubland (MVG 14)	Mid mallee shrubland of <i>Eucalyptus tephroclada</i> / <i>E. pileata</i> / <i>E. transcontinentalis</i> on sand-loam plain	SLP-MWS1	Very Good
		Mid mallee shrubland of <i>Eucalyptus steedmanii</i> on sand-loam plain	SLP-MWS2	Very Good
Sandplain	Heathlands (MVG 18)	Mid heathland of <i>Allocasuarina corniculata</i> / <i>Acacia acuminata</i> on sandplain	SP-H1	Very Good
	Mallee Woodland and Shrubland (MVG 14)	Low open mallee shrubland of <i>Eucalyptus platycorys</i> / <i>E. horistes</i> on sandplain	SP-MWS1	Very Good
N/A	N/A	Cleared Vegetation	CV	Completely Degraded



Figure 4-2: Vegetation Condition Rating of the New Morning Project survey area

4.2.3 Introduced Plant Species

Four introduced species were identified within the survey area:

Dittrichia graveolens (Stinkwort);

Lysimachia arvensis (Pimpernel);

Sonchus olearaceus (Common Sowthistle); and

Wahlenbergia capensis (Common Bluebell).

According to the DPIRD database (DPIRD, 2018), none of these species are listed as a Declared Plant under Section 22 of the BAM Act.

4.2.3.1 *Dittrichia graveolens* (Stinkwort)

This species is described as an erect, bushy, viscid, annual herb that grows up to 0.1-0.5m high (Plate 10). It has yellow/yellow-white flowers from January to November, and grows in a variety of soils. It is a weed of waste grounds, along rivers and roadsides (WAHERB, 2018). This species was recorded within one vegetation association; Low open forest of *Eucalyptus flocktoniae*/ *E. salubris*/ *E. urna* on clay-loam plain (CLP-EW1).



Plate 10: *Dittrichia graveolens* (Stinkwort)

4.2.3.2 *Lysimachia arvensis* (Pimpernel)

No description is available for this taxon (WAHERB, 2018). This species was recorded within one vegetation association; Low open forest of *Eucalyptus flocktoniae*/ *E. salubris*/ *E. urna* on clay-loam plain (CLP-EW1).



Plate 11: *Lysimachia arvensis* (Pimpernel) (WAHERB, 2018)

4.2.3.3 *Sonchus oleraceus* (Common Sowthistle)

This species is described as an erect annual, herb, which grows up to 1.5 m high. It produces yellow flowers from January to December. It occurs on a variety of soils and is a weed of waste places and disturbed ground. This species was recorded within one vegetation association; Low open forest of *Eucalyptus flocktoniae*/ *E. salubris*/ *E. urna* on clay-loam plain (CLP-EW1).



Plate 12: *Sonchus oleraceus* (Common Sowthistle)

4.2.3.4 *Wahlenbergia capensis* (Common Bluebell)

This species is described as a slender, erect or ascending annual herb which grows between 0.1-0.5 m high. It produces blue/blue-green flowers from September to November. This species occurs on sandy soils within disturbed grounds and plains (WAHERB, 2018). This species was recorded within one vegetation association; Low open forest of *Eucalyptus flocktoniae*/ *E. salubris*/ *E. urna* on clay-loam plain (CLP-EW1).



Plate 13: *Wahlenbergia capensis* (Common Bluebell) (WAHERB, 2018)

4.2.4 Floristic Composition of the New Morning Project Quadrats

This analysis was used to determine the similarities or differences between vegetation associations. Appendix 8 provides the dendrogram, two-way table and ordination graph generated from the PATN statistical analysis. A list of the 36 quadrats and their respective vegetation associations are provided in Table 4-14 below. The PATN analysis produced a stress value of 0.1786.

Table 4-14: Vegetation associations with corresponding quadrats

Landform	NVIS	Vegetation Association	Vegetation Code	Quadrat
Clay-Loam Plain	Eucalyptus Woodland (MVG 5)	Low open forest of <i>Eucalyptus flocktoniae</i> / <i>E. salubris</i> / <i>E. urna</i> on clay-loam plain	CLP-EW1	Q3, Q10, Q14, Q19, Q20, Q35
		Mid open woodland of <i>Eucalyptus salmonophloia</i> on clay-loam plain	CLP-EW2	Q5, Q13, Q22
		Burnt open low woodland of <i>Eucalyptus salmonophloia</i> over mallee shrubland of <i>E. pileata</i> / <i>E. tephroclada</i> / <i>E. celastrioides</i> on clay-loam plain	CLP-EW3	Q1, Q4, Q8, Q9, Q24, Q36
		Mid woodland of <i>Eucalyptus longicormis</i> on clay-loam plain	CLP-EW4	Q6, Q7, Q11, Q12
Stony rise	Mallee Woodland and Shrubland (MVG 14)	Mid mallee shrubland of <i>Eucalyptus tephroclada</i> / <i>E. pileata</i> on stony rise	R-MWS1	Q2, Q18, Q21
Sand-Loam Plain	Mallee Woodland and Shrubland (MVG 14)	Mid mallee shrubland of <i>Eucalyptus tephroclada</i> / <i>E. pileata</i> / <i>E. transcontinentalis</i> on sand-loam plain	SLP-MWS1	Q15, Q27, Q28, Q30
		Mid mallee shrubland of <i>Eucalyptus steedmanii</i> on sand-loam plain	SLP-MWS2	Q23, Q25, Q26, Q31
Sandplain	Heathlands (MVG 18)	Mid heathland of <i>Allocasuarina corniculata</i> / <i>Acacia acuminata</i> on sandplain	SP-H1	Q16, Q29, Q34
	Mallee Woodland and Shrubland (MVG 14)	Low open mallee shrubland of <i>Eucalyptus platycorys</i> / <i>E. horistes</i> on sandplain	SP-MWS1	Q17, Q32, Q33

Two 'supergroups' were identified in the PATN analysis:

1. Clay-Loam Plain/ Sand-Loam Plain (Eucalypt Woodlands & Mallee Woodlands and Shrublands); and
2. Sandplain/ Stony Rise (Mallee Woodlands and Shrublands & Heathlands)

Nine species groups were identified in the analysis (species group A to I) as shown in the two-way table (Appendix 8).

The 'Clay-Loam Plain/ Sand-Loam Plain' supergroup included six floristic groups; four groups comprising of quadrats from the Clay-Loam Plain vegetation associations (CLP-EW1 to CLP-EW4) and two groups comprising of quadrats from the Sand-Loam Plain vegetation associations (SLP-MWS1 and SLP-MWS2). The first two floristic groups (1-2) which included quadrats from CLP-EW1

and CLP-EW3 were mainly characterised by species group C and had a mean species richness of 14 taxa and 13 taxa per quadrat respectively. The third group comprised of all four SLP-MWS2 quadrats and were characterised by species group C and H, with an average of 16 taxa per quadrat. The fourth floristic group which comprised of all four SLP-MWS1 quadrats was mainly characterised by species group I with an average of 14 taxa per quadrat. The remaining two floristic groups (5 and 6) which included quadrats from the Clay-Loam Plain vegetation associations (CLP-EW2, CLP-EW3 and CLP-EW4) were mainly characterised by species group E with an average of 11 and 7 taxa per quadrat respectively.

The 'Sandplain/ Stony Rise' supergroup was divided into three floristic groups; the first group (Group 7) included two quadrats of R-MWS1 and was characterised by species group G (average species richness of 10 taxa per quadrat). The second group (Group 8) included quadrats from the two sandplain vegetation associations (Heathland and Mallee Woodlands and Shrublands) and the remaining stony rise quadrats, with an average species richness of 17 taxa per quadrat. This group was mainly characterised by species group A. The final group (Group 9) comprised of a single quadrat (Q33) from SP-MWS1 (12 species per quadrat). Comparative to the other quadrats of R-MWS1 (Q17, Q32 which recorded 22 and 20 taxa respectively), Quadrat 33 had a lower species diversity (8-10 species less) and was mainly characterised by species group B.

Based on the results of the PATN analysis, there was minimal heterogeneity in species composition across the survey area, with majority of vegetation associations (particularly the Eucalypt woodland associations) intermixed into floristic groups despite differences in dominant stratum taxa; however, two distinct supergroups were identified. The first supergroup comprised of a mix of vegetation associations identified in the field including quadrats from the clay-loam plain (Eucalypt Woodlands and sand-loam plain (Mallee Woodlands and Shrublands). The second supergroup comprised a mix of quadrats from the sandplains (Mallee Woodlands and Shrublands/ Heathlands) and stony rise (Mallee Woodlands and Shrublands) vegetation associations.

Species Richness and accumulation estimates

The Chao 2 richness estimator provided an estimated species richness of 188 species in 50 sample sites (quadrats). Species richness recorded for the 36 quadrats surveyed was 167 species (including annuals) which indicates survey intensity was adequate.

A species accumulation curve was created to display the rate of species accumulation. The R^2 value (0.99) suggests that the data "fits" the species accumulation curve shown in Figure 4-3. By the twenty-sixth quadrat the rate of species accumulation was calculated at two species per quadrat up to 45 quadrats. Beyond 45 quadrats the rate of species accumulation was calculated to <1 species per quadrat as quadrat number increased to between 45 to 50 quadrats. BC has determined that according to this data a sufficient number of quadrats were established in the survey area to adequately assess the floristic composition of the area.

