FLORA AND VEGETATION OF THE

EARL GREY, IRISH BREAKFAST AND PRINCE OF WALES

PROSPECTS

Mt Holland Project

Prepared for

Kidman Resources Limited

Prepared by

Mattiske Consulting Pty Ltd

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Mattiske Consulting Pty Ltd

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ABBREVIATIONS

The following abbreviations are used throughout this document:

BAM Act	*Biosecurity and Agriculture Management Act 2007*
BOM	Commonwealth Bureau of Meteorology
DAFWA	Department of Agriculture and Food, Western Australia
DotEE	Department of the Environment and Energy
DPaW	Department of Parks and Wildlife
EPA	Environment Protection Authority
EPBC Act	*Environment Protection and Biodiversity Conservation Act 1999*
ESCAVI	Executive Steering Committee for Australian Vegetation Information
IBRA	Interim Biogeographic Regionalisation for Australia
Kidman	Kidman Resources Ltd
Mattiske	Mattiske Consulting Pty Ltd
NVIS	National Vegetation Information System
PEC	Priority Ecological Community
PRIMER	Plymouth Routines in Multivariate Ecological Research
TEC	Threatened Ecological Community
TSSC	Western Australian Threatened Species Scientific Committee
WAH	Western Australian Herbarium
WAOL	Western Australian Organism List

1. SUMMARY

Kidman Resources Limited (Kidman) owns the historic Mt Holland Project, south of Southern Cross, near Mt Holland in Western Australia. Recent drilling results have confirmed the presence of a lithium pegmatite deposit at Kidman's Earl Grey prospect. The Mt Holland area has been the subject of previous flora and vegetation surveys. Mattiske Consulting Pty Ltd was commissioned in October 2016 to undertake a flora and vegetation survey of three prospects within the Mt Holland Project tenements, comprising Earl Grey, Irish Breakfast and Prince of Wales. The scope of the survey was to record the flora and vegetation of the three prospects and to assess the distribution of any conservation significant flora species and vegetation communities recorded.

A field survey was undertaken in October and November 2016. A total of 43 vegetation survey quadrats were established across the three prospects – 26 in the Earl Grey prospect, nine in the Irish Breakfast prospect and eight in the Prince of Wales prospect. A total of 184 vascular plant taxa which are representative of 86 genera and 35 families were recorded in the Earl Grey, Irish Breakfast and Prince of Wales prospects. The majority of taxa recorded were representative of the Myrtaceae (46 taxa), Fabaceae (30 taxa), and Proteaceae (19 taxa) families. Species which were classified as strictly annual represented 9.9% of all taxa recorded. Several flora of conservation significance were recorded during the field surveys. The most significant taxon recorded was *Banksia sphaerocarpa* var. *dolichostyla* (T). This taxon was not recorded within the Earl Grey, Irish Breakfast or Prince of Wales prospects. It was recorded at a location approximately 200 m from the eastern side of the Earl Grey prospect, in a vegetation community which is bisected by an old haul road. This taxon, nor the soil or landforms on which it was growing, was not recorded in any of the three prosects surveyed, however remains in close proximity to the Earl Grey prospect. Four priority listed taxa were recorded within the Earl Grey, Irish Breakfast or Prince of Wales prospects. These were *Eutaxia lasiocalyx* (P2), *Acacia undosa* (P3), *Hakea pendens* (P3), and *Calamphoreus inflatus* (P4). All four taxa were recorded infrequently.

Statistical analyses of quadrat based species data were carried out on 52 quadrats, including the Van Uden prospect (not presented in this report). Whilst 13 vegetation communities were delineated, only ten of these occur within the Earl Grey, Irish Breakfast and Prince of Wales prospects. Overall much of the vegetation of the Earl Grey, Irish Breakfast and Prince of Wales prospects can be broadly described as *Eucalyptus* mallee woodlands over *Melaleuca* shrubland. The vegetation communities delineated and the species present were consistent with both the historical and the more recent survey data.

None of the vegetation communities defined within the three prospects represents vegetation which could be classified as unique or restricted in the region. There is a considerable degree of disturbance in all three prospects, in terms of access tracks and drill tracks, particularly form past mining and exploration activities. Cleared land represented 16.20% of the area of the three prospects. In addition, both the Earl Grey and Irish Breakfast prospects have large areas of disturbance and clearing associated with old mine pits and waste mounds.

The Earl Grey, Irish Breakfast and Prince of Wales prospects are situated wholly within the buffer of the Ironcap Hills Vegetation Complexes (Mt Holland, Middle, North and South Ironcap Hills, Digger Rock and Hatter Hill) (banded ironstone), a Priority 3 ecological community. All three prospects are located adjacent to the western boundary of the PEC buffer. Given that the vegetation present in all three prospects was typical of the region and that there were no banded ironstone hills outcropping present, it is likely that impacts to the PEC are peripheral and minor in their extent.

The principal issue with respect to the flora and vegetation surveyed is in relation to the presence of *Banksia sphaerocarpa* var. *dolichostyla* (T) in the vicinity of the Earl Grey prospect. It would be appropriate, in the event of future mine development, to put in place a management plan to minimise impacts to this species and the associated vegetation.

2. INTRODUCTION

Kidman Resources Limited (Kidman) owns the historic Mt Holland Project, south of Southern Cross, near Mt Holland in Western Australia. Recent drilling results have confirmed the presence of a lithium pegmatite deposit at Kidman's Earl Grey prospect, located west of the historic Bounty pit and processing plant. Two other prospects, Irish Breakfast and Prince of Wales, located north of Earl Grey, also may have future resource potential. . The Mt Holland area has been the subject of previous flora and vegetation surveys. In 2006, Craig (2006) completed a rare and priority flora survey of the Bounty mine area for Nickel Australia Limited. The survey encompassed the Earl Grey, Irish Breakfast and Prince of Wales prospects. In September 2016, Native Vegetation Solutions (2016a) completed a targeted threatened flora survey of the Earl Grey prospect.

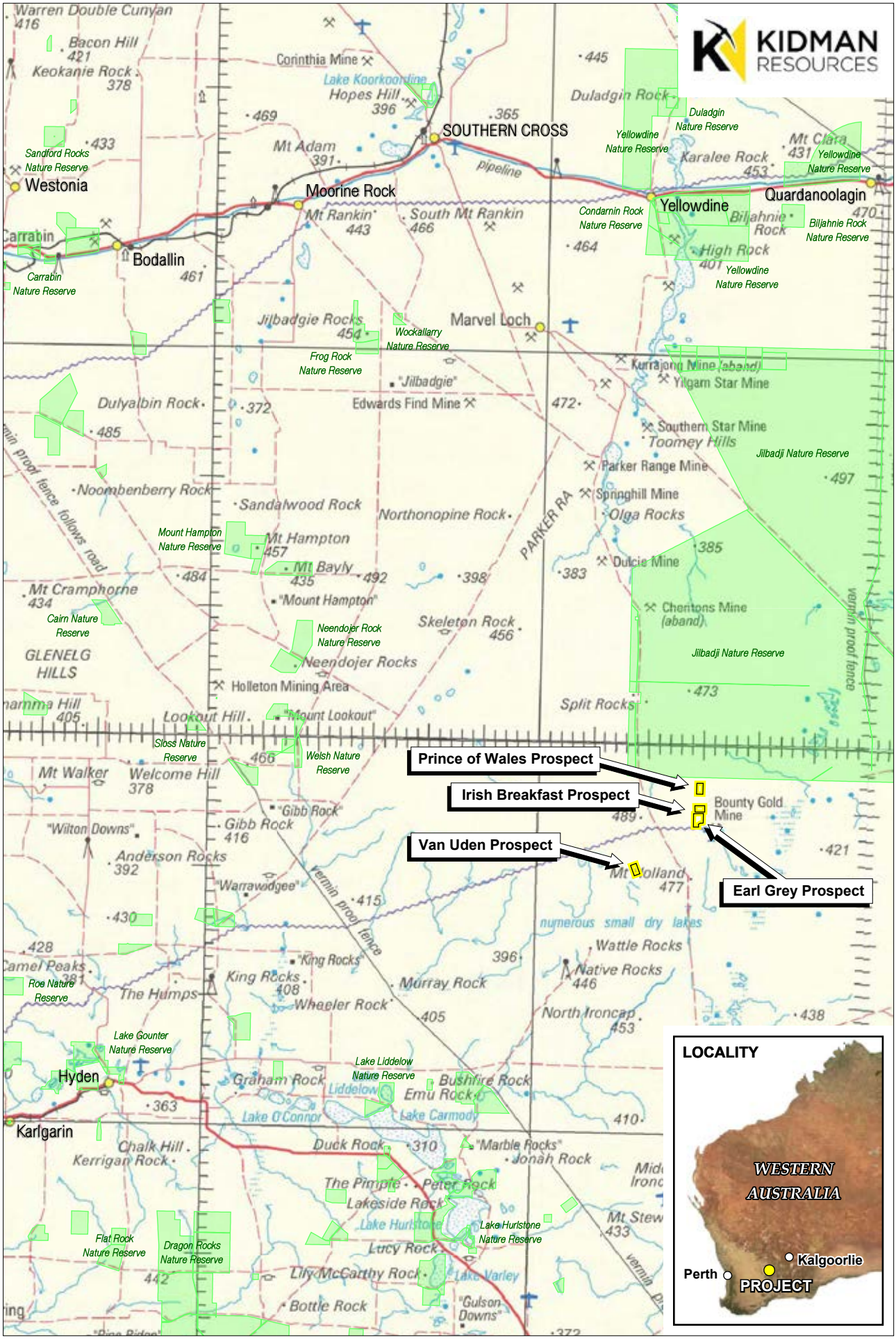
Mattiske Consulting Pty Ltd (Mattiske) was commissioned in October 2016 to undertake a flora and vegetation survey of the Earl Grey, Irish Breakfast and Prince of Wales prospects. Whilst this report focuses on these three prospects, both the desktop assessment and statistical analysis of field survey data used to derive vegetation communities incorporated data from the Van Uden prospect, located 10 km south-west of the Earl Grey prospect.

2.1 Location and Scope of Proposal

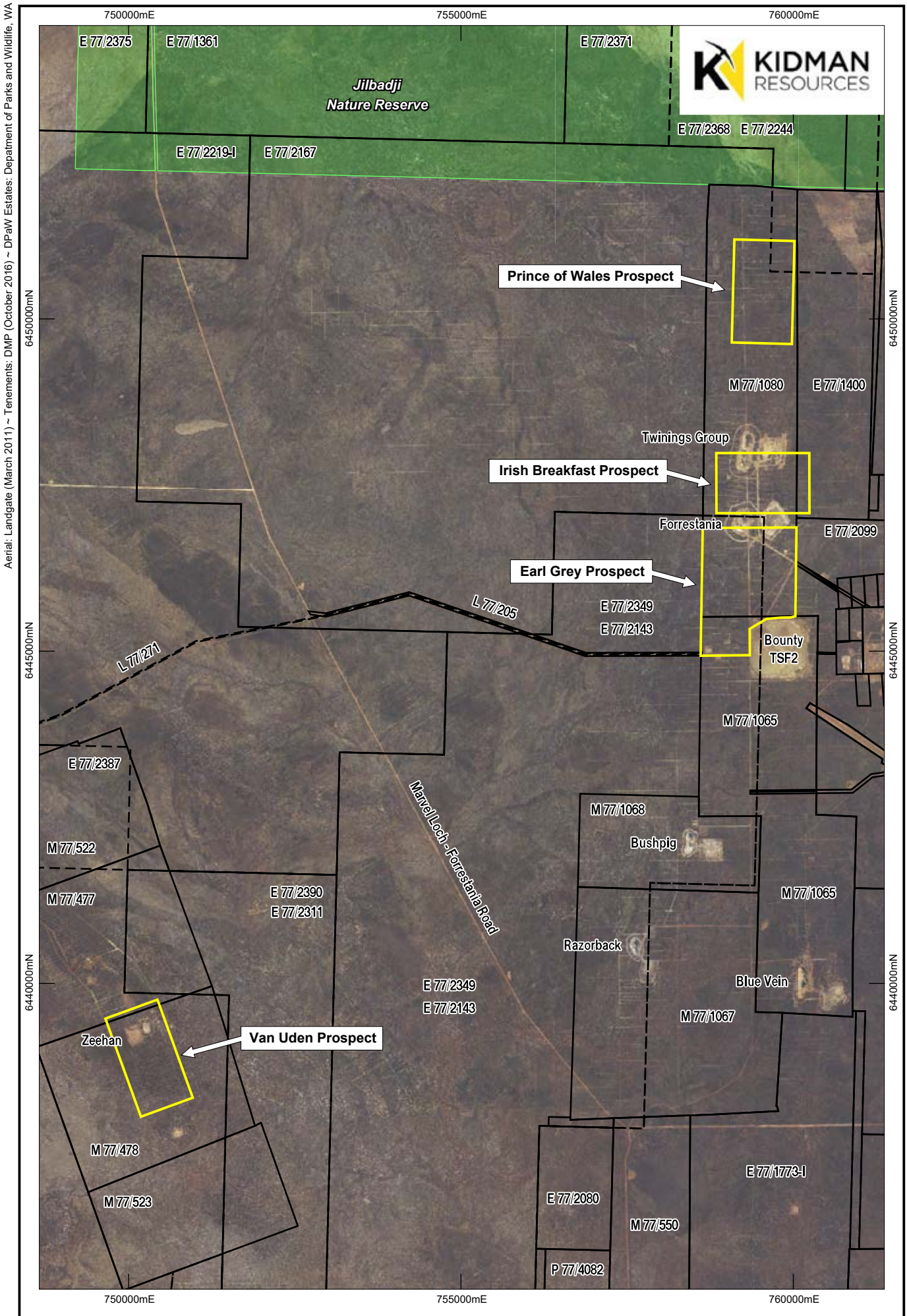
The Earl Grey, Irish Breakfast and Prince of Wales prospects are located approximately 105 km southeast of the town of Southern Cross, and 6.5 km to the east of the Forrestania Southern Cross Road (Figure 1). The Earl Grey, Irish Breakfast and Prince of Wales prospects occupy a combined area of 502.64 ha, with the Earl Grey prospect being 235.48 ha in area, the Irish Breakfast prospect being 126.92 ha in area, and the Prince of Wales prospect being 140.23 ha in area. The Earl Grey prospect is situated in granted mining leases M77/1065 and M77/1080; the Irish Breakfast prospect is situated in granted mining lease M77/1080 and granted exploration tenement E77/1400; the Prince of Wales prospect is situated in granted mining lease M77/1080 (Figure 2).

The scope of the survey was to undertake a reconnaissance flora and vegetation survey of the Earl Grey, Irish Breakfast and Prince of Wales prospects, and to assess the distribution of any conservation significant flora species and vegetation communities recorded.

DPaW Estates: Depatment of Parks and Wildlife, WA



N	0 15km Scale 1:750,000 MGA94 (Zone 50) CAD Ref: g2445_R001 Date: Oct 2016 | Rev: A | A4	Mattiske Consulting Pty Ltd 28 Central Road, Kalamunda WA 6076 ~ Tel: 9257 1625 ~ Fax: 9257 1640 Author: E M Mattiske | MCPL Ref: KID1601/022/16 Drawn: CAD Resources ~ www.cadresources.com.au Tel: (08) 9246 3242 ~ Fax: (08) 9246 3202	**Kidman Resources Ltd.** **Project Area Locality**	Figure: **1**



0 1km
Scale 1:75,000
MGA94 (Zone 50)
CAD Ref: g2445_R002
Date: Oct 2016 | Rev: A | A4

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Kidman Resources Ltd.

Tenements

Figure: **2**

2.2 Western Australia's Flora – A Legislative Perspective

Western Australia has a unique and diverse flora, and is recognised as one of the world's 34 biodiversity hotspots (Myers *et al*. 2000). In this context, Western Australia possesses a high degree of species richness and endemism. This is particularly pronounced in the south-west region of the state. The Department of Parks and Wildlife (DPaW) flora statistics indicate that there are currently over 12,000 native plant species known to occur within Western Australia (DPaW 2017a). Scientific knowledge of many of these species is limited.

The legislative protection of flora within Western Australia is principally governed by four Acts. These are the:

- *Biodiversity Conservation Act 2016* (WA);
- *Wildlife Conservation Act 1950* (WA);
- *Environmental Protection Act 1986* (WA); and
- *Environment Protection and Biodiversity Conservation Act 1999* (Cth).

In December 2016, several parts of the new *Biodiversity Conservation Act 2016* were proclaimed. The *Biodiversity Conservation Act 2016* is ultimately intended to replace the *Sandalwood Act 1929* and the *Wildlife Conservation Act 1950*. At the time of compiling this report, the *Biodiversity Conservation Act 2016* does not fully replace the *Sandalwood Act 1929* and the *Wildlife Conservation Act 1950*. Flora, threatened species listings and controls over the taking and keeping of native species, are still covered under the *Wildlife Conservation Act 1950*. Where reference is made to the *Wildlife Conservation Act 1950*, this also includes the *Biodiversity Conservation Act 2016*.

The unique flora of Western Australia is potentially under threat due to historical clearing practices associated with agricultural, mining and human habitation activities. As a consequence of these historical clearing practices a number of flora species have become threatened or have the potential to become threatened as their habitat is impacted by human activity. In addition, some areas of the State have been affected by past clearing practices such that entire ecological communities are under threat. The following sections describe these threatened and priority flora and ecological communities, and outline the legislative protection afforded to them.

At the State level, the *Wildlife Conservation Act 1950* provides for taxa of native flora (and fauna) to be specially protected because they are subject to identifiable threats. Protection of these taxa has been identified as being warranted because they may become extinct, are threatened, or are otherwise in need of special protection. Ecological communities that are deemed to be threatened are afforded protection under the *Environmental Protection Act 1986*. Listings of threatened species and communities are reviewed annually by the Western Australian Threatened Species Scientific Committee (TSSC), which is a body appointed by the Minister for the Environment and supported by the DPaW. The TSSC reviews threatened and specially protected flora (and fauna) listings on an annual basis. Recommendation for additions or deletions to the listings of specially protected flora (and fauna) is made to the Minister for the Environment by the TSSC, via the Director General of the DPaW, and the WA

Conservation Commission. Under Schedule 1 of the *Wildlife Conservation Act 1950*, the Minister for the Environment may declare a class or description of flora to be threatened flora throughout the State, by notice published in the *Government Gazette* (DPaW 2017b).

At the Commonwealth level, under the *Environment Protection and Biodiversity Conservation Act 1999*, a nomination process exists to list a threatened species or ecological community. Additions or deletions to the lists of threatened species and communities are made by the Minister for the Environment and Energy, on advice from the Federal Threatened Species Scientific Committee. *Environment Protection and Biodiversity Conservation Act 1999* lists of threatened flora and ecological communities are published on the Department of the Environment and Energy (DotEE) website (2017a, 2017b).

2.2.1 Threatened and Priority Flora

Flora within Western Australia that is considered to be under threat may be classed as either threatened flora or priority flora. Where flora has been gazetted as threatened flora under the *Wildlife Conservation Act 1950*, it is an offence "to take" such flora without the written consent of the Minister. The *Wildlife Conservation Act 1950* states that "to take" flora includes to gather, pluck, cut, pull up, destroy, dig up, remove or injure the flora or to cause or permit the same to be done by any means.

Priority flora constitute species which are considered to be under threat, but for which there is insufficient information available concerning their distribution and/or populations to make a proper evaluation of their conservation status. Such species are considered to potentially be under threat, but do not have legislative protection afforded under the *Wildlife Conservation Act 1950*. The DPaW categorises priority flora according to their conservation priority, using four categories, P1 to P4, to denote the conservation priority status of such species, with P1 listed species being the most threatened, and P4 the least. Priority flora species are regularly reviewed, and may have their priority status changed when more information on the species becomes available. Appendix A1 sets out definitions of both threatened and priority flora (DPaW 2017c).

At the Commonwealth level, under the *Environment Protection and Biodiversity Conservation Act 1999*, threatened species can be listed as extinct, extinct in the wild, critically endangered, endangered, vulnerable, or conservation dependent, by the Commonwealth Minister for the Environment and Energy. Refer to Appendix A2 for a description of each of these categories of threatened species. Under the *Environment Protection and Biodiversity Conservation Act 1999*, a person must not take an action that has or will have a significant impact on a listed threatened species without approval from the Commonwealth Minister for the Environment, unless those actions are not prohibited under the Act.

The current *Environment Protection and Biodiversity Conservation Act 1999* list of threatened flora may be found on the DotEE (2017a) website.

2.2.2 Threatened and Priority Ecological Communities

An ecological community is defined as a naturally occurring biological assemblage that occurs in a particular type of habitat composed of specific abiotic and biotic factors. At the State level, ecological communities may be considered as threatened once they have been identified as such by the Western Australian Threatened Ecological Communities Scientific Advisory Committee. A threatened ecological community (TEC) is defined, under the *Environmental Protection Act 1986*, as an ecological community listed, designated or declared under a written law or a law of the Commonwealth as threatened, endangered or vulnerable. There are four State categories of threatened ecological communities, or TECs: presumed totally destroyed (PD); critically endangered (CR); endangered (EN); and vulnerable (VU) (DPaW 2017d). A description of each of these categories of TECs is presented in Appendix A3. Threatened ecological communities are gazetted as such (DPaW 2017e).

At the Commonwealth level, some Western Australian TECs are listed as threatened, under the *Environment Protection and Biodiversity Conservation Act 1999*. Under the *Environment Protection and Biodiversity Conservation Act 1999*, a person must not take an action that has or will have a significant impact on a listed TEC without approval from the Commonwealth Minister for the Environment and Energy, unless those actions are not prohibited under the Act. A description of each of these categories of TECs is presented in Appendix A4. The current *Environment Protection and Biodiversity Conservation Act 1999* list of threatened ecological communities can be located on the DotEE (2017b) website.

Ecological communities identified as threatened, but not listed as TECs, can be classified as priority ecological communities (PECs). These communities are under threat, but there is insufficient information available concerning their distribution to make a proper evaluation of their conservation status. The DPaW categorises PECs according to their conservation priority, using five categories, P1 to P5, to denote the conservation priority status of such ecological communities, with P1 communities being the most threatened and P5 the least. Appendix A5 sets out definitions of priority ecological communities (DPaW 2017d). A list of current priority ecological communities can be viewed at the DPaW (2017f) website.

2.2.3 Clearing of Native Vegetation

Under the *Environmental Protection Act 1986*, the clearing of native vegetation requires a permit to do so, from the Department of Environment Regulation or the Department of Mines and Petroleum, unless that clearing is exempted under specific provisions listed in Schedule 6 of the Act, or are prescribed in the *Environmental Protection (Clearing of Native Vegetation) Regulations 2004*. Under the *Environmental Protection Act 1986*, "native vegetation" means indigenous aquatic or terrestrial vegetation, and includes dead vegetation unless that dead vegetation is of a class declared by regulation to be excluded from this definition but does not include vegetation in a plantation. Under the *Environmental Protection Act 1986*, Section 51A, "clearing" means the killing or destruction of, the removal of, the severing or ringbarking of trunks or stems of, or the doing of any other substantial damage to, some or all of the native vegetation in an area, and includes the draining or flooding of land,

the burning of vegetation, the grazing of stock, or any other act or activity, that causes any of the aforementioned consequences or results.

Under the *Environmental Protection Act 1986*, ten principles are set out, under which native vegetation should not be cleared. These principles state that native vegetation should not be cleared, if:

a. it comprises a high level of biological diversity;
b. it comprises the whole or a part of, or is necessary for the maintenance of, a significant habitat for fauna indigenous to Western Australia;
c. it includes, or is necessary for the continued existence of, threatened flora;
d. it comprises the whole or a part of, or is necessary for the maintenance of, a threatened ecological community;
e. it is significant as a remnant of native vegetation in an area that has been extensively cleared;
f. it is growing in, or in association with, an environment associated with a watercourse or wetland;
g. the clearing of the vegetation is likely to cause appreciable land degradation;
h. the clearing of the vegetation is likely to have an impact on the environmental values of any adjacent or nearby conservation area;
i. the clearing of the vegetation is likely to cause deterioration in the quality of surface or underground water; or
j. the clearing of the vegetation is likely to cause, or exacerbate, the incidence or intensity of flooding.

The *Environmental Protection (Clearing of Native Vegetation) Regulations 2004*, under Regulation 5, sets out prescribed clearing actions that do not require a clearing permit, as defined in Section 51C of the *Environmental Protection Act 1986*. However, exemptions under these Regulations do not apply in Environmentally Sensitive Areas (ESAs).

Under the *Environmental Protection (Clearing of Native Vegetation) Regulations 2004*, under Regulation 6 – "Environmentally sensitive areas" include "the area covered by vegetation within 50 m of threatened flora, to the extent to which the vegetation is continuous with the vegetation in which the threatened flora is located". Similarly, "the area covered by a threatened ecological community" is listed as an environmentally sensitive area under Regulation 6.

2.3 Declared (Plant) Pest Organisms

The *Biosecurity and Agriculture Management Act 2007* (BAM Act), Section 22, makes provision for a plant taxon to be listed as a declared pest organism in respect to parts of, or the entire State. According to the BAM Act, a declared pest is defined as a prohibited organism (Section 12), or an organism for which a declaration under section 22 (2) of the Act is in force.

Under section 26 (1) of the BAM Act, a person who finds a declared plant pest must report, in accordance with subsection (2), the presence or suspected presence of the declared pest to the Director General or an inspector of the Department of Agriculture and Food Western Australia.

Under the *Biosecurity and Agriculture Management Regulations 2013*, declared plant pests are placed in one of three control categories, C1 (exclusion), C2 (eradication) or C3 (management), which determines the measures of control which apply to the declared pest (Appendix A6). According to section 30 (3) of the BAM Act, the owner or occupier of land, or a person who is conducting an activity on the land, must take the prescribed control measures to control the declared pest if it is present on the land.