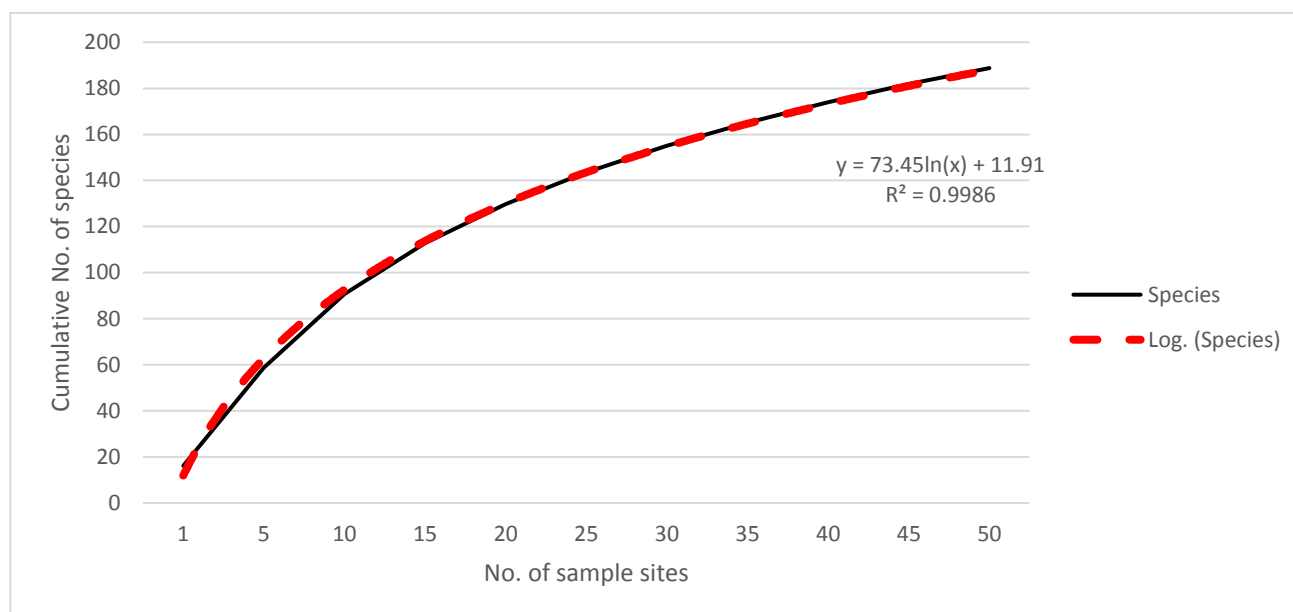


Figure 4-3: Species accumulation curve

4.2.5 Significant Flora

According to the EPA *Environmental Factor Guideline for Flora and Vegetation* (EPA, 2016a) significant flora includes:

- flora being identified as threatened or priority species
- locally endemic flora or flora associated with a restricted habitat type (e.g. surface water or groundwater dependent ecosystems)
- new species or anomalous features that indicate a potential new species
- flora representative of the range of a species (particularly, at the extremes of range, recently discovered range extensions, or isolated outliers of the main range)
- unusual species, including restricted subspecies, varieties or naturally occurring hybrids
- flora with relictual status, being representative of taxonomic groups that no longer occur widely in the broader landscape.

Two Threatened Flora taxon pursuant to subsection (2) of section 23F of the WC Act and the EPBC Act were identified within the survey area:

1. *Eucalyptus steedmanii*.
2. *Paragoodia crenulata* (also considered endemic to the area)

Four Priority Flora taxa as listed by DBCA were identified within the survey area:

1. *Eremophila racemosa* (P4);
2. *Eutaxia acanthoclada* (P3);
3. *Microcorys* sp. Forrestania (V. English 2004) (P4); and
4. *Stylidium sejunctum* (P3).

Descriptions of these species are provided in the following sections. GPS locations of all Priority Flora recorded by Botanica are provided in Appendix 4 (Threatened Flora locations have been excluded due to the sensitivity of this data). No other significant flora (i.e. groundwater or surface water dependent, new or anomalous species, range extension, relictual or unusual species) were identified within the survey area.

4.2.5.1 *Eucalyptus steedmanii* (T)

Eucalyptus steedmanii is listed as a Threatened Flora taxon (Vulnerable) pursuant to subsection (2) of section 23F of the Western Australian WC Act and the Commonwealth EPBC Act. This taxon is described as a tree that grows to 2-8m high (



Plate 14). It has smooth bark, and produces white flowers from January to March (WAHERB, 2018). It grows in gravelly loam over ironstone and sand, and it can be found on low hills and undulating plains.

Four previously recorded populations/DBCA known locations were identified within the survey area (referred to as Population 1, 2, 7 and 8). An additional location of this taxon was identified during the survey, located within 500m of the existing Population 8 boundary (tentatively referred to as Population 8a pending determination from DBCA). This newly identified location of *Eucalyptus steedmanii* will be formally lodged with DBCA. This taxon was identified within one vegetation association; Mid mallee shrubland of *Eucalyptus steedmanii* on sand-loam plain (SLP-MWS2).



Plate 14: *Eucalyptus steedmanii* (T)

4.2.5.2 *Pargodia crenulata* (T)

Pargodia crenulata is listed as a Threatened Flora taxon (Vulnerable) pursuant to subsection (2) of section 23F of the Western Australian WC Act and Critically Endangered under the Commonwealth EPBC Act. This taxon is described as a small herbaceous plant with perennial underground parts (Plate 15). The flower spike has 1–3 flowers that are brown and yellow in colour. The flowering period is from July to August. This taxon is endemic to Western Australia, known from two populations in the Forrestania area (DotEE, 2018c).

One location of this taxon was recorded within the survey area, which is not a DBCA listed/known location. The nearest known DBCA location is approximately 12.7km north-east of the survey area, along the Forrestania-Southern Cross Road. This newly identified location of *Pargodia crenulata* will be formally lodged with DBCA. This taxon was identified within one vegetation association; Low open forest of *Eucalyptus flocktoniae*/ *E. salubris*/ *E. urna* on clay-loam plain (CLP-EW1).



Plate 15: *Pargoodia crenulata* (T)

4.2.5.3 *Eremophila racemosa* (P4)

This taxon is described as an erect shrub that grows up to 0.5-1.7m high (Plate 16). It produces purple-pink-red/white flowers in March or August to December. It grows in sandy or stony loam, clay loam, and can be found on undulating plains and roadsides (WAHERB, 2018). Botanica recorded 35 locations of this taxon within the survey area, two of which are DBCA known locations. This taxon was recorded within four vegetation associations:

1. Low open forest of *Eucalyptus flocktoniae*/ *E. salubris*/ *E. urna* on clay-loam plain (CLP-EW1);
2. Mid open woodland of *Eucalyptus salmonophloia* on clay-loam plain (CLP-EW2);
3. Burnt open low woodland of *Eucalyptus salmonophloia* over mallee shrubland of *E. pileata*/ *E. tephroclada*/ *E. celastrioides* on clay-loam plain (CLP-EW3); and
4. Mid mallee shrubland of *Eucalyptus tephroclada*/ *E. pileata* on stony rise (R-MWS1).



Plate 16: *Eremophila racemosa* (P4)

4.2.5.4 *Eutaxia acanthoclada* (P3)

This taxon is described as a compact, mat-forming, prostrate shrub, which grows to 0.3 m high (Plate 17). It produces yellow/orange/red flowers from October to November. This taxon occurs on light brown sandy clay, shallow sandy loam and red clay soils over banded ironstone and gravel. It occurs on gently undulating plains (WAHERB, 2018). Botanica recorded 22 locations of this taxon within the survey area. There are no DBCA records of this taxon located within the survey area. This taxon was identified within three vegetation associations:

1. Burnt open low woodland of *Eucalyptus salmonophloia* over mallee shrubland of *E. pileata*/*E. tephroclada*/*E. celastrioides* on clay-loam plain (CLP-EW3);
2. Mid woodland of *Eucalyptus longicormis* on clay-loam plain (CLP-EW4); and
3. Mid mallee shrubland of *Eucalyptus steedmanii* on sand-loam plain (SLP-MWS2).



Plate 17: *Eutaxia acanthoclada* (P3)

4.2.5.5 *Microcorys* sp. Forrestania (V. English 2004) (P4)

This taxon is described as a prostrate or erect shrub that grows up to 0.35-0.4m high (Plate 18). It produces white/purple flowers in January or April. It grows in yellow sandy clay or red-brown clay, and it can be found in open woodland or cleared areas (WAHERB, 2018). Botanica recorded 78 locations of this taxon within the survey area. There are no DBCA records of this taxon located within the survey area. This taxon was recorded within five vegetation associations:

1. Low open forest of *Eucalyptus flocktoniae*/ *E. salubris*/ *E. urna* on clay-loam plain (CLP-EW1);
2. Mid open woodland of *Eucalyptus salmonophloia* on clay-loam plain (CLP-EW2);
3. Burnt open low woodland of *Eucalyptus salmonophloia* over mallee shrubland of *E. pileata*/ *E. tephroclada*/ *E. celastrioides* on clay-loam plain (CLP-EW3);

4. Mid mallee shrubland of *Eucalyptus tephroclada*/ *E. pileata*/ *E. transcontinentalis* on sand-loam plain (SLP-MWS1); and
5. Mid mallee shrubland of *Eucalyptus steedmanii* on sand-loam plain (SLP-MWS2).



Plate 18: *Microcorys* sp. *Forrestania* (V. English 2004) (P4)

4.2.5.6 *Stylidium sejunctum* (P3)

This taxon is described as a caespitose perennial herb that reaches heights of 0.25–0.45 metres (Plate 19). The flowers are white, pink and purple and bloom from September through November. It inhabits sites with clayey sand, loam or laterite on outcrops, upper slopes and breakaways (WAHERB, 2018). Botanica recorded 98 locations of this taxon within the survey area, two of which are DBCA known locations. This taxon was recorded within two vegetation associations:

1. Low open forest of *Eucalyptus flocktoniae*/ *E. salubris*/ *E. urna* on clay-loam plain (CLP-EW1); and
2. Mid mallee shrubland of *Eucalyptus tephroclada*/ *E. pileata* on stony rise (R-MWS1).