The current listing of declared pest organisms and their control category is available on the Western Australian Organism List (WAOL), at the Biosecurity and Agriculture Management website of the Department of Agriculture and Food Western Australia (DAFWA 2017).

2.4 Local and Regional Significance

Flora or vegetation may be locally or regionally significant in addition to statutory listings by the State or Federal Government. Under the *Environmental Factor Guideline: Flora and Vegetation* (EPA 2016a), flora may be considered significant for a range of reasons, including, but not limited to the following:

- being identified as threatened or priority species;
- locally endemic or 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;
- representative of the range of a species (particularly, at the extremes of a range, recently discovered range extensions, or isolated outliers of the main range);
- unusual species, including restricted subspecies, varieties or naturally occurring hybrids; or
- relictual status, being representative of taxonomic groups that no longer occur widely in the broader landscape.

Under the *Environmental Factor Guideline: Flora and Vegetation* (EPA 2016a), vegetation may be considered significant for a range of reasons, including, but not limited to the following:

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

3. OBJECTIVES

The aim of this survey was to complete a flora and vegetation survey of the Earl Grey, Irish Breakfast and Prince of Wales prospects. Specifically, the objectives included:

- Undertake a desktop assessment to evaluate the botanical values of the local and broader area associated with the Earl Grey, Irish Breakfast and Prince of Wales prospects to identify any matters of botanical or conservation significance;
- Review previous literature and current databases associated with the Earl Grey, Irish Breakfast and Prince of Wales prospects;
- On the basis of the reviews, provide summaries to assist in the assessment of the potential range of values and the potential for conservation significant species and communities;
- Undertake botanical data collection in quadrats that are representative of all potential vegetation communities within the survey area of sufficient detail to permit appropriate statistical analyses;
- Collect and identify the vascular plant species present in vegetation survey quadrats, as well as opportunistically, within the Earl Grey, Irish Breakfast and Prince of Wales prospects;
- Record visual observations on the fire regimes, grazing pressures and overall health of the vegetation to allow for an assessment of the overall condition of the flora and vegetation within the Earl Grey, Irish Breakfast and Prince of Wales prospects;
- Identify and record the locations of any declared pest organisms within the Earl Grey, Irish Breakfast and Prince of Wales prospects;
- Review the conservation status of the vascular plant species recorded by reference to current literature and current listings by the DPaW (2017g) and plant collections held at the Western Australian State Herbarium, and listed by the Department of the Environment (DotEE 2017a) under the *Environment Protection and Biodiversity Conservation Act 1999*;
- Define and prepare a vegetation map of the vegetation communities within the Earl Grey, Irish Breakfast and Prince of Wales prospects;
- Assess the condition of the vegetation communities within the Earl Grey, Irish Breakfast and Prince of Wales prospects;
- Evaluate the distributions of any conservation significant flora recorded within the Earl Grey, Irish Breakfast and Prince of Wales prospects and evaluate their regional significance;
- Provide descriptions of the vegetation communities present within the Earl Grey, Irish Breakfast and Prince of Wales prospects and evaluate their regional significance; and
- Prepare a report summarising the findings.

4. METHODS

The coordinates delineating the boundaries of the Earl Grey, Irish Breakfast and Prince of Wales prospects are set out in Table 1. The boundary coordinates of all three prospects were supplied by Kidman.

The survey was completed to the standards set out in *Technical Guidance – Flora and Vegetation Surveys for Environmental Impact Assessment* (EPA 2016b) and *Environmental Factor Guideline: Flora and Vegetation* (EPA 2016a).

Table 1: Coordinates delineating the boundaries of the Earl Grey, Irish Breakfast and Prince of Wales prospects

Waypoint	Location (MGA94, Zone 50)	
	Easting (mE)	Northing (mN)
Earl Grey		
1	760048	6446862
2	760032	6445527
3	759964	6445507
4	759815	6445505
5	759600	6445487
6	759345	6445335
7	759347	6444937
8	758607	6444930
9	758638	6446854
Irish Breakfast		
1	760245	6447075
2	758845	6447075
3	758842	6447982
4	760242	6447982
Prince of Wales		
1	759115	6451196
2	760019	6451173
3	759979	6449622
4	759075	6449645

4.1 Desktop Survey

The desktop assessment for the Earl Grey, Irish Breakfast and Prince of Wales prospects was undertaken using the resources of the DPaW (2007-, 2017b, 2017e, 2017f, 2017g) and DotEE (2017a, 2017b, 2017c) databases, along with historic surveys in the immediate vicinity (Craig 2006, Native Vegetation Solutions 2014, Native Vegetation Solutions 2016a) or the broader region (Gibson 2004a). The search parameters used were a 20 km radius 'by circle' at 759408 mE, 6448103 mN, (MGA94 zone 50). The Earl Grey and Prince of Wales prospects are located 0.25 km south and 1.7 km north respectively of the Irish Breakfast prospect. The Van Uden prospect is located 10 km south-west of the Earl Grey prospect (Figure 2).

These databases were utilised to identify the possible occurrence of threatened and priority flora, threatened and priority ecological communities and any other matters protected under the *Environment Protection and Biodiversity Conservation Act 1999* within the vicinity of the Earl Grey, Irish Breakfast and Prince of Wales prospects. Data from the Van Uden search area were included to provide a more comprehensive list of species of conservation significance in the project vicinity.

4.2 Field Survey

The assessment of the flora and vegetation of the Earl Grey, Irish Breakfast and Prince of Wales prospects (Figure 2) was undertaken by two experienced botanists from Mattiske, from the 24th to 26th October 2016 and the 9th to 10th November 2016. All botanists held valid collection licences to collect flora for scientific purposes, issued under the *Wildlife Conservation Act 1950*. Additionally, one botanist held a valid permit to take Declared Rare Flora, issued under the *Wildlife Conservation Act 1950*.

The coordinates delineating the boundaries of the Earl Grey, Irish Breakfast and Prince of Wales prospects were supplied by Kidman (Table 1). Aerial photographic maps at a 1:4,000 scale of the Earl Grey and Irish Breakfast prospects, and 1:5,000 of the Prince of Wales prospect were prepared by CAD Resources of Carine, Western Australia. To sample all the apparent vegetation types across the three prospects, the location of vegetation survey quadrats was made primarily on the basis of aerial photographic maps. Additional sites were selected *in situ*, based on observations of vegetation communities during the field survey. Wherever possible, replicate vegetation survey quadrats were established in the same but discontinuous vegetation community types. In addition to data recorded from vegetation survey quadrats, a more comprehensive species inventory of the three prospects was achieved using supplementary survey techniques - opportunistic collections, relevés and traverses.

A total of 43 vegetation survey quadrats were established and surveyed across the three prospects. Twenty six quadrats were established within the Earl Grey prospect, nine within the Irish Breakfast prospect and eight within the Prince of Wales prospect. All vegetation survey quadrats measured 20 m x 20 m in size. In situations where vegetation community shape (e.g. drainage channels) precluded establishing quadrats of the standard dimension, an area of equivalent size (i.e. 400 m^2) was surveyed. The locations of all survey quadrats are set out in Appendix B.

The flora and vegetation was described and sampled systematically at each vegetation survey quadrat, and additional opportunistic collecting was undertaken wherever previously unrecorded plants were observed. At each vegetation survey quadrat, the following floristic and environmental parameters were recorded:

- GPS location (GDA94 datum);
- soil type, colour and any additional observations;
- local site topography;
- presence of any outcropping rocks and their type;
- aspect of the hill-slopes;
- percentage of litter cover (logs, twigs and/or leaves);
- percentage of bare ground;
- time since fire;
- condition of the vegetation, based on Trudgen's (1988) condition ratings (Appendix A7); and
- alive and dead percentage of foliage cover and average height of each species recorded.

All plant specimens collected during the field survey were dried and processed in accordance with the requirements of the Western Australian Herbarium (WAH). All plant specimens were identified through comparisons with pressed specimens housed at the Mattiske herbarium and WAH. Where appropriate, plant taxonomists with specialist skills were consulted. Nomenclature of the species recorded is in accordance with the WAH (DPaW 2017g).

4.3 Statistical Analysis of Data and Vegetation Mapping

A species accumulation curve, based on accumulated species versus number of quadrats surveyed was prepared, to evaluate the level of adequacy of the survey effort. The species accumulation curve was based on the species accumulation analysis of Colwell (2013).

Plymouth Routines in Multivariate Ecological Research version 6 (PRIMER v6) statistical analysis software was used to analyse species-by-site data and discriminate sites on the basis of their species composition (Clarke and Gorley 2006). To down weight the relative contributions of quantitatively dominant species a 4^{th} root transformation was applied to the data set. Introduced species, singletons (species recorded at only one site) and specimens that were not identified down to the species level were excluded from the analysis. Annuals were removed from the data in analysis due to the likelihood of substantial differences between years based on seasonality of local rainfall events. Computation of similarity matrices was based on the Bray-Curtis similarity measure. Transformed data were analysed using a series of multivariate analysis routines including Hierarchical Clustering (CLUSTER), Similarity Profile (SIMPROF) and Similarity Percentages (SIMPER). Results were used to inform and support interpretation of aerial photography and delineation of individual vegetation communities.

Vegetation descriptions were based on Alpin's (1979) modification of the vegetation classification system of Specht (1970), to align with the National Vegetation Information Systems (NVIS). Vegetation communities were described at the association level of the NVIS classification framework, as defined by the Executive Steering Committee for Australian Vegetation Information (ESCAVI 2003).

5. DESKTOP SURVEY RESULTS

5.1 Climate

Beard (1972) described the climate of the wider region (containing the Earl Grey, Irish Breakfast and Prince of Wales prospects) as Mediterranean, with a pronounced winter maximum and long dry summer, and annual precipitation of just over 330 mm, consistent with descriptions of a characteristically arid to semi-arid climate with 200-300 mm of precipitation (Beard 1990, Cowan *et al.*, 2001). Hyden, which is located approximately 85 km to the south west of the prospects, has an average annual rainfall of 339.5 mm (Bureau of Meteorology, BOM 2017). Rainfall and temperature data for Hyden is illustrated in Figure 3. Rainfall in the four months preceding the October/November 2016 field survey was 165.0 mm, which is approximately 90% of the long-term average for the corresponding period.

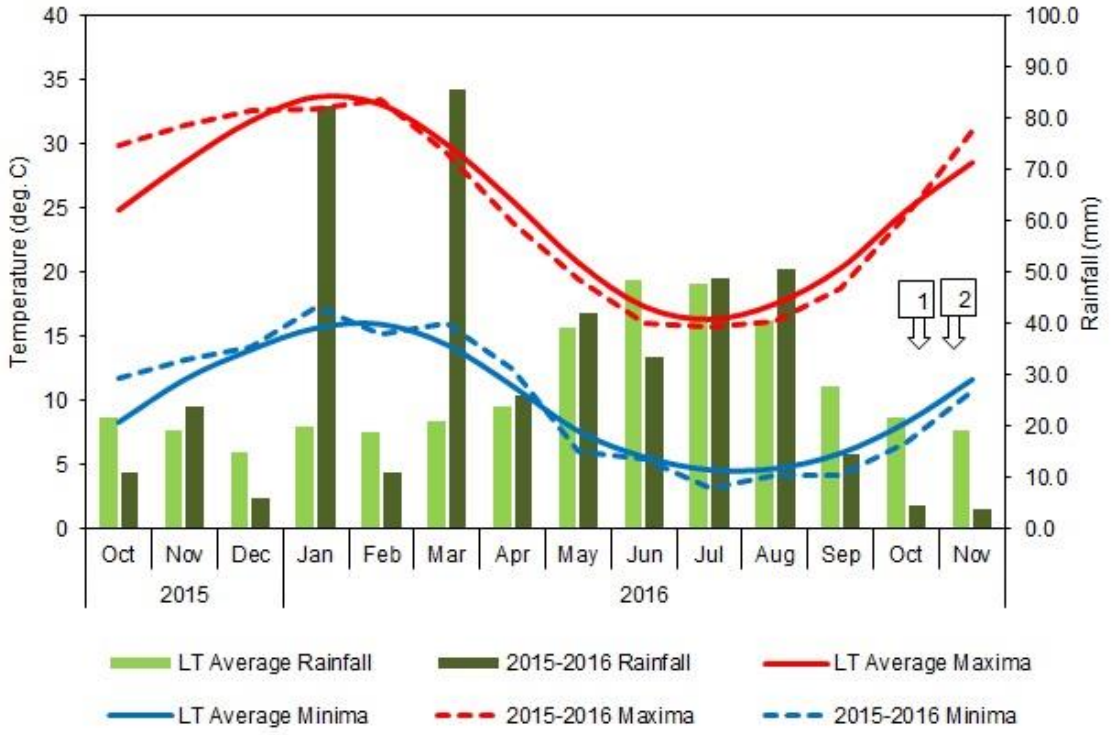


Figure 3: Rainfall and temperature data for Hyden
Long term average rainfall and temperature data, together with monthly rainfall data for the period October 2015 to November 2016 are shown (BOM 2017). The numbered markers indicate the timing of flora and vegetation surveys: 1 – Earl Grey and Irish Breakfast prospects; 2 - Earl Grey, Irish Breakfast, Prince of Wales prospects.