Plate 19: *Stylidium sejunctum* (P3)

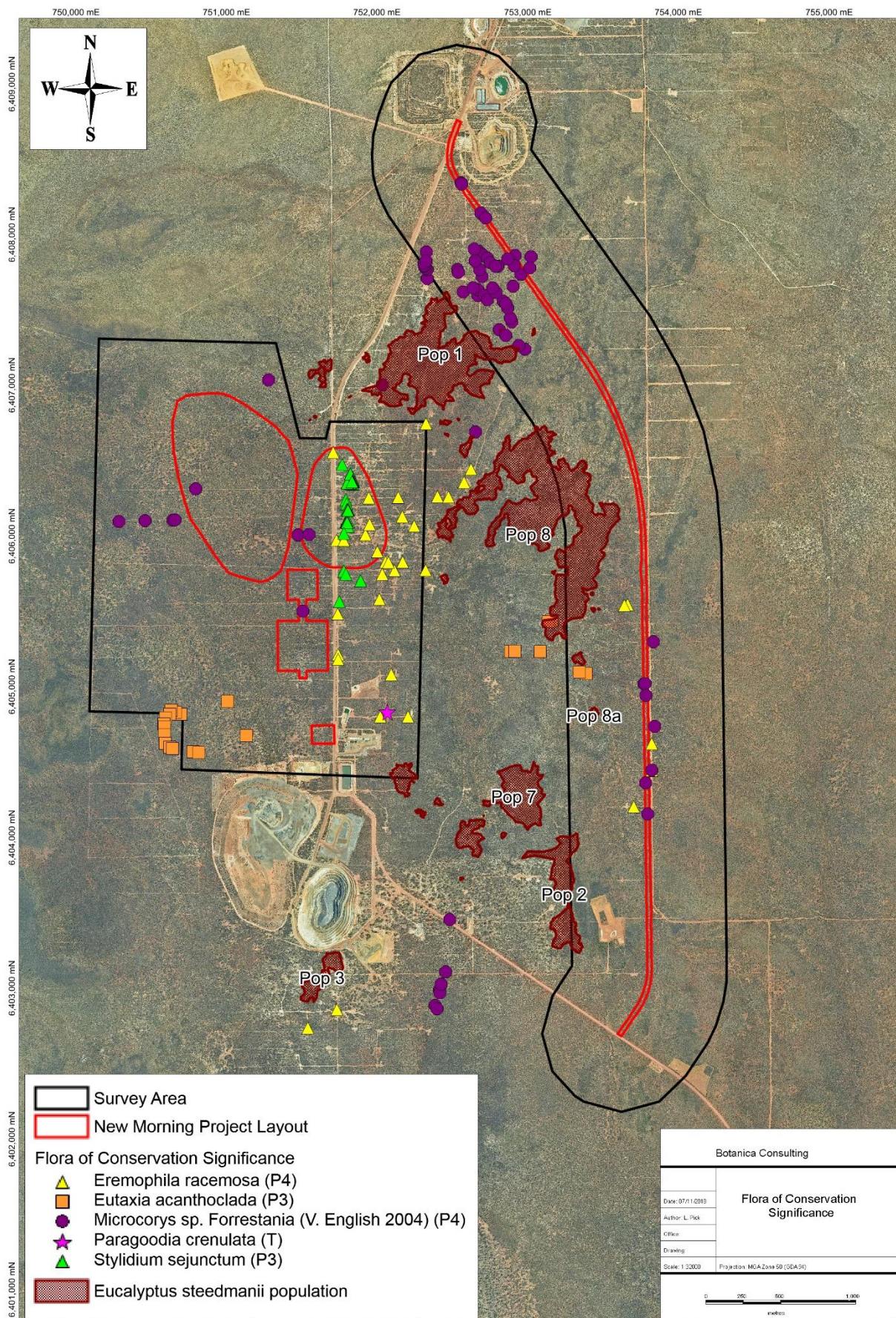


Figure 4-4: Flora of Conservation Significance identified within the New Morning Project survey area

4.2.6 Significant Vegetation

According to the EPA *Environmental Factor Guideline for Flora and Vegetation* (EPA, 2016b) significant vegetation includes:

- vegetation being identified as threatened or priority ecological communities
- vegetation with restricted distribution
- vegetation subject to a high degree of historical impact from threatening processes
- vegetation which provides a role as a refuge
- vegetation providing an important function required to maintain ecological integrity of a significant ecosystem.

The survey area is located within the North Ironcap buffer of the *Ironcap Hills Vegetation Complexes* which is listed by the DBCA as a Priority 3 Ecological Community. This vegetation community was first described by Newbey and Hnatiuk (1988) during the biological survey of the Lake Johnston-Hyden area as a BIF complex and was considered one of seven unique vegetation communities to the Lake Johnston-Hyden area. The description of the North Ironcap BIF complex is provided below: *The complex vegetation on banded ironstone formation had a number of species dominant at different sites. Low trees (Acacia lasiocalyx and Eucalyptus flocktoniae [Merritt]) were rare. Mallees of Eucalyptus aff. wandoo (E. livida, E. capillosa subsp. polyclada) were usually present in small areas partially lateritized, while E. eremophila occurred rarely. Tall shrubs that were occasionally present included Allocasuarina campestris ssp. campestris (also low shrub), A. corniculata, Banksia sphaerocarpa var. dolichostyla (Ironcaps), Calothamnus quadrifidus (also low shrub), Dryandra aff. cersoides, Grevillea pterosperma, Hakea subsulcata, H. scoparia, Leptospermum erubescens, Melaleuca fulgens, M. uncinata, Santalum acuminatum and Trymalium aff. ledifolium; low shrubs were Acacia sulcata var. platyphylla, Acacia sp. (KRN 5226), Chamelaucium ciliatum (south), Cryptandrailiaris, Dodonaea adenophora, D. amblyophylla (west), Dryandra sp. (KRN 5229), Melaleuca cordata, Phebalium filifolium, P. microphyllum, P. tuberosum ssp. tuberosum, P. aff. tuberosum and Platysace maxwellii (west); perennial grasses of Spartochloa scirpoidea; and sedges of Lepidosperma drummondii, L. viscidum var. viscidum, Lepidosperma sp. (KRN 5232), Lepidosperma sp. (KRN 5233) and Lepidosperma sp. (KRN 6488).*

The vegetation complex described was not represented within the survey area.

According to the DAFWA (2011) the BIF complex within the Greater North Ironcap area is classified by pre-european vegetation association Forrestania 1413; Shrublands; *Acacia*, *Casuarina* & *Melaleuca* thicket which is represented in both the Southern Cross and Western Mallee subregion. Neither of these vegetation associations occur within the survey area (see Section 2.3).

4.3 Matters of National Environmental Significance

None of the following matters of national environmental significance as defined by the Commonwealth EPBC Act were identified within the survey area:

- world heritage properties
- national heritage places
- wetlands of international importance (often called 'Ramsar' wetlands after the international treaty under which such wetlands are listed)
- nationally threatened ecological communities
- Commonwealth marine areas

- the Great Barrier Reef Marine Park
- nuclear actions (including uranium mining) a water resource, in relation to coal seam gas development and large coal mining development.

Two nationally threatened flora species; *Eucalyptus steedmanii* and *Paragoodia crenulata* were recorded within the survey area.

4.4 Matters of State Environmental Significance

There are no wetlands of national importance (ANCA Wetlands) or conservation category wetlands within the survey area. The survey area does not contain any TEC listed under the Western Australian *Environmental Protection (EP) Act 1986*. Two threatened flora species; *Eucalyptus steedmanii* and *Pargoodia crenulata* listed under the WC Act were recorded within the survey area. A 50m radius of each Threatened Flora plant is protected as an ESA under Regulation 6 of the *Environmental Protection (Clearing of Native Vegetation) Regulations WA 2004*.

Approximately 215ha of the north-east corner of survey area lies within the Lake Cronin ESA with the survey area located approximately 5km south-west of the Lake Cronin 'A' Class Nature Reserve. A description of the Lake Cronin Region is provided below;

Lake Cronin is a semi-permanent freshwater lake located in the south western region of the Eastern Goldfields and is the largest freshwater lake in the region. The Lake Cronin area is one of a number of areas in the Wheatbelt region that are significant for rare species, due to widespread clearing in the surrounding landscape, and to the high diversity and level of local endemism. The Lake Cronin area supports extensive shrubland, sandplain and woodland environments, including excellent representation of a range of vegetation associations that are now extensively cleared in the Wheatbelt and supports a high number of species that are disjunct. Disjunct populations are those that have become physically separated, resulting in minimal or no gene flow between them, and they are an important precursor to the development of new species. A number of species in Australia have separate eastern and western populations, and some have formed sub-species, reflecting important broader long-term processes such as sea level changes and climatic fluctuations. It also supports a number of species reaching the limit of their distribution range. The number of species at the edge of their range reflects the convergence in the area of the Avon, Mallee and Coolgardie Biogeographic regions (DotEE, 2017c).

According to the EPA (2009) *Advice on Conservation Values and Review of Nature Reserve Proposals in the Lake Cronin Region*, an area of 56,750ha within the mineralised greenstone belt in the Lake Cronin Region (encompassing the entire Greater New Morning/Spotted Quoll area) is proposed to be managed under Section 33(2) of the *CALM Act 1984* but not formally reserved. A proposed 'C' Class Nature Reserve is also proposed in the surrounding area to protect the Lake Cronin catchment and areas of extensive sandplain and woodland vegetation located immediately east of the Wheatbelt, which represents vegetation communities and fauna habitats that have been extensively cleared and fragmented in the adjacent Wheatbelt. Lake Cronin is not formally protected under the Commonwealth *EPBC Act 1999*.

The survey area is located within the North Ironcap buffer of the *Ironcap Hills Vegetation Complexes* which is listed by the DBCA as a Priority 3 Ecological Community. A map showing areas of conservation significance in relation to the survey area is provided in Appendix 1.

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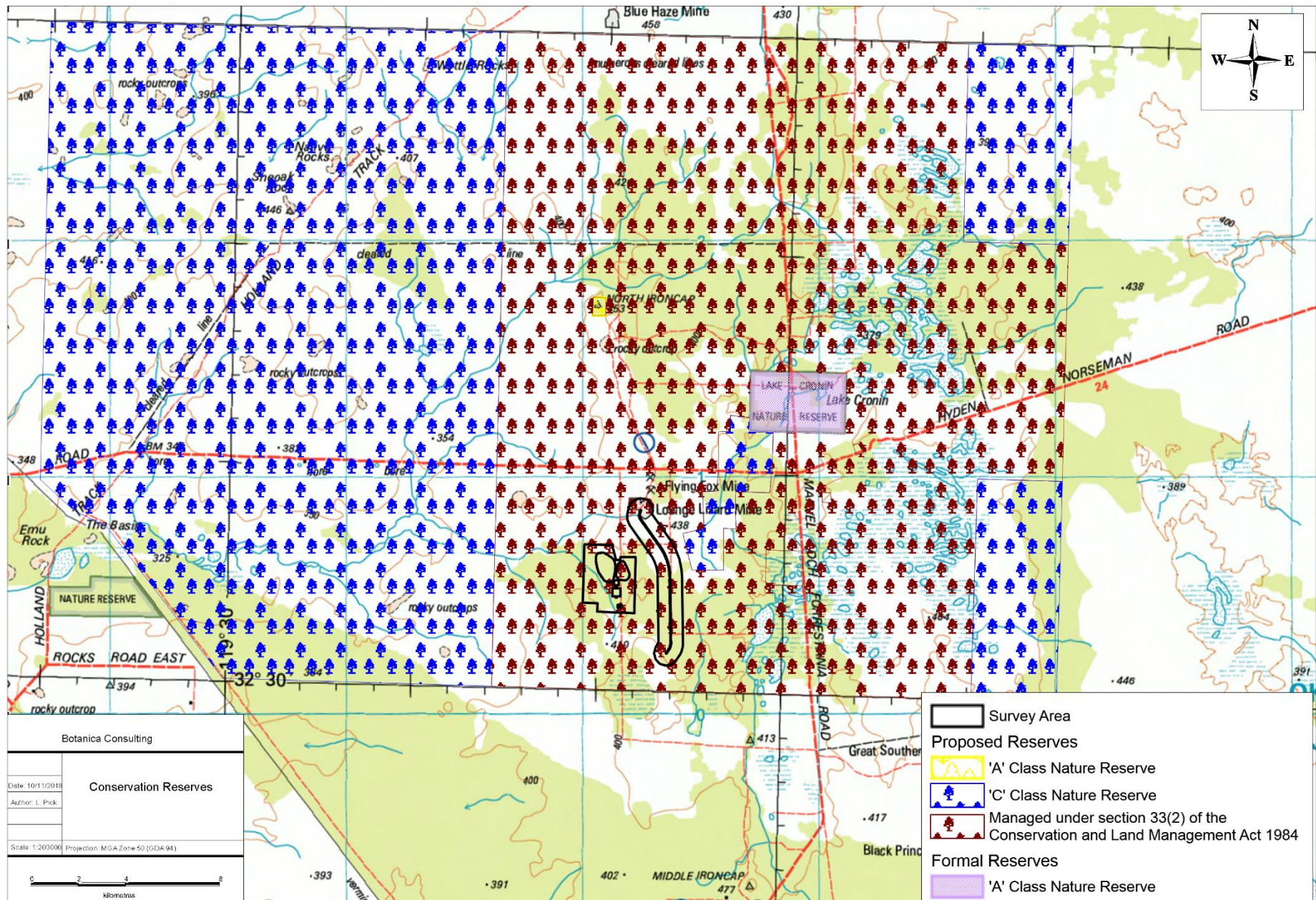
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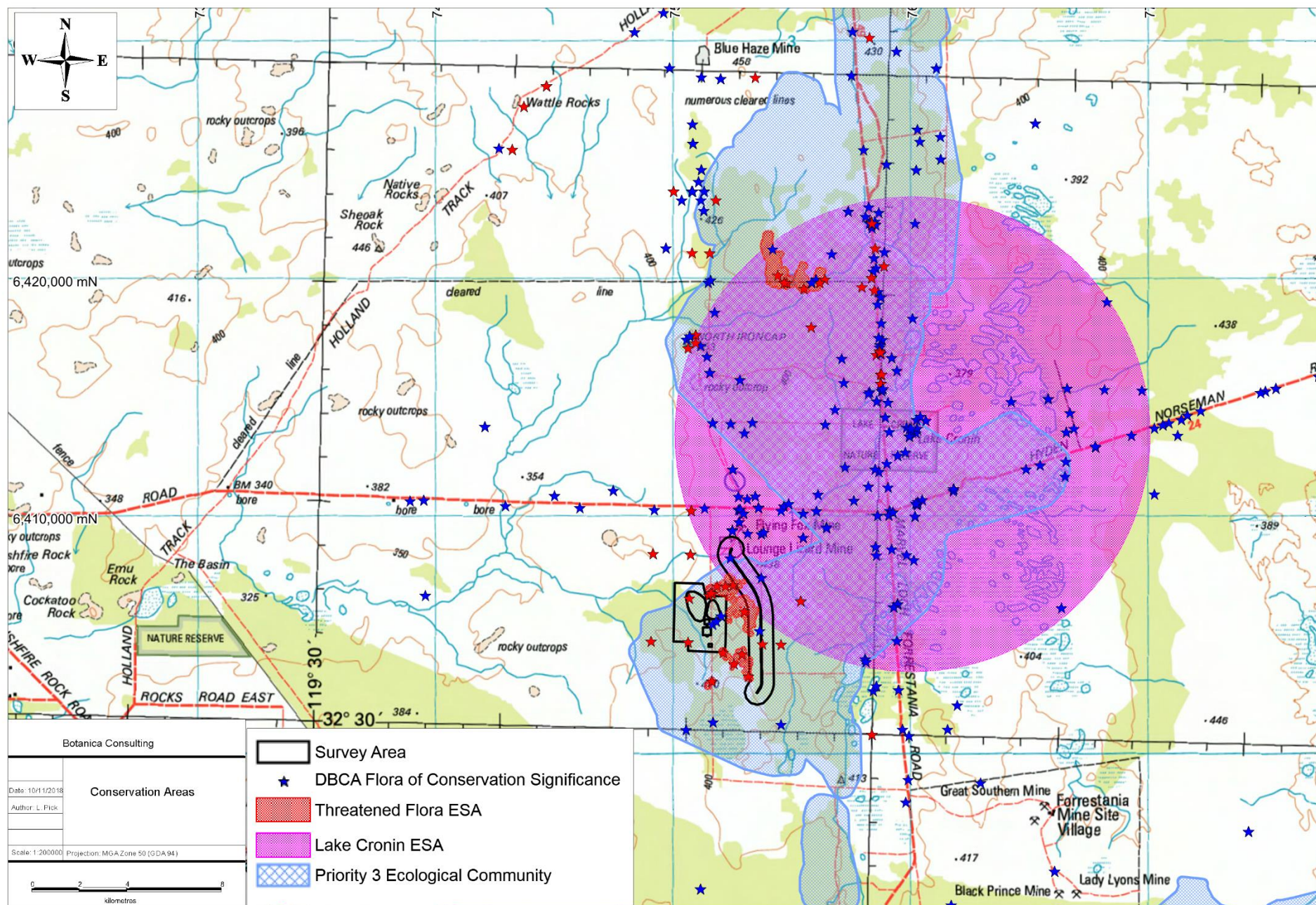
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Appendix 1: Regional maps of the survey area in relation to areas of conservation significance





Appendix 2: List of species identified within each vegetation association

(A) Blue text Denotes Annual species; (W) Green text Denotes Introduced species; (P/T) Red text Denotes Flora of Conservation Significance