5.2 Geology, Soils and Topography

The Earl Grey, Irish Breakfast and Prince of Wales prospects are situated within Beard's (1990) Coolgardie Botanical District, near its boundary with the Roe Botanical District (Mallee Region). A summary of the geology, soils and topography of each district is set out on the following page.

Coolgardie Botanical District

Geologically, the area consists of Proterozoic granite and gneiss of the Fraser Range block and Archaean granite with infolded volcanics and meta sediments of the Yilgarn block. Major greenstone belts provide the major hilly topography of the district (Beard 1990). Valley areas consist of quaternary duplex soils and chains of playa lakes. Upper levels in the landscape comprise the eroded remnants of a lateritic duricrust, yielding yellow sandplains, gravelly sandplains and laterite breakaways (Cowan *et al.* 2001).

Roe Botanical District

Geologically, the area consists of Archean and Proterozoic granites overlain in the east by Tertiary sediments (Beard 1990). The main surface soils consist of clays and silts underlain by Kankar, exposed granite, sandplains and laterite pavements (Beecham and Danks 2001).

In more recent times mapping of soils and landscapes has become available at a greater level of detail. The Department of Agriculture, in its "Soil-landscapes of Western Australia's Rangelands and Arid Interior" (Tille 2006), described a range of soil-landscape mapping units. The Earl Grey, Irish Breakfast and Prince of Wales prospects are situated within Tille's (2006) Southern Cross Zone (Zone 261). Tille (2006) describes the soils of the Southern Cross Zone as comprising undulating plains and uplands (with some salt lakes and low hills) on deeply weathered mantle, colluvium and alluvium over greenstone and granitic rocks of the Yilgarn Craton. The Southern Cross zone comprises 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. The Southern Cross zone is located in the eastern Wheatbelt/south-western Goldfields between Bullfinch and Mt Holland.

5.3 Beard's Vegetation Mapping

5.3.1 Botanical Districts

The Earl Grey, Irish Breakfast and Prince of Wales prospects are situated within the Coolgardie Botanical District, near its boundary with the Roe Botanical District (Mallee Region) (Beard 1990). Consequently, there is the potential for elements of all three districts to be present within the Earl Grey, Irish Breakfast and Prince of Wales prospects. A summary of the general vegetation features of each of the botanical districts is set out below (adapted from Beard 1990).

Coolgardie Botanical District

The major greenstone belts in the district that form the banded ironstone hills and are the main source of topographical relief, are dominated by *Allocasuarina acutivalvis*, *Casuarina campestris* and *Banksia arborea*. The slopes of these banded ironstone hills are home to mallee species, such as *Eucalyptus gardneri*, *Eucalyptus redunca*, *Eucalyptus loxophleba* and *Eucalyptus sheathiana*. The slopes and flats generally consist of woodlands in which *Eucalyptus longicornis*, *Eucalyptus salmonophloia*, *Eucalyptus corrugata* and *Eucalyptus sheathiana* are common. The understorey in these woodlands may be either sclerophyllous, with shrubs such as *Melaleuca pauperiflora*, or where the soils are more alkaline, soft-leaved shrubs such as *Atriplex vesicaria* and *Atriplex nummularia* are more dominant.

Roe Botanical District (Mallee Region)

Mallee, in the context of the Roe Botanical District, refers to a shrub-eucalypt formation. The most typical form of mallee is a closed community of mallee habit rising to 3-4.5 m in height, with an understorey of small ericoid shrubs of the genus *Melaleuca*. Elsewhere, the understorey may consist of mixed shrubs belonging to the scrub-heath, where there is a transition to the latter formation, or saltbush under alkaline soil conditions, or of hummock grass on red sand. Beard (1990) states that within the Roe Botanical District, these vegetation formations occupy only small patches of the District. In the mallee formation, *Eucalyptus eremophila* is the most consistent species, being nearly always present, but it has numerous associates, about three of which seem to be present at any one site. These associated species include *Eucalyptus celastroides, Eucalyptus cerasiformis, Eucalyptus conglobata, Eucalyptus cylindriflora, Eucalyptus deflexa, Eucalyptus dielsii, Eucalyptus foecunda, Eucalyptus georgei, Eucalyptus goniantha, Eucalyptus incrassata, Eucalyptus leptocalyx, Eucalyptus longicornis, Eucalyptus loxophleba, Eucalyptus merrickiae, Eucalyptus micranthera, Eucalyptus oleosa, Eucalyptus ovularis, Eucalyptus pileata, Eucalyptus redunca*, *Eucalyptus sheathiana*, *Eucalyptus transcontinentalis* and *Eucalyptus uncinata*. The understorey is most commonly dominated by one or more species of *Melaleuca*, forming a more or less continuous layer with other casual species. Beard (1990) lists the recorded species composition as including *Melaleuca pungens*, *Melaleuca spicigera*, *Melaleuca viminea*, *Melaleuca urceolaris*, *Melaleuca hamulosa*, *Acacia beauverdiana*, *Acacia ericifolia*, *Acacia fragilis*, *Acacia hemiteles*, *Baeckea grandibracteata*, *Boronia ternata, Callitris roei*, *Cryptandra minutifolia*, *Eremophila lehmanniana*, *Gastrolobium parvifolium*, *Grevillea paradoxa*, *Grevillea petrophiloides*, *Hakea falcata*, *Hakea multilineata*, *Hybanthus floribundus*, *Isopogon scabriusculus*, *Isopogon teretifolius*, *Leptospermum erubescens*, *Micromyrtus imbricata*, *Mirbelia spinosa*, *Petrophile ericifolia*, *Phebalium filifolium*, *Pimelea suaveolens* and *Pityrodia lepidota*.

Woodland areas consist of mixtures of large mallees including *Eucalyptus salubris*, *Eucalyptus gracilis*, *Eucalyptus loxophleba*, *Eucalyptus oleosa*, *Eucalyptus sheathiana*, *Eucalyptus flocktoniae*, *Eucalyptus annulata* and *Eucalyptus spathulata*. A saltbush (*Atriplex* sp.) understorey is often present, otherwise scattered woody shrubs of *Acacia*, *Eremophila*, *Pittosporum* and some grasses predominate.

5.3.2 Vegetation Systems

Beard (1972), in his 1:250,000 mapping series, described the vegetation of the Hyden Area, which encompasses the Earl Grey, Irish Breakfast and Prince of Wales prospects in its north eastern extent. Within the Hyden Area, Beard (1972) described a range of vegetation systems. A vegetation system consists of a particular series of plant communities recurring in a catenary sequence or mosaic pattern linked to topographic, pedological and/or geological features (Beard 1969). The Earl Grey, Irish Breakfast and Prince of Wales prospects are situated within Beard's (1972) Forrestania System. The Forrestania vegetation system is developed on the greenstone belt and comprises a variety of communities, which are controlled by the underlying geology largely in a mosaic form. The greenstones weather to form a flat tract of country with a heavy soil supporting sclerophyll woodland broken by numerous small salt lakes. There are included granites and quartzites which form siliceous soils, frequently lateritic, and account for areas of mallee, thicket and scrub heath within the mosaic.

Additionally, there are banded ironstone formations forming prominent ridges with distinctive associations of heath and thicket.

The sclerophyll woodlands within the Forrestania System are dominated by two eucalypt species – *Eucalyptus salmonophloia* and *Eucalyptus longicornis* (Beard 1972). According to Beard (1972) the majority of this woodland is in poor condition as a result of past mining and farming activities. Other overstorey species in the sclerophyll woodland include *Eucalyptus salubris* and *Eucalyptus flocktoniae*, with smaller trees such as *Eucalyptus eremophila* and *Eucalyptus annulata* present as a middle layer. The shrub layer includes *Dodonaea stenozyga*, *Eremophila saligna* and *Daviesia nematophylla*. A second major vegetation component of the Forrestania System consist of the mallee scrub, the components of which have been described earlier in this section.

A particular feature of the Forrestania System are the ridges of banded ironstone which form hills with skeletal soil. These hills include Mount Holland, North Ironcap Hill, South Ironcap Hill and Hatter's Hill. The vegetation described by Beard (1972) on these hills is set out below.

Mt. Holland: Dense thicket, approximately 2 m tall, consisting predominantly of *Casuarina campestris*, *Calothamnus asper*, *Hakea* sp., *Banksia* sp., *Callitris preissii*, *Isopogon teretifolius*, *Santalum acuminatum*, *Melaleuca* sp., and *Leptospermum* sp.

North Ironcap Hill: Same species as per Mt Holland.

South Ironcap Hill: *Banksia sphaerocarpa*, *Allocasuarina* ?*dielsiana*, *Banksia* sp., *Melaleuca cardiophylla*, *Grevillea insignis*, *Adenanthos viridiflorus*, *Isopogon teretifolius*, *Callitris roei*, *Calothamnus quadrifidus*, *Mirbelia dilatata*, *Acacia hemiteles*, *Verticordia chrysantha*, *Hibbertia* aff. *mucronata*, *Calytrix breviseta*, Damp*iera juncea*, *Lysinema ciliatum*, *Lasiopetalum* sp., and occasional *Eucalyptus falcata* to 4.5 m tall.

Hatter's Hill: Casuarina thickets resembling those on Mt. Holland, but comprising *Allocasuarina* ?*dielsiana, Eucalyptus loxophleba, Senna glutinosa* subsp. *chatelainiana, Dodonaea stenozyga, Melaleuca acuminata, Calothamnus quadrifidus, Santalum acuminatum, Boronia inornata, Westringia dampieri,* and *Halgania lavandulacea.*

The Earl Grey, Irish Breakfast and Prince of Wales prospects are situated within Beard's (1972) eSi vegetation unit. This vegetation is broadly described as mallee with patches of broombrush thicket.

5.4 Pre-European Vegetation

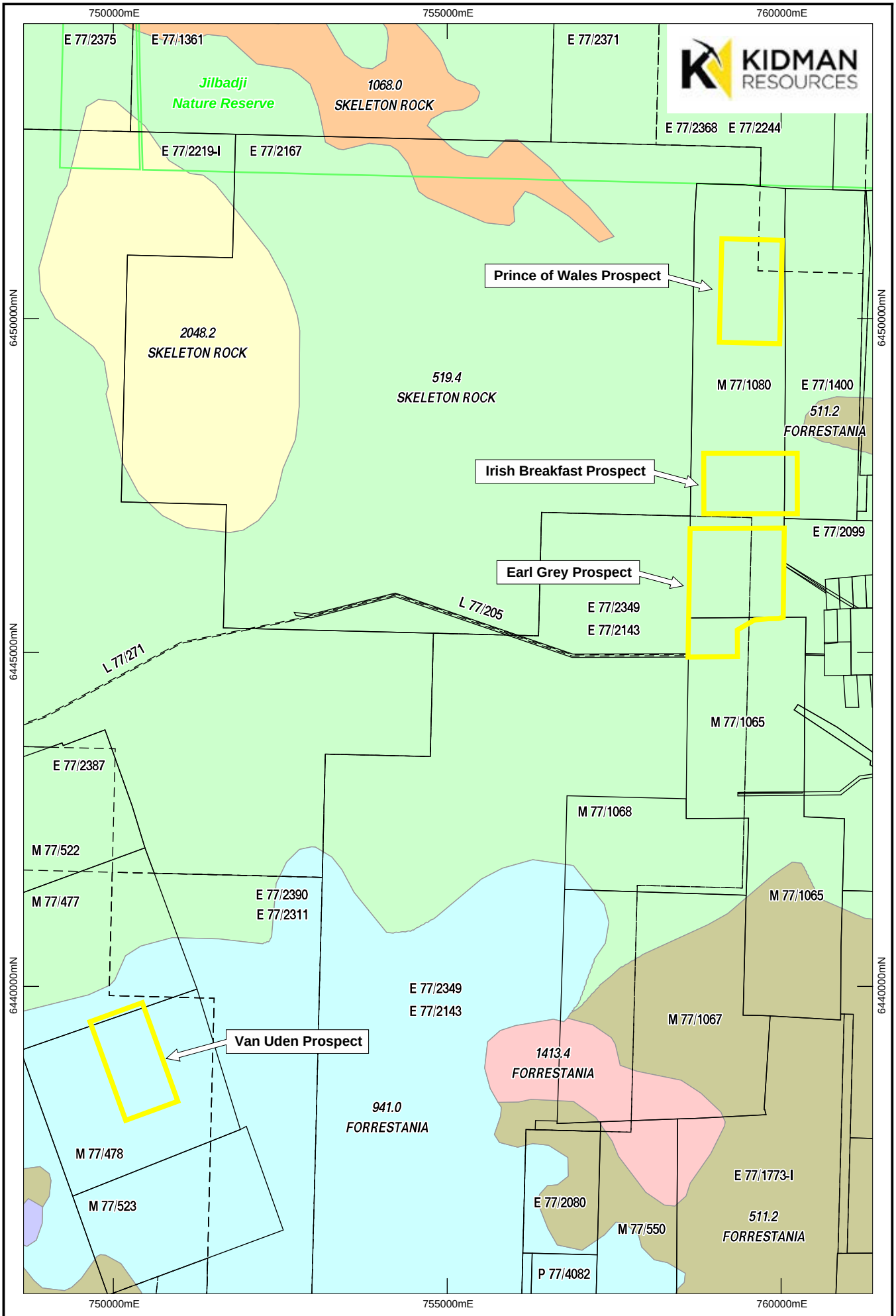
The pre-European vegetation dataset, prepared through the National Land and Water Resources Audit, describes vegetation in relation to natural resource boundaries commonly used for environmental reporting (Shepherd *et al.* 2001). The pre-European vegetation dataset builds on the vegetation map database developed by G R Beeston and A J M Hopkins, based on 1: 250,000 scale mapping. A total of

819 vegetation types were recognised in Western Australia, ranging from tall forests, through to a wide variety of forests and woodlands, shrublands and grasslands, mostly with an overstorey of trees. The identification of the original pre-European and current extent of each of the vegetation types assist in providing baselines for managing issues such as land clearing. Although the extent of native vegetation remains largely intact within the inland areas of Western Australia, the structure and floristic composition have been altered since European settlement through grazing by introduced animals such as sheep, cattle, goats and rabbits, mining activities and by altered fire regimes (Shepherd *et al*. 2001).