Family	Genus	Taxon	CLP-EW1	CLP-EW2	CLP-EW3	CLP-EW4	R-MWS1	SLP-MWS1	SLP-MWS2	SP-H1	SP-MWS1
Apiaceae	<i>Platysace</i>	<i>maxwellii</i>					*			*	
Asparagaceae	<i>Thysanotus</i>	<i>dichotomus</i>					*		*		
Geraniaceae	<i>Pelargonium</i>	<i>havlasae</i>	*								
Poaceae	<i>Austrostipa</i>	sp. (sterile)	*		*	*					
Aizoaceae	<i>Disphyma</i>	<i>crassifolium</i> subsp. <i>clavellatum</i>		*							
Asparagaceae	<i>Thysanotus</i>	<i>sparteus</i>		*						*	
Asphodelaceae	<i>Bulbine</i>	<i>semibarbata</i>	*								
Asteraceae	<i>Angianthus</i>	<i>tomentosus</i> (A)	*				*				
Asteraceae	<i>Calotis</i>	<i>hispidula</i> (A)	*								
Asteraceae	<i>Dittrichia</i>	<i>graveolens</i> (W)	*				*				
Asteraceae	<i>Erymophyllum</i>	<i>ramosum</i> subsp. <i>ramosum</i> (A)		*							
Asteraceae	<i>Gnephosis</i>	<i>tenuissima</i> (A)	*								
Asteraceae	<i>Olearia</i>	<i>muelleri</i>	*	*	*	*	*	*	*		
Asteraceae	<i>Olearia</i>	<i>pimeleoides</i>	*		*						
Asteraceae	<i>Sonchus</i>	<i>oleraceus</i> (W)	*								
Campanulaceae	<i>Wahlenbergia</i>	<i>capensis</i> (W)	*								
Casuarinaceae	<i>Allocasuarina</i>	<i>acutivalvis</i>					*	*		*	
Casuarinaceae	<i>Allocasuarina</i>	<i>campestris</i>	*				*			*	
Casuarinaceae	<i>Allocasuarina</i>	<i>corniculata</i>					*	*	*	*	*
Casuarinaceae	<i>Allocasuarina</i>	<i>helmsii</i>	*					*			
Casuarinaceae	<i>Allocasuarina</i>	<i>microstachya</i>									*
Casuarinaceae	<i>Allocasuarina</i>	sp. (sterile)			*		*				*
Chenopodiaceae	<i>Atriplex</i>	<i>stipitata</i>	*	*		*	*				
Chenopodiaceae	<i>Atriplex</i>	<i>vesicaria</i>				*					
Chenopodiaceae	<i>Maireana</i>	<i>georgei</i>	*	*							
Chenopodiaceae	<i>Maireana</i>	<i>oppositifolia</i>	*								
Chenopodiaceae	<i>Rhagodia</i>	<i>drummondii</i>				*					
Chenopodiaceae	<i>Sclerolaena</i>	<i>diacantha</i>	*	*							
Chenopodiaceae	<i>Sclerolaena</i>	<i>parviflora</i>	*	*	*	*					
Chenopodiaceae	<i>Sclerolaena</i>	<i>uniflora</i>	*	*				*			

Family	Genus	Taxon	CLP-EW1	CLP-EW2	CLP-EW3	CLP-EW4	R-MWS1	SLP-MWS1	SLP-MWS2	SP-H1	SP-MWS1
Convolvulaceae	<i>Wilsonia</i>	<i>humilis</i>	*	*	*	*		*	*		
Cupressaceae	<i>Callitris</i>	<i>preissii</i>	*				*	*	*	*	
Cyperaceae	<i>Gahnia</i>	<i>ancistrophylla</i>					*				
Cyperaceae	<i>Gahnia</i>	<i>aristata</i>									*
Cyperaceae	<i>Lepidosperma</i>	<i>sanguinolentum</i>					*	*		*	*
Cyperaceae	<i>Lepidosperma</i>	<i>brunonianum</i>		*	*			*		*	
Cyperaceae	<i>Lepidosperma</i>	<i>carphoides</i>									*
Cyperaceae	<i>Lepidosperma</i>	aff. sp.Maggie Hills (R. Barrett)								*	
Cyperaceae	<i>Lepidosperma</i>	<i>drummondii</i>					*	*	*	*	
Cyperaceae	<i>Lepidosperma</i>	<i>pubisquameum</i>								*	
Dilleniaceae	<i>Hibbertia</i>	<i>eatoniae</i>								*	*
Dilleniaceae	<i>Hibbertia</i>	<i>exasperata</i>					*				*
Dilleniaceae	<i>Hibbertia</i>	<i>gracilipes</i>					*	*		*	*
Dilleniaceae	<i>Hibbertia</i>	<i>pungens</i>					*	*	*	*	
Droseraceae	<i>Drosera</i>	<i>macrantha</i> (A)					*			*	*
Ericaceae	<i>Astroloma</i>	<i>serratifolium</i>					*	*	*	*	*
Ericaceae	<i>Leucopogon</i>	?sp. Newdegate (M. Hislop 3585)									*
Ericaceae	<i>Leucopogon</i>	<i>cuneifolius</i>						*	*	*	
Ericaceae	<i>Leucopogon</i>	sp. outer wheatbelt (M. Hislop 30)								*	
Ericaceae	<i>Leucopogon</i>	sp. Wheatbelt (S. Murray 257)									*
Ericaceae	<i>Lysinema</i>	<i>ciliatum</i>								*	*
Ericaceae	<i>Lysinema</i>	<i>pentapetalum</i>									*
Euphorbiaceae	<i>Beyeria</i>	<i>brevifolia</i>					*			*	
Fabaceae	<i>Acacia</i>	<i>acanthoclada</i> subsp. <i>acanthoclada</i>	*				*		*	*	
Fabaceae	<i>Acacia</i>	<i>acuaria</i>		*							
Fabaceae	<i>Acacia</i>	<i>acuminata</i>	*					*		*	
Fabaceae	<i>Acacia</i>	<i>assimilis</i> subsp. <i>assimilis</i>								*	*
Fabaceae	<i>Acacia</i>	<i>brachyclada</i>								*	
Fabaceae	<i>Acacia</i>	<i>camptoclada</i>	*				*	*	*	*	
Fabaceae	<i>Acacia</i>	<i>castanostegia</i>					*				*
Fabaceae	<i>Acacia</i>	<i>colletoides</i>				*					
Fabaceae	<i>Acacia</i>	<i>coolgardiensis</i>						*		*	
Fabaceae	<i>Acacia</i>	<i>deficiens</i>	*	*	*		*	*	*	*	

Family	Genus	Taxon	CLP-EW1	CLP-EW2	CLP-EW3	CLP-EW4	R-MWS1	SLP-MWS1	SLP-MWS2	SP-H1	SP-MWS1
Fabaceae	<i>Paragoodia</i>	<i>crenulata</i> (T)	*								
Fabaceae	<i>Pultenaea</i>	aff. <i>arida</i>	*								
Fabaceae	<i>Pultenaea</i>	<i>arida</i>						*			
Fabaceae	<i>Senna</i>	<i>artemisioides</i> subsp. <i>xartemisioides</i>				*					
Fabaceae	<i>Senna</i>	<i>artemisioides</i> subsp. <i>filifolia</i>	*		*		*				
Fabaceae	<i>Senna</i>	<i>cardiosperma</i>	*								
Fabaceae	<i>Templetonia</i>	<i>egena</i>						*			
Fabaceae	<i>Templetonia</i>	<i>sulcata</i>		*	*		*		*		
Goodeniaceae	<i>Coopernookia</i>	<i>strophiolata</i>		*				*	*	*	
Goodeniaceae	<i>Dampiera</i>	<i>angulata</i>					*	*		*	
Goodeniaceae	<i>Goodenia</i>	<i>dyeri</i> (A)	*								
Goodeniaceae	<i>Goodenia</i>	<i>pinifolia</i>		*	*		*	*		*	
Goodeniaceae	<i>Goodenia</i>	<i>viscida</i>	*					*	*		
Goodeniaceae	<i>Scaevola</i>	<i>spinescens</i>		*		*	*			*	
Haloragaceae	<i>Glischrocaryon</i>	<i>roei</i>						*			
Hemerocallidaceae	<i>Dianella</i>	<i>revoluta</i>	*	*	*		*	*		*	
Lamiaceae	<i>Microcorys</i>	sp. <i>Forrestania</i> (V. English 2004) (P4)	*	*	*			*	*		
Lamiaceae	<i>Westringia</i>	<i>cephalantha</i> var. <i>caterva</i>	*	*	*		*	*	*	*	
Lamiaceae	<i>Westringia</i>	<i>rigida</i>	*	*	*					*	
Lauraceae	<i>Cassytha</i>	<i>melantha</i> (A)	*	*			*	*	*	*	
Lauraceae	<i>Cassytha</i>	<i>pomiformis</i> (A)								*	
Malvaceae	<i>Thomasia</i>	<i>sarotes</i>									*
Myrtaceae	<i>Astartea</i>	<i>heteranthera</i>								*	
Myrtaceae	<i>Baeckea</i>	<i>crispiflora</i>					*	*		*	
Myrtaceae	<i>Baeckea</i>	sp. (sterile)						*			
Myrtaceae	<i>Beaufortia</i>	<i>micrantha</i>									*
Myrtaceae	<i>Beaufortia</i>	<i>schaueri</i>								*	*
Myrtaceae	<i>Calothamnus</i>	<i>quadrifidus</i> subsp. <i>seminudus</i>								*	
Myrtaceae	<i>Calytrix</i>	<i>breviseta</i> subsp. <i>stipulosa</i>						*		*	
Myrtaceae	<i>Chamelaucium</i>	? <i>virgatum</i>								*	
Myrtaceae	<i>Chamelaucium</i>	<i>ciliatum</i>								*	*
Myrtaceae	<i>Cyathostemon</i>	<i>tenuifolius</i>					*		*	*	
Myrtaceae	<i>Darwinia</i>	sp. Lake Cobham (K. Newbey 3262)					*	*		*	*

Family	Genus	Taxon	CLP-EW1	CLP-EW2	CLP-EW3	CLP-EW4	R-MWS1	SLP-MWS1	SLP-MWS2	SP-H1	SP-MWS1
Myrtaceae	<i>Verticordia</i>	<i>plumosa</i>								*	
Myrtaceae	<i>Verticordia</i>	<i>roei</i>								*	
Olacaceae	<i>Olax</i>	<i>benthamiana</i>									*
Orchidaceae	<i>Caladenia</i>	<i>hirta</i> (A)					*		*	*	
Orchidaceae	<i>Pterostylis</i>	<i>arbuscula</i> (A)	*								
Orchidaceae	<i>Pterostylis</i>	<i>mutica</i> (A)	*						*		
Orchidaceae	<i>Thelymitra</i>	<i>petrophila</i> (A)							*		
Primulaceae	<i>Lysimachia</i>	<i>arvensis</i> (W)	*								
Proteaceae	<i>Adenanthos</i>	<i>argyreus</i>									*
Proteaceae	<i>Banksia</i>	<i>audax</i>									*
Proteaceae	<i>Banksia</i>	<i>cirsiioides</i>								*	
Proteaceae	<i>Banksia</i>	<i>densa</i> var. Wheatbelt (M. Pieroni s.n. PERTH 04083407)									*
Proteaceae	<i>Banksia</i>	<i>elderiana</i>								*	
Proteaceae	<i>Banksia</i>	<i>erythrocephala</i> var. <i>erythrocephala</i>								*	*
Proteaceae	<i>Banksia</i>	<i>laevigata</i> subsp. <i>fuscolutea</i>								*	*
Proteaceae	<i>Conospermum</i>	<i>brownii</i>							*	*	*
Proteaceae	<i>Grevillea</i>	<i>acuaria</i>	*	*	*		*	*	*	*	
Proteaceae	<i>Grevillea</i>	<i>cagiana</i>	*							*	*
Proteaceae	<i>Grevillea</i>	<i>decipiens</i>								*	
Proteaceae	<i>Grevillea</i>	<i>eristostachya</i>						*		*	*
Proteaceae	<i>Grevillea</i>	<i>huegelii</i>	*	*	*	*		*			*
Proteaceae	<i>Grevillea</i>	<i>obliquistigma</i>	*							*	
Proteaceae	<i>Grevillea</i>	<i>oligantha</i>	*								
Proteaceae	<i>Grevillea</i>	<i>oncogyne</i>		*				*		*	
Proteaceae	<i>Grevillea</i>	<i>pterosperma</i>						*		*	*
Proteaceae	<i>Hakea</i>	<i>commutata</i>	*					*			
Proteaceae	<i>Hakea</i>	<i>corymbosa</i>	*				*			*	*
Proteaceae	<i>Hakea</i>	<i>erecta</i>					*			*	*
Proteaceae	<i>Hakea</i>	<i>francisiana</i>								*	
Proteaceae	<i>Hakea</i>	<i>kippistiana</i>								*	
Proteaceae	<i>Hakea</i>	<i>multilineata</i>						*	*	*	
Proteaceae	<i>Hakea</i>	<i>newbeyana</i>						*			

Family	Genus	Taxon	CLP-EW1	CLP-EW2	CLP-EW3	CLP-EW4	R-MWS1	SLP-MWS1	SLP-MWS2	SP-H1	SP-MWS1
Proteaceae	<i>Hakea</i>	<i>platysperma</i>						*		*	*
Proteaceae	<i>Hakea</i>	<i>scoparia</i> subsp. <i>scoparia</i>					*	*		*	
Proteaceae	<i>Hakea</i>	<i>subsulcata</i>					*		*	*	
Proteaceae	<i>Hakea</i>	<i>erecta</i>					*				
Proteaceae	<i>Hakea</i>	<i>multilineata</i>								*	
Proteaceae	<i>Hakea</i>	sp. (sterile)									*
Proteaceae	<i>Isopogon</i>	<i>axillaris</i>								*	
Proteaceae	<i>Isopogon</i>	<i>scabriusculus</i> subsp. <i>pubifloris</i>								*	*
Proteaceae	<i>Isopogon</i>	<i>scabriusculus</i> subsp. <i>scabriusculus</i>									*
Proteaceae	<i>Persoonia</i>	<i>cordifolia</i>									*
Proteaceae	<i>Persoonia</i>	<i>coriacea</i>								*	*
Proteaceae	<i>Persoonia</i>	<i>helix</i>								*	
Proteaceae	<i>Petrophile</i>	<i>divaricata</i>								*	
Proteaceae	<i>Petrophile</i>	<i>merrallii</i>									*
Proteaceae	<i>Petrophile</i>	<i>trifida</i>								*	
Proteaceae	<i>Synaphea</i>	<i>interioris</i>								*	
Restionaceae	<i>Chordifex</i>	<i>sphacelatus</i>									*
Rhamnaceae	<i>Cryptandra</i>	<i>aridicola</i>		*	*						
Rhamnaceae	<i>Cryptandra</i>	<i>intonsa</i>		*							
Rhamnaceae	<i>Cryptandra</i>	<i>minutifolia</i> subsp. <i>minutifolia</i>	*		*			*		*	
Rhamnaceae	<i>Cryptandra</i>	<i>nutans</i>								*	
Rhamnaceae	<i>Trymalium</i>	<i>myrtillus</i>							*		
Rutaceae	<i>Boronia</i>	<i>inornata</i> subsp. <i>inornata</i>		*				*	*	*	
Rutaceae	<i>Boronia</i>	<i>inornata</i> subsp. <i>leptophylla</i>						*			
Rutaceae	<i>Drummondita</i>	<i>hassellii</i>								*	
Rutaceae	<i>Microcybe</i>	<i>multiflora</i>	*		*						
Rutaceae	<i>Phebalium</i>	<i>ambiguum</i>						*		*	
Rutaceae	<i>Phebalium</i>	<i>filifolium</i>					*		*	*	*
Rutaceae	<i>Phebalium</i>	<i>lepidotum</i>									*
Rutaceae	<i>Phebalium</i>	<i>megaphyllum</i>								*	
Rutaceae	<i>Phebalium</i>	<i>microphyllum</i>			*		*				
Rutaceae	<i>Phebalium</i>	sp. (sterile)								*	
Rutaceae	<i>Phebalium</i>	<i>tuberculosum</i>	*	*				*	*	*	

Family	Genus	Taxon	CLP-EW1	CLP-EW2	CLP-EW3	CLP-EW4	R-MWS1	SLP-MWS1	SLP-MWS2	SP-H1	SP-MWS1
Rutaceae	<i>Philotheca</i>	<i>rhomboidea</i>	*								
Santalaceae	<i>Exocarpos</i>	<i>aphyllus</i>	*	*	*		*	*	*	*	
Santalaceae	<i>Exocarpos</i>	<i>sparteus</i>					*	*			*
Santalaceae	<i>Santalum</i>	<i>acuminatum</i>	*	*	*	*	*	*	*	*	*
Santalaceae	<i>Santalum</i>	<i>murrayanum</i>									*
Sapindaceae	<i>Dodonaea</i>	<i>bursariifolia</i>		*	*		*	*	*	*	
Sapindaceae	<i>Dodonaea</i>	<i>microzyga</i>	*					*			
Sapindaceae	<i>Dodonaea</i>	<i>microzyga</i> var. <i>acrolobata</i>								*	
Sapindaceae	<i>Dodonaea</i>	<i>stenozyga</i>	*	*	*		*	*	*		
Sapindaceae	<i>Dodonaea</i>	<i>viscosa</i> subsp. <i>spatulata</i>	*				*		*		
Scrophulariaceae	<i>Eremophila</i>	<i>decipiens</i> subsp. <i>decipiens</i>	*	*	*				*		
Scrophulariaceae	<i>Eremophila</i>	<i>densifolia</i>	*	*				*			
Scrophulariaceae	<i>Eremophila</i>	<i>densifolia</i> subsp. <i>capitata</i>			*				*		
Scrophulariaceae	<i>Eremophila</i>	<i>dichroantha</i>	*		*			*			
Scrophulariaceae	<i>Eremophila</i>	<i>drummondii</i>	*		*			*	*	*	
Scrophulariaceae	<i>Eremophila</i>	<i>ionantha</i>		*	*						
Scrophulariaceae	<i>Eremophila</i>	<i>maculata</i>	*	*	*	*					
Scrophulariaceae	<i>Eremophila</i>	<i>racemosa</i> (P4)	*	*	*		*				
Stylidiaceae	<i>Stylidium</i>	<i>sejunctum</i> (P3)	*				*				
Thymelaeaceae	<i>Pimelea</i>	<i>aeruginosa</i>						*		*	

Appendix 3: Vegetation Condition Rating

Vegetation Condition Rating	South West and Interzone Botanical Provinces	Eremaean and Northern Botanical Provinces
Pristine	Pristine or nearly so, no obvious signs of disturbance or damage caused by human activities since European settlement.	
Excellent	Vegetation structure intact, disturbance affecting individual species and weeds are non-aggressive species. Damage to trees caused by fire, the presence of non-aggressive weeds and occasional vehicle tracks.	Pristine or nearly so, no obvious signs of damage caused by human activities since European settlement.
Very Good	Vegetation structure altered, obvious signs of disturbance. Disturbance to vegetation structure caused by repeated fires, the presence of some more aggressive weeds, dieback, logging and grazing.	Some relatively slight signs of damage caused by human activities since European settlement. For example, some signs of damage to tree trunks caused by repeated fire, the presence of some relatively non-aggressive weeds, or occasional vehicle tracks.
Good	Vegetation structure significantly altered by very obvious signs of multiple disturbances. Retains basic vegetation structure or ability to regenerate it. Disturbance to vegetation structure caused by very frequent fires, the presence of very aggressive weeds, partial clearing, dieback and grazing.	More obvious signs of damage caused by human activity since European settlement, including some obvious impact on the vegetation structure such as that caused by low levels of grazing or slightly aggressive weeds.
Poor		Still retains basic vegetation structure or ability to regenerate it after very obvious impacts of human activities since European settlement, such as grazing, partial clearing, frequent fires or aggressive weeds.
Degraded	Basic vegetation structure severely impacted by disturbance. Scope for regeneration but not to a state approaching good condition without intensive management. Disturbance to vegetation structure caused by very frequent fires, the presence of very aggressive weeds at high density, partial clearing, dieback and grazing.	Severely impacted by grazing, very frequent fires, clearing or a combination of these activities. Scope for some regeneration but not to a state approaching good condition without intensive management. Usually with a number of weed species present including very aggressive species.
Completely Degraded	The structure of the vegetation is no longer intact and the area is completely or almost completely without native species. These areas are often described as 'parkland cleared' with the flora comprising weed or crop species with isolated native trees and shrubs.	Areas that are completely or almost completely without native species in the structure of their vegetation; i.e. areas that are cleared or 'parkland cleared' with their flora comprising weed or crop species with isolated native trees or shrubs.