In more recent years Hopkins, Beeston and Shepherd (2001) delineated a series of vegetation maps based primarily on the work of John Beard carried out from 1964 to 1981. The pre-European vegetation associations occurring within the vicinity of the Earl Grey, Irish Breakfast, and Prince of Wales prospects are illustrated in Figure 4. The prospects intersect the Skeleton Rock System (Beard 1972). The area of pre-European vegetation associations intersecting the prospects are set out in Table 2, and are based on the 2015 Statewide Vegetation Statistics (Government of Western Australia 2015). All three prospects constitute a small impact to the Skeleton Rock_519.4 vegetation association.

Table 2: Extent of pre-European vegetation associations intersecting the Earl Grey, Irish Breakfast and Prince of Wales prospects

Vegetation Association	State-wide			Survey Area	
	Pre-European Extent (ha)	Current Extent (ha)	Percent Remaining (%)	Area of Intersection (ha)	Proportion of Current Extent (%)
Earl Grey prospect					
Skeleton Rock_519.4 Shrublands: mallee scrub, *Eucalyptus eremophila*	156,242.20	129,453.91	82.85	235.48	0.18
Irish Breakfast prospect					
Skeleton Rock_519.4 Shrublands: mallee scrub, *Eucalyptus eremophila*	156,242.20	129,453.91	82.85	126.93	0.10
Prince of Wales prospect					
Skeleton Rock_519.4 Shrublands: mallee scrub, *Eucalyptus eremophila*	156,242.20	129,453.91	82.85	140.23	0.11



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Date: Feb 2017 | Rev: B | A4

Mattiske Consulting Pty Ltd
28 Central Road, Kalamunda WA 6076 ~ Tel: 9257 1625 ~ Fax: 9257 1640
Author: E M Mattiske | MCPL Ref: KID1601/022/16
Drawn: CAD Resources ~ www.cadresources.com.au
Tel: (08) 9246 3242 ~ Fax: (08) 9246 3202

Kidman Resources Ltd.

Pre-European Vegetation

Figure: **4**

5.5 IBRA7 Biogeographical Sub-regions

The Interim Biogeographic Regionalisation for Australia (IBRA) delineated 85 bioregions across Australia, based on a range of biotic and abiotic factors, including climate, vegetation, fauna, geology and landform (Thackway and Cresswell 1995; DotEE 2017d). IBRA Version 7 refined the original 85 bioregions and 403 sub-regions described in IBRA 6.1, by expanding the number of regions to 89 and the number of sub-regions to 419. The sub-regions represent more localised and homogenous geomorphological units in each bioregion. IBRA7 includes four new oceanic bioregions, and seven new sub-regions in the oceanic bioregions and six new sub-regions in South Australia (DotEE 2017d).

The Earl Grey, Irish Breakfast, and Prince of Wales prospects are situated within the Coolgardie 2 (COO2-Southern Cross) sub-region of the Coolgardie region, near its junction with the Mallee 2 (MAL2-Western Mallee) sub-region of the Mallee region and the Avon Wheatbelt 1 (AW1-Ancient Drainage) sub-region of the Avon Wheatbelt region (Figure 5). A summary of each of these sub-regions is set out below. Whilst the prospects only intersect the COO2 (Southern Cross) sub-region, a description of the adjacent MAL2 (Western Mallee) an AW1 (Ancient Drainage) sub-regions are presented as it is reasonable to expect some degree of floristic commonality due to its close proximity. Table 3 sets out the extent of intersection of the Study Area with the COO2 IBRA7 sub-region.

Table 3: Extent of IBRA sub-region intersecting the Earl Grey, Irish Breakfast and Prince of Wales prospects

IBRA Sub-region	State-wide	Survey Area	
	Current Extent (ha)	Area of Intersection (ha)	Proportion of Current Extent (%)
Early Grey prospect			
COO2 (Southern Cross)	6010838.35	235.48	0.004
Irish Breakfast prospect			
COO2 (Southern Cross)	6010838.35	126.93	0.002
Prince of Wales prospect			
COO2 (Southern Cross)	6010838.35	140.23	0.002
Total potential impact		**502.64**	**0.008**

COO2 – Southern Cross sub-region

Cowan *et al*. (2001) described the Southern Cross sub-region as having subdued relief, comprising gently undulating uplands dissected by broad valleys with bands of low greenstone hills. It lies on the 'Southern Cross Terrains' of the Yilgarn Craton. The granite strata of Yilgarn Craton are interrupted by parallel intrusions of Archaean Greenstone. Drainage is occluded. Chains of saline playa lakes occur within the sub-region. Floristically the sub-region has extensive eucalypt woodlands (*Eucalyptus salmonophloia*, *Eucalyptus salubris*, *Eucalyptus transcontinentalis*, *Eucalyptus longicornis*) rich in endemic eucalypts occur around these salt lakes, on the low greenstone hills, valley alluvials and broad plains of calcareous earths. The salt lake surfaces support dwarf shrublands of samphire. The granite basement outcrops at mid-levels in the landscape and supports swards of *Borya constricta*, with stands of *Acacia acuminata* and *Eucalyptus loxophleba*. Upper levels in the landscape are the eroded remnants

of a lateritic duricrust yielding yellow sandplains, gravelly sandplains and laterite breakaways. Mallees (*Eucalyptus leptopoda*, *Eucalyptus platycorys* and *Eucalyptus scyphocalyx*) and scrub-heaths (*Allocasuarina corniculata*, *Callitris preissii*, *Melaleuca uncinata* and *Acacia beauverdiana*) occur on these uplands, as well as on sand lunettes associated with playas along the broad valley floors, and sand sheets around the granite outcrops. The scrubs are rich in endemic acacias and Myrtaceae. The dominant land uses are grazing and dry land agriculture.

MAL2 – Western Mallee sub-region

Beecham and Danks (2001) described the Western mallee sub-region as gently undulating, with partially occluded drainage. Mallee over myrtaceous-proteaceous heaths on duplex (sand over clay) soils are common. *Melaleuca* shrublands characterise alluvia, and *Halosarcia* low shrublands occur on saline alluvium. A mosaic of mixed eucalypt woodlands and mallee occur on calcareous earth plains and sandplains overlying Eocene limestone strata in the east. The landscape is fragmented with particular surface-types almost completely cleared as wheatfields. The dominant land use is dry land agriculture.

AW1 – Ancient Drainage sub-region

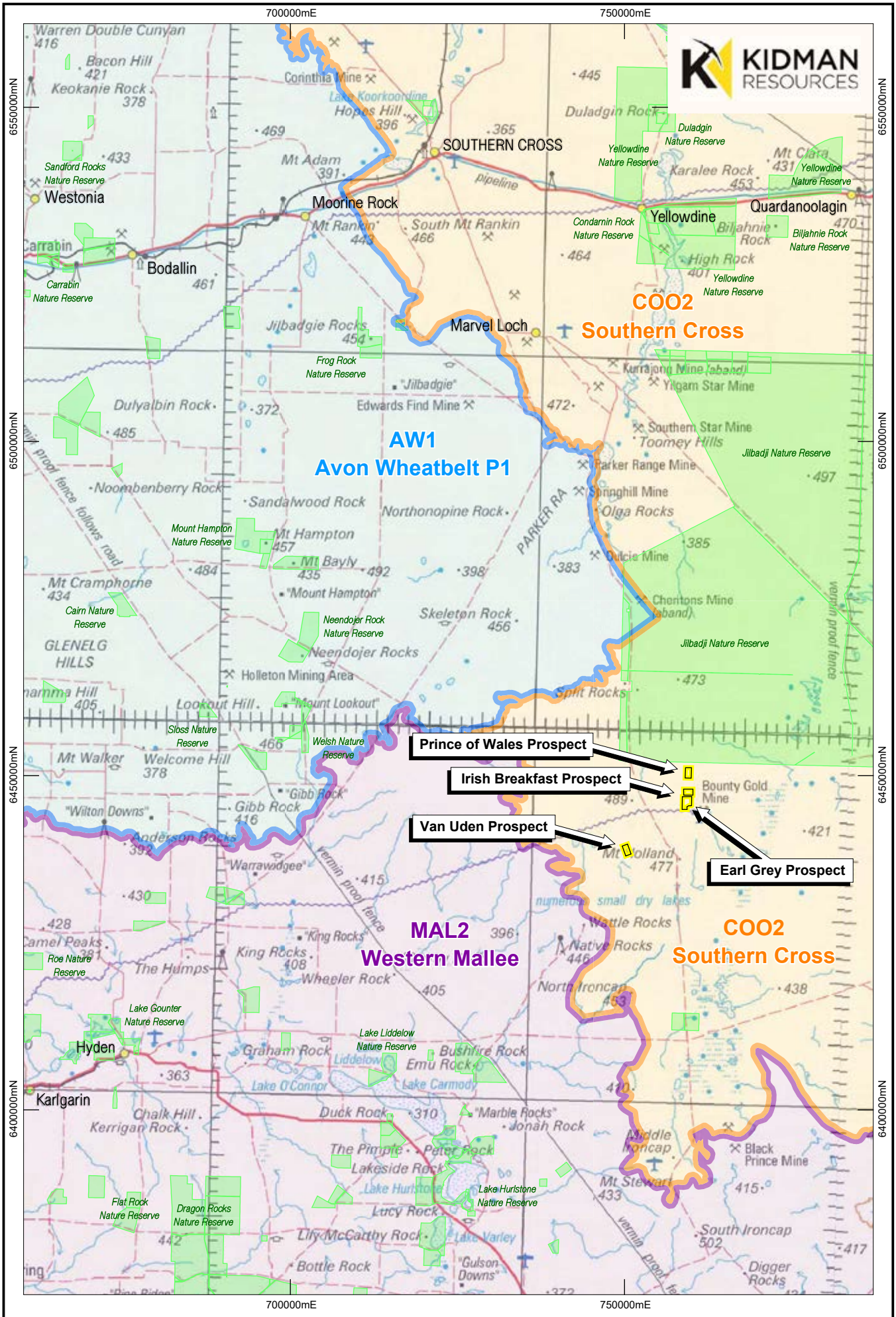
Beecham (2001) described the Ancient Drainage sub-region as an area of active drainage dissecting a Tertiary plateau on the Yilgarn Craton. It has a gently undulating landscape of low relief. Proteaceous scrub-heaths, rich in endemics, on residual lateritic uplands and derived sandplains; mixed eucalypt, *Allocasuarina huegeliana* and Jam-York Gum woodlands on Quaternary alluvials and colluvials. Within this bioregion, the AW1 is an ancient peneplain with low relief, gently undulating landscape. There is no connected drainage; salt lake chains occur as remnants of ancient drainage systems that now only function in very wet years. Lateritic uplands are dominated by yellow sandplain. The dominant land uses are dry land agriculture, grazing, mining and rural residential.

5.6 Previous Flora and Vegetation Surveys in the Vicinity of the Earl Grey, Irish Breakfast, and Prince of Wales Prospects

Several reports related to flora and vegetation surveys in the vicinity of the Earl Grey, Irish Breakfast, and Prince of Wales prospects were reviewed to provide localised contextual flora information. These results of these reports are summarised below.

Craig, G.F. (2006). Bounty *JV - Tenements M77/1080, M77/1065, M77/1066, M77/1067, M77/1068 - Declared Rare and Priority Survey*. Unpublished report prepared for Nickel Australia Limited.