Appendix 4: Priority Flora Locations Recorded by Botanica

Note: Records of Threatened Flora excluded due to sensitivity of the data

Taxon	DBCA known location	Zone	Easting	Northing
<i>Eremophila racemosa</i> (P4)	N	50 H	753589	6405427
<i>Eremophila racemosa</i> (P4)	N	50 H	753747	6404325
<i>Eremophila racemosa</i> (P4)	N	50 H	753748	6404506
<i>Eremophila racemosa</i> (P4)	N	50 H	753628	6404088
<i>Eremophila racemosa</i> (P4)	N	50 H	753567	6405422
<i>Eremophila racemosa</i> (P4)	N	50 H	752249	6406629
<i>Eremophila racemosa</i> (P4)	N	50 H	752548	6406326
<i>Eremophila racemosa</i> (P4)	N	50 H	752502	6406239
<i>Eremophila racemosa</i> (P4)	N	50 H	752325	6406145
<i>Eremophila racemosa</i> (P4)	N	50 H	752399	6406141
<i>Eremophila racemosa</i> (P4)	N	50 H	751980	6405710
<i>Eremophila racemosa</i> (P4)	N	50 H	752246	6405657
<i>Eremophila racemosa</i> (P4)	N	50 H	752040	6405654
<i>Eremophila racemosa</i> (P4)	N	50 H	751960	6405628
<i>Eremophila racemosa</i> (P4)	N	50 H	751939	6405463
<i>Eremophila racemosa</i> (P4)	N	50 H	751663	6405366
<i>Eremophila racemosa</i> (P4)	N	50 H	751667	6405097
<i>Eremophila racemosa</i> (P4)	N	50 H	751666	6405065
<i>Eremophila racemosa</i> (P4)	N	50 H	752129	6404685
<i>Eremophila racemosa</i> (P4)	N	50 H	751946	6404685
<i>Eremophila racemosa</i> (P4)	N	50 H	752020	6404963
<i>Eremophila racemosa</i> (P4)	N	50 H	751656	6405853
<i>Eremophila racemosa</i> (P4)	N	50 H	751704	6405853
<i>Eremophila racemosa</i> (P4)	N	50 H	751633	6406437
<i>Eremophila racemosa</i> (P4)	N	50 H	752001	6405707
<i>Eremophila racemosa</i> (P4)	N	50 H	752095	6405710
<i>Eremophila racemosa</i> (P4)	N	50 H	751926	6405779
<i>Eremophila racemosa</i> (P4)	N	50 H	751849	6405891
<i>Eremophila racemosa</i> (P4)	N	50 H	752172	6405948
<i>Eremophila racemosa</i> (P4)	N	50 H	751874	6405960
<i>Eremophila racemosa</i> (P4)	N	50 H	751870	6406136
<i>Eremophila racemosa</i> (P4)	N	50 H	752064	6406139
<i>Eremophila racemosa</i> (P4)	N	50 H	752093	6406012
<i>Eremophila racemosa</i> (P4)	N	50 H	751658	6402742
<i>Eremophila racemosa</i> (P4)	N	50 H	751465	6402618
<i>Eutaxia acanthoclada</i> (P3)	N	50 H	753087	6405324
<i>Eutaxia acanthoclada</i> (P3)	N	50 H	753062	6405314
<i>Eutaxia acanthoclada</i> (P3)	N	50 H	752811	6405117
<i>Eutaxia acanthoclada</i> (P3)	N	50 H	752839	6405119
<i>Eutaxia acanthoclada</i> (P3)	N	50 H	753007	6405116
<i>Eutaxia acanthoclada</i> (P3)	N	50 H	750934	6404785
<i>Eutaxia acanthoclada</i> (P3)	N	50 H	750622	6404700
<i>Eutaxia acanthoclada</i> (P3)	N	50 H	750586	6404715
<i>Eutaxia acanthoclada</i> (P3)	N	50 H	750558	6404726
<i>Eutaxia acanthoclada</i> (P3)	N	50 H	750549	6404700
<i>Eutaxia acanthoclada</i> (P3)	N	50 H	750521	6404675
<i>Eutaxia acanthoclada</i> (P3)	N	50 H	750509	6404634
<i>Eutaxia acanthoclada</i> (P3)	N	50 H	750512	6404616
<i>Eutaxia acanthoclada</i> (P3)	N	50 H	750513	6404564
<i>Eutaxia acanthoclada</i> (P3)	N	50 H	750519	6404508
<i>Eutaxia acanthoclada</i> (P3)	N	50 H	750548	6404481
<i>Eutaxia acanthoclada</i> (P3)	N	50 H	750566	6404472
<i>Eutaxia acanthoclada</i> (P3)	N	50 H	750702	6404452
<i>Eutaxia acanthoclada</i> (P3)	N	50 H	750740	6404444

Taxon	DBCA known location	Zone	Easting	Northing
<i>Eutaxia acanthoclada</i> (P3)	N	50 H	751059	6404558
<i>Eutaxia acanthoclada</i> (P3)	N	50 H	753315	6404968
<i>Eutaxia acanthoclada</i> (P3)	N	50 H	753269	6404980
<i>Microcorys</i> sp. Forrestania (V. English 2004) (P4)	N	50 H	753747	6404328
<i>Microcorys</i> sp. Forrestania (V. English 2004) (P4)	N	50 H	751399	6405889
<i>Microcorys</i> sp. Forrestania (V. English 2004) (P4)	N	50 H	750570	6405988
<i>Microcorys</i> sp. Forrestania (V. English 2004) (P4)	N	50 H	750385	6405985
<i>Microcorys</i> sp. Forrestania (V. English 2004) (P4)	N	50 H	750211	6405978
<i>Microcorys</i> sp. Forrestania (V. English 2004) (P4)	N	50 H	753698	6404901
<i>Microcorys</i> sp. Forrestania (V. English 2004) (P4)	N	50 H	751474	6405891
<i>Microcorys</i> sp. Forrestania (V. English 2004) (P4)	N	50 H	750582	6405991
<i>Microcorys</i> sp. Forrestania (V. English 2004) (P4)	N	50 H	750721	6406197
<i>Microcorys</i> sp. Forrestania (V. English 2004) (P4)	N	50 H	753706	6404904
<i>Microcorys</i> sp. Forrestania (V. English 2004) (P4)	N	50 H	753709	6404826
<i>Microcorys</i> sp. Forrestania (V. English 2004) (P4)	N	50 H	753768	6404620
<i>Microcorys</i> sp. Forrestania (V. English 2004) (P4)	N	50 H	753707	6404245
<i>Microcorys</i> sp. Forrestania (V. English 2004) (P4)	N	50 H	753721	6404039
<i>Microcorys</i> sp. Forrestania (V. English 2004) (P4)	N	50 H	752482	6408227
<i>Microcorys</i> sp. Forrestania (V. English 2004) (P4)	N	50 H	752486	6408219
<i>Microcorys</i> sp. Forrestania (V. English 2004) (P4)	N	50 H	752613	6408026
<i>Microcorys</i> sp. Forrestania (V. English 2004) (P4)	N	50 H	752646	6407992
<i>Microcorys</i> sp. Forrestania (V. English 2004) (P4)	N	50 H	751204	6406917
<i>Microcorys</i> sp. Forrestania (V. English 2004) (P4)	N	50 H	753760	6405181
<i>Microcorys</i> sp. Forrestania (V. English 2004) (P4)	N	50 H	751432	6405385
<i>Microcorys</i> sp. Forrestania (V. English 2004) (P4)	N	50 H	752259	6407592
<i>Microcorys</i> sp. Forrestania (V. English 2004) (P4)	N	50 H	752257	6407652
<i>Microcorys</i> sp. Forrestania (V. English 2004) (P4)	N	50 H	752246	6407660
<i>Microcorys</i> sp. Forrestania (V. English 2004) (P4)	N	50 H	752240	6407672
<i>Microcorys</i> sp. Forrestania (V. English 2004) (P4)	N	50 H	752238	6407679
<i>Microcorys</i> sp. Forrestania (V. English 2004) (P4)	N	50 H	752237	6407691
<i>Microcorys</i> sp. Forrestania (V. English 2004) (P4)	N	50 H	752253	6407768
<i>Microcorys</i> sp. Forrestania (V. English 2004) (P4)	N	50 H	752460	6407650
<i>Microcorys</i> sp. Forrestania (V. English 2004) (P4)	N	50 H	752498	6407503
<i>Microcorys</i> sp. Forrestania (V. English 2004) (P4)	N	50 H	752594	6407476
<i>Microcorys</i> sp. Forrestania (V. English 2004) (P4)	N	50 H	752735	6407252
<i>Microcorys</i> sp. Forrestania (V. English 2004) (P4)	N	50 H	752778	6407214
<i>Microcorys</i> sp. Forrestania (V. English 2004) (P4)	N	50 H	752907	6407123
<i>Microcorys</i> sp. Forrestania (V. English 2004) (P4)	N	50 H	752251	6407707
<i>Microcorys</i> sp. Forrestania (V. English 2004) (P4)	N	50 H	752464	6407632
<i>Microcorys</i> sp. Forrestania (V. English 2004) (P4)	N	50 H	752562	6407528
<i>Microcorys</i> sp. Forrestania (V. English 2004) (P4)	N	50 H	752594	6407519
<i>Microcorys</i> sp. Forrestania (V. English 2004) (P4)	N	50 H	752639	6407480
<i>Microcorys</i> sp. Forrestania (V. English 2004) (P4)	N	50 H	752656	6407451
<i>Microcorys</i> sp. Forrestania (V. English 2004) (P4)	N	50 H	752865	6407147
<i>Microcorys</i> sp. Forrestania (V. English 2004) (P4)	N	50 H	752820	6407304
<i>Microcorys</i> sp. Forrestania (V. English 2004) (P4)	N	50 H	752808	6407329
<i>Microcorys</i> sp. Forrestania (V. English 2004) (P4)	N	50 H	752792	6407395
<i>Microcorys</i> sp. Forrestania (V. English 2004) (P4)	N	50 H	752779	6407427
<i>Microcorys</i> sp. Forrestania (V. English 2004) (P4)	N	50 H	752773	6407432
<i>Microcorys</i> sp. Forrestania (V. English 2004) (P4)	N	50 H	752761	6407443
<i>Microcorys</i> sp. Forrestania (V. English 2004) (P4)	N	50 H	752715	6407498
<i>Microcorys</i> sp. Forrestania (V. English 2004) (P4)	N	50 H	752692	6407529
<i>Microcorys</i> sp. Forrestania (V. English 2004) (P4)	N	50 H	752622	6407606
<i>Microcorys</i> sp. Forrestania (V. English 2004) (P4)	N	50 H	752606	6407652
<i>Microcorys</i> sp. Forrestania (V. English 2004) (P4)	N	50 H	752576	6407708
<i>Microcorys</i> sp. Forrestania (V. English 2004) (P4)	N	50 H	752569	6407788
<i>Microcorys</i> sp. Forrestania (V. English 2004) (P4)	N	50 H	752596	6407774
<i>Microcorys</i> sp. Forrestania (V. English 2004) (P4)	N	50 H	752620	6407753

[illegible]

[illegible]

Taxon	DBCA known location	Zone	Easting	Northing
<i>Stylidium sejunctum</i> (P3)	N	50 H	751705	6405900
<i>Stylidium sejunctum</i> (P3)	N	50 H	751703	6405651
<i>Stylidium sejunctum</i> (P3)	N	50 H	751718	6405629
<i>Stylidium sejunctum</i> (P3)	Y	50 H	751815	6405584
<i>Stylidium sejunctum</i> (P3)	Y	50 H	751673	6405448

Appendix 5: Quadrat Locations

Quadrat	Vegetation Code	Zone	Easting	Northing	Elevation (m)
Q1	CLP-EW3	50 H	753302	6402951	401 m
Q2	R-MWS1	50 H	753807	6402956	405 m
Q3	CLP-EW1	50 H	754216	6403095	414 m
Q4	CLP-EW3	50 H	754016	6404073	414 m
Q5	CLP-EW2	50 H	751367	6404776	371 m
Q6	CLP-EW4	50 H	750862	6404741	390 m
Q7	CLP-EW4	50 H	750523	6405081	392 m
Q8	CLP-EW3	50 H	751430	6405271	384 m
Q9	CLP-EW3	50 H	750690	6405678	381 m
Q10	CLP-EW1	50 H	751250	6405665	386 m
Q11	CLP-EW4	50 H	750282	6405734	377 m
Q12	CLP-EW4	50 H	750212	6406615	376 m
Q13	CLP-EW2	50 H	750761	6406454	379 m
Q14	CLP-EW1	50 H	752015	6404638	399 m
Q15	SLP-MWS1	50 H	751204	6406917	396 m
Q16	SP-H1	50 H	751029	6407072	396 m
Q17	SP-MWS1	50 H	750779	6407113	398 m
Q18	R-MWS1	50 H	750711	6406987	395 m
Q19	CLP-EW1	50 H	751851	6406555	409 m
Q20	CLP-EW1	50 H	752109	6406378	410 m
Q21	R-MWS1	50 H	751805	6406320	406 m
Q22	CLP-EW2	50 H	751848	6405867	394 m
Q23	SLP-MWS2	50 H	753196	6403312	391 m
Q24	CLP-EW3	50 H	753474	6404061	420 m
Q25	SLP-MWS2	50 H	753351	6404733	405 m
Q26	SLP-MWS2	50 H	753486	6406049	417 m
Q27	SLP-MWS1	50 H	753772	6406454	416 m
Q28	SLP-MWS1	50 H	753843	6406876	416 m
Q29	SP-H1	50 H	753282	6407810	426 m
Q30	SLP-MWS1	50 H	752990	6408776	420 m
Q31	SLP-MWS2	50 H	752627	6407181	417 m
Q32	SP-MWS1	50 H	752264	6408482	416 m
Q33	SP-MWS1	50 H	751965	6408664	414 m
Q34	SP-H1	50 H	753996	6402410	410 m
Q35	CLP-EW1	50 H	751909	6405332	391 m
Q36	CLP-EW3	50 H	754053	6405175	417 m

Appendix 6: Quadrat Datasheets

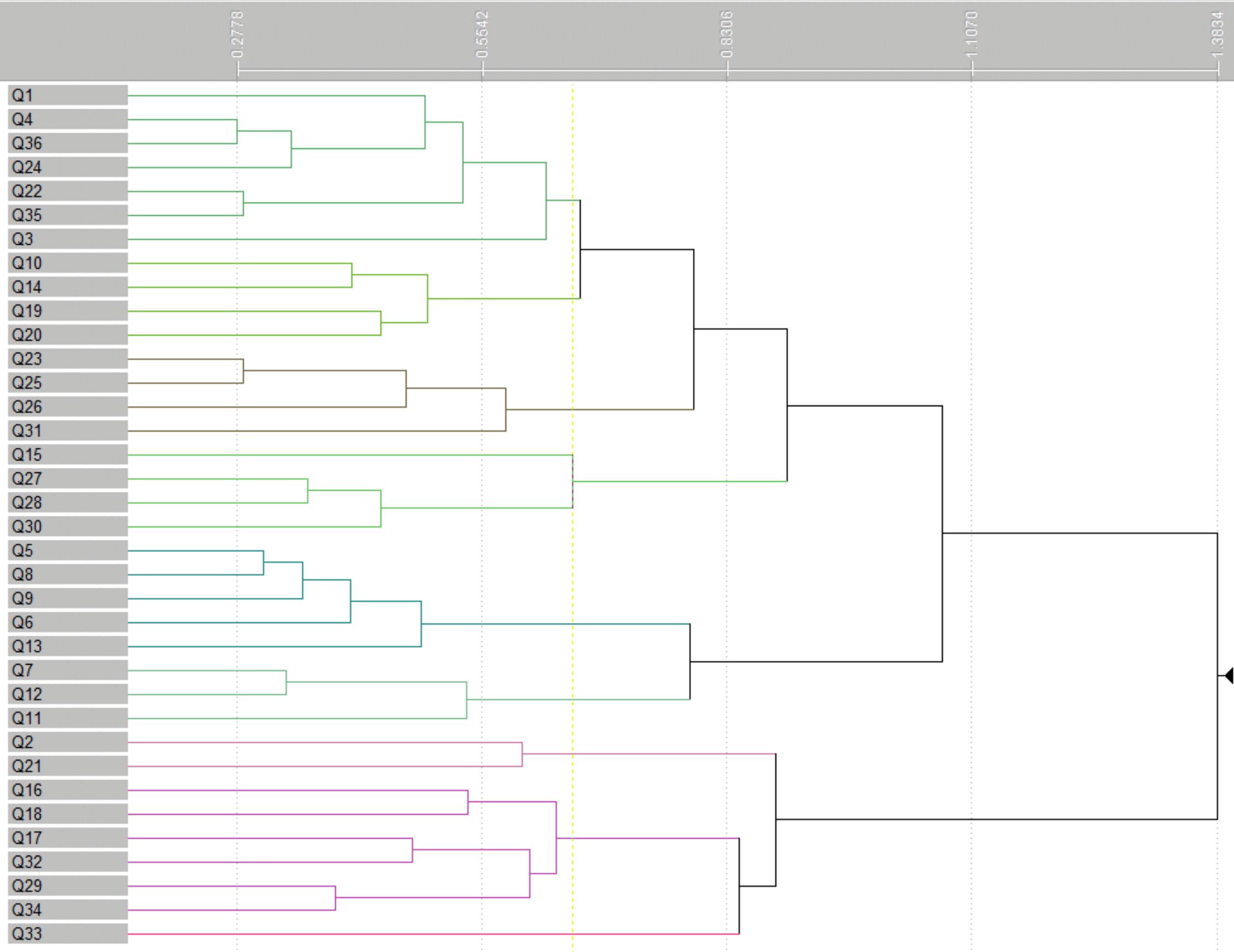
Provided as a separate document

Appendix 7: Quadrat Photographs

Provided as a separate document

Appendix 8: PATN Analysis results

Row Fusion Dendrogram



[illegible]

Stress: 0.1786

- LEGEND
- Group 1
 - Group 2
 - Group 3
 - Group 4
 - Group 5
 - Group 6
 - Group 7
 - Group 8
 - Group 9

PATN groups