In 2006, Craig (2006) completed a threatened and priority flora survey for Nickel Australia Limited along a series of 30 drill lines at its Bounty mine site. Some of the drill lines surveyed were within Kidman's Earl Grey and Prince of Wales prospects. No threatened flora pursuant to Schedule 1 of the *Wildlife Conservation Act 1950* and as listed by the DPaW (2017b) were recorded along any of the drill lines searched. Three taxa which were priority flora (DPaW 2017g) at the time of the survey were recorded. These were: *Baeckea* sp. Forrestania (KR Newbey 1105) (P1) – a minimum of 160 plants recorded at 11



Interim Biogeographic Regionalisation for Australia (IBRA), Version 7: Australian Government Department of the Environment ~ DPaW Estates: Depatment of Parks and Wildlife, WA

N	0 15km Scale 1:750,000 MGA94 (Zone 50) CAD Ref: g2445_R003 Date: Feb 2017 | Rev: B | A4	Mattiske Consulting Pty Ltd 28 Central Road, Kalamunda WA 6076 ~ Tel: 9257 1625 ~ Fax: 9257 1640 Author: E M Mattiske | MCPL Ref: KID1601/022/16 Drawn: CAD Resources ~ www.cadresources.com.au Tel: (08) 9246 3242 ~ Fax: (08) 9246 3202	**Kidman Resources Ltd.** **IBRA Regions**

Figure: **5**

separate locations; *Daviesia newbeyi* (P3) – a single plant recorded at one location; and *Stenanthemum* aff. *poicilum* (P3) – a minimum of 110 plants recorded at 13 separate locations.

At the time of the 2006 survey, *Daviesia newbeyi* was listed as a Priority 2 taxon and *Stenanthemum poicilum* was listed as a Priority 2 taxon. *Stenanthemum poicilum* (P3) does not occur in the Forrestania area. Its distribution is restricted to the northern portion of the Avon Wheatbelt region at its boundary with the Yalgoo bioregion (DPaW 2017g). At the time of the 2006 survey (Craig 2006), a personal communication with Barbara Rye of the Western Australian Herbarium indicated that the specimens collected during the survey for Nickel Australia Limited differed from the typical *Stenanthemum poicilum* (P3), which grows in the Morawa – Mullewa district, some 600 km to the north-west. Due to its similarity to *Stenanthemum poicilum* (P3), it was attributed as *Stenanthemum* aff. *poicilum* (P3).

Native Vegetation Solutions (2014). *Level 1 Flora and Vegetation Survey of the Proposed Blue Vein Mine Mt. Holland Operation (Tenement M77/1065)*. Unpublished report prepared for Convergent Minerals Limited, September 2014.

Convergent Minerals Limited, as part of their proposal to recommence mining activities at their Blue Vein Mine, 4.5 km south-south-west of the Earl Grey prospect, commissioned a Level 1 flora and vegetation survey of approximately 90 ha at their Blue Vein Mine. The area surveyed included existing pit and waste dump areas, as well as nearby bushland, some of which had been the subject of an intense fire in April of 2014 (Native Vegetation Solutions 2014).

The survey resulted in a total of 71 vascular plant tax being recorded (Appendix C). The names of the taxa recorded by Native Vegetation Solutions (2014) have been updated, where required, to make them consistent with current day nomenclature (DPaW 2017g). No threatened flora pursuant to Schedule 1 of the *Wildlife Conservation Act 1950* and as listed by the DPaW (2017b) were recorded. No priority flora, as listed by the DPaW (2017g), were recorded within the survey area. Two major vegetation communities were defined within the survey area. One of these vegetation communities was a *Eucalyptus* mallee woodland over *Melaleuca* shrubland. The dominant species in this community were *Eucalyptus urna*, *Eucalyptus loxophleba* subsp. *lissophloia*, *Eucalyptus platycorys*, *Melaleuca pauperiflora* subsp. *pauperiflora*, *Melaleuca eleuterostachya*, *Melaleuca lateriflora*, *Melaleuca cucullata*, *Phebalium filifolium*, and *Phebalium tuberculosum*. The second major vegetation community defined was a *Eucalyptus* woodland over *Allocasuarina* shrubland. The dominant species in this vegetation community were *Eucalyptus livida*, *Eucalyptus loxophleba* subsp. *lissophloia*, *Allocasuarina acutivalvis* subsp. *acutivalvis*, *Allocasuarina campestris*, *Allocasuarina huegeliana*, *Hibbertia rostellata*, *Calothamnus quadrifidus* subsp. *semilunaris*, *Rinzia sessilis*, *Thryptomene kochii* and *Persoonia helix*. Native Vegetation Solutions (2014) delineated both burnt and unburnt area of both vegetation communities within the survey area.

Convergent Minerals Limited (2014). *Threatened Flora Management Plan for Banksia sphaerocarpa var. dolichostyla.* Mt. Holland Gold Project Blue Vein Operations DRAFT V2.0., October 2014.

Convergent Minerals Limited, as part of their proposal to recommence mining activities at their Blue Vein Mine, 4.5 km south-south-west of the Earl Grey prospect, prepared a management plan to ensure existing populations of *Banksia sphaerocarpa* var. *dolichostyla* (T) were not impacted from proposed mining activities in the project area. Whilst no *Banksia sphaerocarpa* var. *dolichostyla* (T) were recorded within the proposed development areas (Native Vegetation Solutions 2014), *Banksia sphaerocarpa* var. *dolichostyla* (T) was recorded along existing roadside edges proposed to be utilised by light vehicles to access the camp and a separate existing haul road proposed to be utilised by haulage trucks. The objectives of the management plan (Convergent Minerals Limited 2014) were to prevent potential adverse impacts on *Banksia sphaerocarpa* var. *dolichostyla* populations in, or adjacent to the Blue Vein Mine Project and its associated operations, and to raise awareness about *Banksia sphaerocarpa* var. *dolichostyla.* These objectives were to be met by documenting the distribution of the species in the vicinity of the Blue Vein Mine Project; providing detailed species and preferred habitat description; identifying threatening processes to the species arising from the implementation of mining operations; developing strategies to reduce avoidable adverse impacts on the species; outline a monitoring program that aims to detect a decline in the health of local *Banksia sphaerocarpa* var. *dolichostyla* populations associated with the proposed mining activities; and allocate responsibilities for the implementation of the management plan.

Native Vegetation Solutions (2016a). *Level 1 Flora and Vegetation Survey of the Proposed Initial Cheritons and Texas Exploration Drill Lines- Jilbadji Nature Reserve Mt Holland Operation (Tenements E77/2111 & E77/2244).* Unpublished draft report prepared for Kidman Resources Limited, August 2016

Kidman commissioned Native Vegetation Solutions to undertake a Level 1 flora and vegetation survey of their Cheritons (exploration tenement E77/2111) and Texas (exploration tenement E77/2244) tenements, which form part of their Mt Holland project. Both tenements are situated within the Jilbadji Nature Reserve, and as such the flora and vegetation survey was an integral part of the process to develop a Conservation Management Plan. The Texas prospect is situated 800 m north of the Prince of Wales prospect.

The survey resulted in a total of 151 species of vascular plants being recorded (Appendix C). The names of the taxa recorded by Native Vegetation Solutions (2016a) have been updated, where required, to make them consistent with current day nomenclature (DPaW 2017g). No threatened flora pursuant to Schedule 1 of the *Wildlife Conservation Act 1950* and as listed by the DPaW (2017b) were recorded. Three priority flora, as listed by the DPaW (2017g), were recorded within the survey areas. The priority flora recorded were *Acacia undosa* (P3), *Grevillea lullfitzii* (P1) and *Microcorys* sp. Forrestania (V. English 2004) (P4). No introduced species were recorded within the surveyed area. Native Vegetation Solutions defined eight vegetation communities in the combined Cheritons/Texas project areas. These are summarised below.

Eucalyptus mallee woodland over *Melaleuca* shrubland and emergent *Callitris preissii*

The dominant species in this community were *Eucalyptus eremophila* subsp. *eremophila*, *Eucalyptus livida*, *Melaleuca pauperiflora* subsp. *pauperiflora*, *Melaleuca lateriflora*, *Melaleuca hamata*, *Phebalium tuberculosum* and *Cryptandra nutans*. This community occupied an area of 1.29 ha (11.93%) of the total area surveyed (10.81 ha).

Eucalyptus mallee woodland (burnt)

The dominant species in this community were *Eucalyptus eremophila* subsp. *eremophila, Eucalyptus livida*, *Eucalyptus polita*, *Acacia fragilis*, *Gastrolobium spinosum*, *Melaleuca lateriflora*, *Thryptomene kochii*, *Grevillea acuaria*, *Dodonaea stenozyga* and *Hakea scoparia* subsp. *scoparia*. This community occupied an area of 2.76 ha (25.53%) of the total area surveyed (10.81 ha).

Eucalyptus woodland over *Allocasuarina* shrubland

The dominant species in this community were *Eucalyptus livida*, *Eucalyptus polita*, *Allocasuarina campestris*, *Hakea scoparia* subsp. *scoparia*, *Cryptandra nutans*, *Acacia sphacelata* subsp. *sphacelata*, *Calothamnus quadrifidus* subsp. *seminudus* and *Beyeria sulcata* var. *brevipes*. This community occupied an area of 0.07 ha (0.65%) of the total area surveyed (10.81 ha).

Sandplain mallee heath shrubland (burnt)

The dominant species in this community were *Persoonia helix*, *Persoonia coriacea*, *Melaleuca hamata*, *Hakea multilineata*, *Cyathostemon heterantherus*, *Hibbertia eatoniae*, *Melaleuca cordata, Gastrolobium spinosum*, *Bertya dimerostigma*, *Lepidosperma sanguinolentum* and *Gompholobium gompholobioides.* This community occupied an area of 4.48 ha (41.44%) of the total area surveyed (10.81 ha).

Eucalyptus salmonophloia woodland

The dominant species in this community were *Eucalyptus salmonophloia*, *Alyxia buxifolia*, *Scaevola spinescens*, *Acacia colletioides*, *Acacia hemiteles*, *Westringia cephalantha* var. *cephalantha* and *Acacia acuminata*. This community occupied an area of 0.17 ha (1.57%) of total area surveyed (10.81 ha).

Eucalyptus salmonophloia woodland (burnt)

The dominant species in this community were *Eucalyptus salmonophloia*, *Alyxia buxifolia*, *Scaevola spinescens*, *Acacia colletioides*, *Acacia hemiteles*, *Westringia cephalantha* var. *cephalantha* and *Acacia acuminata*. This community occupied an area of 0.47 ha (4.35%) of total area surveyed (10.81 ha).

Eucalyptus urna woodland over *Melaleuca* shrubland

The dominant species in this community were *Eucalyptus urna*, *Eucalyptus salubris*, *Eucalyptus eremophila* subsp. *eremophila*, *Olearia muelleri*, *Melaleuca lateriflora*, *Phebalium tuberculosum* and *Melaleuca pauperiflora* subsp. *pauperiflora.* This community occupied an area of 0.05 ha (0.46%) of total area surveyed (10.81 ha).

Eucalyptus mallee woodland over *Acacia steedmanii*

The dominant species in this community were *Eucalyptus livida*, *Eucalyptus loxophleba* subsp. *lissophloia*, *Phebalium filifolium*, *Acacia hemiteles*, *Allocasuarina helmsii*, *Grevillea stenobotrya*, *Grevillea*

pterosperma, *Melaleuca cordata*, *Leucopogon* sp. outer wheatbelt (M. Hislop 30), *Acacia neurophylla* subsp. *erugata* and *Acacia steedmanii* subsp. *steedmanii.* This community occupied an area of 1.52 ha (14.06%) of total area surveyed (10.81 ha).

Native Vegetation Solutions (2016b). *Threatened flora targeted survey for Kidman Resources Ltd – Mt Holland Gold project, Earl Grey Prospect*. Unpublished memorandum prepared for Kidman Resources Limited, 16th September 2016.

In September 2016, Native Vegetation Solutions was commissioned to undertake a targeted search to assess potential threatened flora within the Earl Grey prospect at the Mt Holland Project (Native Vegetation Solutions 2016b). The result of the search was that no threatened flora pursuant to Schedule 1 of the *Wildlife Conservation Act 1950* and as listed by the DPaW (2017b) were recorded in the Earl Grey prospect. The majority of vegetation within the survey area comprised mallee woodland over *Melaleuca* shrubland, which was deemed not to be suitable habitat for *Banksia sphaerocarpa* var. *dolichostyla*, which is known to exist in the area about the Mt Holland Project area.

5.7 Survey of the Eastern Goldfields in the Vicinity of the Earl Grey, Irish Breakfast, and Prince of Wales Prospects

Newbey and Hnatiuk (1988), as part of a series of biological surveys of the Eastern Goldfields described, in broad terms, the landforms and vegetation of the area in which the Earl Grey, Irish Breakfast, and Prince of Wales prospects are situated. Newbey (1988) classed the landform of the area in which the Earl Grey, Irish Breakfast, and Prince of Wales prospects are situated as comprising sandplain, made up of the following component landform elements (Newbey and Hnatiuk 1988):

- Plains of shallow sandy clays supporting *Eucalyptus salmonophloia* woodlands, *Eucalyptus celastroides* subsp. *virella* mallee and E*ucalyptus salubris* low woodlands;
- Plains of shallow sand supporting *Eucalyptus redunca* mallee; *Eucalyptus transcontinentalis* mallee and *Melaleuca* spp. tall shrubland;
- Thick soil sheets on plain in deep sands supporting *Eucalyptus* aff. *decipiens* mallee, *Eucalyptus* aff. *occidentalis* mallee, *Eucalyptus tetragona* mallee, *Eucalyptus eremophila* mallee, *Acacia beauverdiana* tall shrubland, and *Grevillea eriostachya* subsp. *eriostachya* tall shrubland;
- Slight rises comprising gravelly sands supporting *Acacia signata* tall shrubland, *Allocasuarina acutivalvis* tall shrubland, *Allocasuarina campestris* tall shrubland, *Callitris preissii* subsp. *verrucosa* tall shrubland;
- Plains of gravelly sands supporting *Hakea* cf. *falcata* low shrubland; and
- Small depressions of alluvium supporting *Eucalyptus georgei* low woodlands.

5.8 Survey Associated with the Banded Ironstone Hill Formations in the Vicinity of the Earl Grey, Irish Breakfast, and Prince of Wales Prospects

The flora and vegetation of the Middle and South Ironcap, Digger Rock and Hatter Hill was surveyed and the results reported by Gibson (2004a), as part of a series of detailed floristic studies of the ranges of the Eastern Goldfields. The Earl Grey, Irish Breakfast, and Prince of Wales prospects are situated in the

vicinity of the Forrestania greenstone belt, which extends from Mt Holland south to Hatter Hill, a distance of some 70 km. The study area was located 80 km east-south-east of Hyden, between Middle Ironcap and Hatter Hill. Gibson (2004a) established 38 quadrats along the range system and data from these quadrats was used to define four floristic community types.

Gibson (2004a) recorded a total of 343 vascular plant taxa across the 38 survey quadrats established (Appendix C). The names of the taxa recorded by Gibson (2004a) have been updated, where required, to make them consistent with contemporary nomenclature (DPaW 2017g). Thirty-five of the taxa recorded at the time of the survey were of conservation significance. These included:

- three taxa listed as threatened;
- a further 29 that are being considered for listing as threatened flora;
- 10 taxa considered endemic to the range; and
- a further eight that are regional endemics (found within 100 km).

The multivariate statistical analysis of the data resulted in the division of the 38 survey quadrats into four community types. Community types 1 and 2 occurred on skeletal soils derived from banded ironstone and the massive laterites. Community types 3 and 4 occurred on deeper soils derived from greenstone or decomposing laterites. A summary of each of the four community types is set out below.

Community Type 1

Community type 1 is comprised of the species-rich shrublands or mallee shrublands. Average species richness was 27.2 taxa/quadrat. This community type was restricted to the massive outcrops along the range (Middle Ironcap, South Ironcap, Digger Rock and Hatter Hill). Three subtypes were recognized. Type 1a occurred on all outcrops. Type 1b was restricted to area around South Ironcap. Type 1c generally lacked taxa in species was found at Middle Ironcap and the Hatter Hill area. Indicator species for this community type were *Lepidosperma* sp (NG & KB 2509), *Beaufortia schaueri, Gastrolobium spinosum, Dryandra pallida, Melaleuca pungens, Petrophile glauca, Hakea multilineata, Goodenia pinifolia, Persoonia helix, Isopogon gardneri, Leptospermum fastigiatum, Dryandra viscida, Allocasuarina campestris, Melaleuca cordata, Astroloma serratifolium, Hakea subsulcata, Comesperma volubile, Calytrix breviseta* subsp*. stipulosa, Verticordia chrysantha, Drummondita hassellii, Stylidium breviscapum, Micromyrtus racemosa, Phebalium ambiguum* and *Psammomoya choretroides*.

Community Type 2

Community type 2 were generally mallee shrublands or *Allocasuarina* thickets primarily found on massive laterites. Species richness tended to be lower than in community type 1 (20.3 taxa/quadrat). Distribution of this community was again closely correlated with the massive outcrops at Middle Ironcap, Digger Rock and Hatter Hill. It was not recorded from South Ironcap. Indicator species for this community type were *Acrotriche patula, Callitris canescens, Eriochilus dilatatus, Austrodanthonia caespitosa, Caladenia paradoxa, Platysace maxwellii, Melaleuca uncinata, Dodonaea bursariifolia, Santalum acuminatum* and *Olearia muelleri*.

Community Type 3

Community type 3 were eucalypt woodlands dominated or co-dominated by *Eucalyptus urna* and *Eucalyptus salubris* 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 *Melaleuca* spp. Species richness was considerably lower (14.4 taxa/quadrat). Only one local endemic (*Melaleuca agathosmoides*) is found in this community group - all the other local and regional endemics are restricted to community types 1 and 2. Indicator species for this community type were *Eucalyptus calycogona* subsp. *calycogona, Eucalyptus salmonophloia, Melaleuca teuthidoides, Microtis media* subsp*. media, Pultenaea arida, Dodonaea stenozyga, Eucalyptus annulata, Eucalyptus salubris, Melaleuca cucullata, Eucalyptus urna, Exocarpos aphyllus, Melaleuca pauperiflora* subsp. *pauperiflora* and *Microcybe albiflora.*

Community Type 4

Community type 4 was a species poor mallee community generally dominated by *Eucalyptus calycogona* with large emergent *Eucalyptus salmonophloia* on small colluvial flats in the ranges. Species richness was low with an average 12.5 taxa/quadrat. Indicator species for this community type were *Eucalyptus calycogona*, *Eucalyptus salmonophloia* and *Olearia muelleri*.

In biogeographical terms the range was most similar to the Bremer Range (Gibson and Lyons 1998a) and Parker Ranges (Gibson & Lyons 1998b), with a high diversity of eucalypts, acacias and melaleucas, and low richness of *Eremophila* spp. compared to the more northern ranges (Highclere Hills, Jaudi uplands, Helena and Aurora Range, Mt Manning Range) (Gibson and Lyons 2001a, Gibson and Lyons 2001b, Gibson *et. al*. 1997, Gibson 2004b). Despite considerable mining and exploration activity in the area, the flora and vegetation remain poorly known.

5.9 Threatened Ecological Communities

No TECs listed by the DPaW (2017e) occur within the vicinity of the Earl Grey, Irish Breakfast, and Prince of Wales prospects. No TECs, pursuant to the EPBC Act and as listed by the DotEE (2017b) occur within the vicinity of the Earl Grey, Irish Breakfast, and Prince of Wales prospects.

5.10 Priority Ecological Communities

One PEC, as listed by DPaW (2017f) currently intersects the Earl Grey, Irish Breakfast, and Prince of Wales prospects. The entire areas of the three prospects are situated within the Ironcap Hills Vegetation Complexes (Mt. Holland, Middle, North and South Ironcap Hills, Digger Rock and Hatter Hill) (banded ironstone), a Priority 3 ecological community (Figure 6). The principle threat to this PEC is mining (DPaW 2017f).

5.11 Nature Reserves

The Prince of Wales, Irish Breakfast and Earl Grey prospects are situated situated 800 m, 4km and 5.2km south of the Jilbadji Nature Reserve, respectively (Figure 6). The Jilbadji Nature Reserve (Reserve C 24049) comprises an area of 208,860 ha, situated along the Forrestania Southern Cross

Road, west of Barker Lake, 20 km east-south-east of Marvel Loch. The Jilbadji Nature reserve is on the Register of the National Estate and was registered in 1978 (DotEE 2017e).

Given the extent of clearing in the Wheatbelt for dryland agriculture, the Jilbadji Nature Reserve is a significant area in maintaining existing ecological processes at a regional scale. With an area of 208,860 ha, it is a potentially important refugium for many species, including invertebrates and smaller vertebrates. The Jilbadji Nature Reserve is in the north-eastern part of the Wheatbelt region that is rich in endemic species at a national scale (DotEE 2017e).

5.12 Flora

A total of 720 plant taxa were identified in the desktop assessment as having the potential to occur within the Earl Grey, Irish breakfast, Prince of Wales and Van Uden prospects (Appendix C). These 720 taxa are representative of 62 families and 205 genera. The most commonly represented families were the Myrtaceae (158 taxa), Fabaceae (119 taxa), Proteaceae (69 taxa), Orchidaceae (32 taxa) and Asteraceae (30 taxa). The most commonly represented genera were *Acacia* and *Eucalyptus* (both 65 taxa), *Melaleuca* (39 taxa), and *Grevillea* (25 taxa).

5.13 Threatened and Priority Flora

A total of four known threatened flora taxa, 56 known priority flora taxa and one taxon which is currently presumed to be extinct have the potential to occur within the survey area. The 56 priority flora taxa were comprised of fifteen Priority 1, seven Priority 2, twenty-four Priority 3 and ten Priority 4 taxa (DPaW 2017g). These priority flora taxa are listed in Table 4. The distribution of known threatened and priority flora taxa, based on the DPaW's Threatened (Declared Rare) and Priority Flora database and the Western Australian Herbarium Specimen database in the vicinity of the Earl Grey, Irish Breakfast, Prince of Wales and Van Uden prospects is illustrated in Figure 6.

An assessment of the likelihood of recording any of the listed threatened and priority taxa within the Earl Grey, Irish Breakfast, and Prince of Wales prospects, based on factors including known soil type, topography and distribution, is set out in Appendix D. Based on this assessment, one taxon – *Acacia undosa* (P3) – was ranked as being highly likely to be recorded as it is known to occur within the vicinity of the Earl Grey, Irish Breakfast, and Prince of Wales prospects. Twenty-two taxa were ranked with a medium likelihood of being recorded in the survey area, of which three are considered threatened taxa (Table 4). The remaining 37 taxa were ranked with a low likelihood of being recorded in the survey area, and a single taxon presumed to be extinct was ranked as unlikely (Table 4).

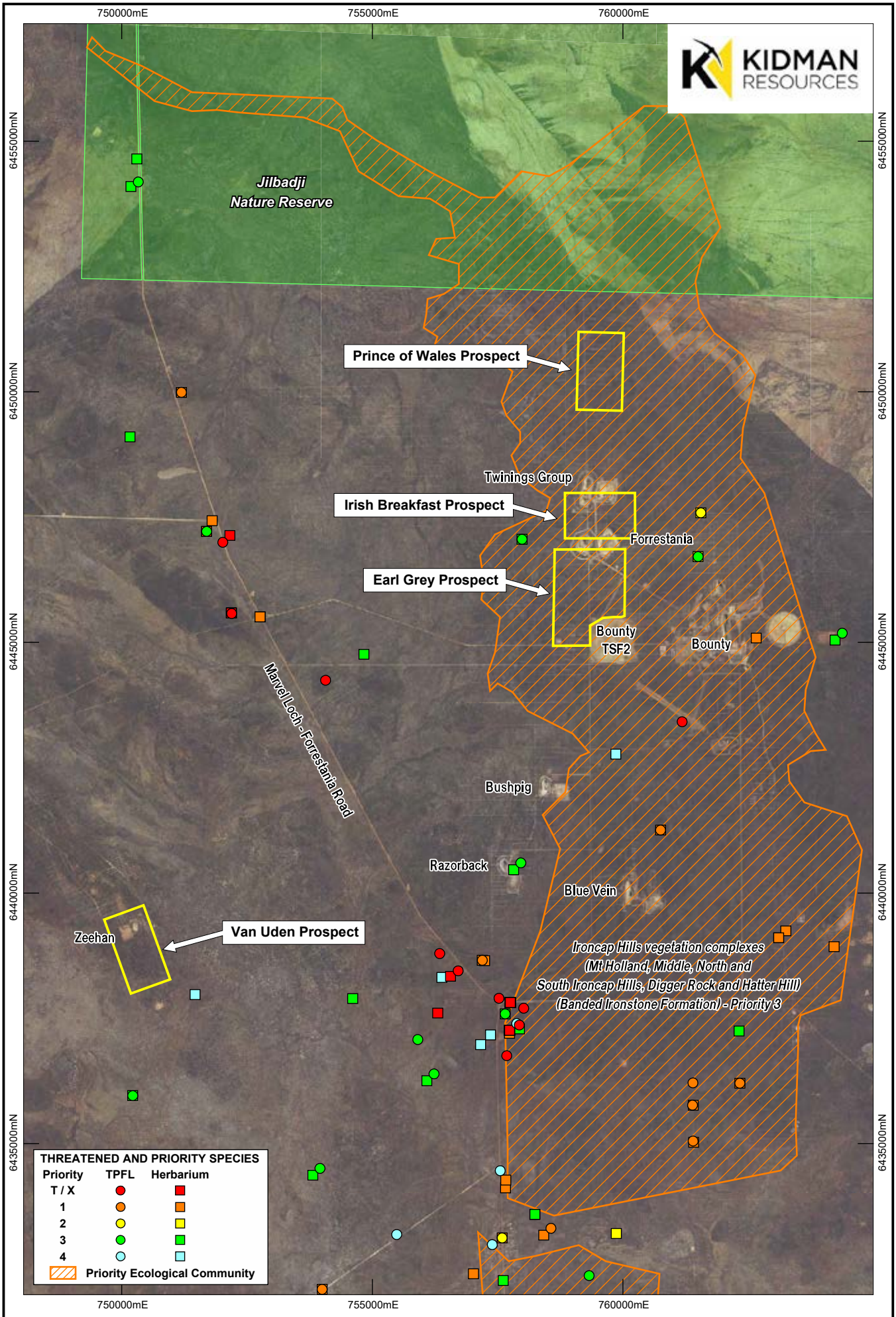
Table 4: Priority flora taxa in the vicinity of the Earl Grey, Irish Breakfast and Prince of Wales prospects

Species	SCC[1]	FCC[2]	Family	Likelihood to Record
Acacia undosa	P3	-	Fabaceae	high
Acacia lanuginophylla	T	E	Fabaceae	medium
Banksia sphaerocarpa var. *dolichostyla*	T	V	Proteaceae	medium
Eucalyptus steedmanii	T	V	Myrtaceae	medium
Baeckea sp. Blue Haze Mine (P. Armstrong 06/910)	P1	-	Myrtaceae	medium
Baeckea sp. North Ironcap (R.J. Cranfield 10580)	P1	-	Myrtaceae	medium
Dicrastylis capitellata	P1	-	Lamiaceae	medium
Hemigenia sp. Newdegate (E. Bishop 75)	P1	-	Lamiaceae	medium
Acacia asepala	P2	-	Fabaceae	medium
Eutaxia lasiocalyx	P2	-	Fabaceae	medium
Acacia singula	P3	-	Fabaceae	medium
Baeckea sp. Merredin (K.R. Newbey 2506)	P3	-	Myrtaceae	medium
Eutaxia acanthoclada	P3	-	Fabaceae	medium
Leucopogon sp. Ironcaps (N. Gibson & K. Brown 3070)	P3	-	Ericaceae	medium
Persoonia cymbifolia	P3	-	Proteaceae	medium
Phebalium brachycalyx	P3	-	Rutaceae	medium
Pultenaea daena	P3	-	Fabaceae	medium
Seringia adenogyna	P3	-	Malvaceae	medium
Stylidium sejunctum	P3	-	Stylidiaceae	medium
Verticordia gracilis	P3	-	Myrtaceae	medium
Verticordia stenopetala	P3	-	Myrtaceae	medium
Microcorys sp. Forrestania (V. English 2004)	P4	-	Lamiaceae	medium
Stenanthemum bremerense	P4	-	Rhamnaceae	medium
Boronia revoluta	T	E	Rutaceae	low
Austrostipa sp. Carlingup Road (S. Kern & R. Jasper LCH 18459)	P1	-	Poaceae	low
Brachyloma stenolobum	P1	-	Ericaceae	low
Eucalyptus myriadena subsp. *parviflora*	P1	-	Myrtaceae	low
Gastrolobium tenue	P1	-	Fabaceae	low
Grevillea lissopleura	P1	-	Proteaceae	low
Grevillea lullfitzii	P1	-	Proteaceae	low
Grevillea marriottii	P1	-	Proteaceae	low
Hibbertia axillibarba	P1	-	Dilleniaceae	low
Labichea rossii	P1	-	Fabaceae	low
Lepidosperma amantiferrum	P1	-	Cyperaceae	low
Stenanthemum liberum	P1	-	Rhamnaceae	low
Acacia heterochroa subsp. *robertii*	P2	-	Fabaceae	low

Table 4 (ctd): Priority flora taxa in the vicinity of the Earl Grey, Irish Breakfast and Prince of Wales prospects

Species	SCC[1]	FCC[2]	Family	Likelihood to Record
Bentleya diminuta	P2	-	Pittosporaceae	low
Conospermum sigmoideum	P2	-	Proteaceae	low
Dampiera orchardii	P2	-	Goodeniaceae	low
Orianthera exilis	P2	-	Loganiaceae	low
Angianthus micropodioides	P3	-	Asteraceae	low
Baeckea sp. Parker Range (M. Hislop & F. Hort MH 2968)	P3	-	Myrtaceae	low
Banksia viscida	P3	-	Myrtaceae	low
Chorizema circinale	P3	-	Fabaceae	low
Daviesia newbeyi	P3	-	Fabaceae	low
Eucalyptus exigua	P3	-	Myrtaceae	low
Grevillea insignis subsp. *elliotii*	P3	-	Proteaceae	low
Grevillea pilosa subsp. *redacta*	P3	-	Proteaceae	low
Hakea pendens	P3	-	Proteaceae	low
Melaleuca ochroma	P3	-	Myrtaceae	low
Mirbelia densiflora	P3	-	Fabaceae	low
Oxymyrrhine plicata	P3	-	Myrtaceae	low
Calamphoreus inflatus	P4	-	Scrophulariaceae	low
Eremophila biserrata	P4	-	Scrophulariaceae	low
Eremophila racemosa	P4	-	Scrophulariaceae	low
Eucalyptus georgei subsp. *fulgida*	P4	-	Myrtaceae	low
Eucalyptus rugulata	P4	-	Myrtaceae	low
Grevillea neodissecta	P4	-	Proteaceae	low
Gyrostemon ditrigynus	P4	-	Gyrostemonaceae	low
Myriophyllum petraeum	P4	-	Haloragaceae	low
Thomasia gardneri	X	Ex	Malvaceae	unlikely

1 - State Conservation Code (refer Appendix A). 2 – Federal Conservation Code (refer Appendix A).



Aerial: Landgate (March 2011) ~ DPaW Estates: Depatment of Parks and Wildlife, WA ~ Priority Flora: Depatment of Parks and Wildlife, WA (Ref 55-1016FL & 04-01116EC)

0 1km
Scale 1:100,000
MGA94 (Zone 50)
CAD Ref: g2445_R005
Date: Feb 2017 | Rev: B | A4

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Kidman Resources Ltd.

PECs, Nature Reserve, Threatened and Priority Flora

Figure: 6

5.14 Introduced (Exotic) Plant Species

A total of seven introduced (exotic) plant species were recorded from the desktop assessment utilising a 20 km search buffer about the Earl Grey, Irish breakfast, and Prince of Wales prospects (Table 5). None of the species are listed as Declared Pest species pursuant to Section 22 of the *Biosecurity and Agriculture Management Act 2007*. None of the species are listed as a Prohibited Organism pursuant to Section 12 of the *Biosecurity and Agriculture Management Act 2007* or listed as a Weed of National Significance (DotEE 2017f).

Table 5: Introduced plant species in the vicinity of the Earl Grey, Irish Breakfast, and Prince of Wales prospects

Introduced Species	Common Name	Family	Potential /Recorded[4]
**Carrichtera annua*[2, 3]	Ward's Weed	Brassicaceae	P
**Hypochaeris glabra*[1, 3]	Smooth Cats-ear	Asteraceae	P
**Mesembryanthemum nodiflorum*[1, 3]	Slender Iceplant	Aizoaceae	P
**Pentameris airoides* subsp. *airoides*[1, 3]	-	Poaceae	P
**Rostraria pumila*[1, 3]	Roughtail	Poaceae	P
**Ursinia anthemoides*[1, 3]	South African marigold	Asteraceae	P
**Vulpia myuros* forma *megalura*[1, 3]	Rats Tail Fescue	Poaceae	P
**Vulpia myuros* forma *myuros*[1, 3]			

1 - recorded from NatureMap (DPaW 2007-); 2 - recorded from DotEE (2017d); 3 – Permitted (s11) under the BAM Act 2007; 4 - P = Potential to occur.

5.15 Other Matters

In addition to the items reviewed in the preceding paragraphs of this desktop assessment (paragraphs 5.1 through 5.14), the EPBC Act Protected Matters Report (DotEE 2017c) reveals that within 20 km of the Earl Grey, Irish breakfast, and Prince of Wales, the following applies:

World Heritage Properties	none
National Heritage Places	none
Wetlands of International Importance	none
Listed Threatened Ecological Communities	none
Commonwealth Heritage Places	none
Critical Habitats	none
Commonwealth Terrestrial Reserves	none
Regional Forest Agreements	none
Nationally Important Wetlands	none

6. FIELD SURVEY RESULTS

A total of 43 survey quadrats were used to assess the flora and vegetation of the Earl Grey (26 quadrats), Irish Breakfast (nine quadrats), and Prince of Wales (eight quadrats) prospects. Refer to Appendix B for a list of the geographic locations for each of the survey quadrats.

6.1 Field Survey Limitations and Constraints

An assessment of the survey against a range of factors which may have had an impact on the outcomes of the present survey was made (Table 6). Based on this assessment, the survey of the Earl Grey, Irish Breakfast, and Prince of Wales prospects has not been subject to constraints which would affect the thoroughness of the survey and the conclusions which have been formed.

Table 6: Potential flora and vegetation survey limitations for the Earl Grey, Irish Breakfast, and Prince of Wales prospects

Potential Survey Limitation	Impact on Survey
Sources of information and availability of contextual information (i.e. pre-existing background versus new material).	**Not a constraint.** Reference resources such as Beard's mapping, historical survey data in both the vicinity of the survey area (Consultant's reports) and in the broader region (Gibson's series of Flora and Vegetation surveys of the Eastern Goldfield Ranges / Newbey & Hnatiuk's Biological Surveys of the Eastern Goldfields), together with online flora and vegetation information, has provided an appropriate level of information for the current survey.
Scope (i.e. what life forms, etc., were sampled).	**Not a constraint.** Vascular flora, which was the focus of the present survey of the Earl Grey, Irish Breakfast and Prince of Wales prospects, was thoroughly sampled.
Proportion of flora collected and identified (based on sampling, timing and intensity).	**Not a constraint.** The survey was undertaken over two consecutive months on the Earl Grey, Irish Breakfast and Prince of Wales prospects. Additionally, a search to determine if any conservation significant flora were present was undertaken concurrently. Based on the survey quadrat data, it was estimated that approximately 79.35% of the potential flora species that may occur were recorded. This value is based on the combined data for the Earl Grey, Irish Breakfast, Prince of Wales and Van Uden prospects. The use of data from all four prospects is justified on the basis that they were all situated in proximity to each other.
Completeness and further work which might be needed (i.e. was the relevant survey area fully surveyed).	**Potential constraint**. The survey of the Earl Grey, Irish Breakfast and Prince of Wales prospects was undertaken over two consecutive months and therefore there were potential constraints in relation to the aspect of multiple seasons of a "detailed" survey as defined in the EPA Technical Guide (2016b). Given that the survey area is situated within a PEC and that conservation significant flora were recorded either within the Earl Grey, Irish Breakfast and Prince of Wales prospects or the adjacent prospects and areas, a more detailed survey, together with a targeted search for conservation significant flora is recommended.
Mapping reliability.	**Potential constraint**. The spatial coverage of the survey area is considered to be adequate. The aerial photographic maps available for the survey were of moderate resolution. Higher resolution aerials are likely to be available in the first quarter of 2017. As part of future planned survey work, vegetation communities will be validated using the high resolution aerial imagery, however it is unlikely that the areas will change significantly. Vegetation community boundaries were often discontinuous with interfaces resembling admixtures of one or more communities. This is a recognised and unavoidable limitation of vegetation mapping, particularly across mosaic *Eucalyptus* / *Melaleuca* and other shrubs associations and open woodland associations.

Potential Survey Limitation	Impact on Survey
Timing, weather, season, cycle.	**Not a constraint**. The EPA (2016a) recommends that flora and vegetation surveys in the Coolgardie region should be undertaken after the main rainfall period in the winter months. Rainfall in the four months preceding the October and November 2016 surveys was slightly below average (Figure 3), with the area experiencing approximately 90% of the long term average rainfall. From a seasonal perspective, the majority of all flora present were either in flower or were towards the end of their flowering period. Consequently it was possible to collect excellent specimens (fertile and many with fruit) of the majority of flora for identification purposes. This was especially important given the diversity of flora and the high potential for conservation significant species to be present.
Disturbances (fire, flood, accidental human intervention, etc.).	**Not a constraint**. The Earl Grey, Irish Breakfast and Prince of Wales prospects exhibits moderate to high levels of disturbance form past mining activities. Old mine pits and waste deposits are present, together with old roads and exploration tracks. In addition, part of the Prince of Wales prospect was subject to a fire in February 2015 (Carla Vincent, Kidman, pers. comm.). The aerial photographic maps used for the present survey show the pre-fire vegetation, thus increasing the degree of error associated with delineating accurate vegetation community boundaries.
Intensity (in retrospect, was the intensity adequate).	**Not a constraint**. The intensity of the survey effort of the Earl Grey, Irish Breakfast and Prince of Wales prospects, given the level of survey, was considered to be good.
Resources (i.e. were there adequate resources to complete the survey to the required standard).	**Not a constraint**. Resources, in terms of equipment, support and personnel were good.
Access problems (i.e. ability to access survey area).	**Not a constraint**. Vehicle access to the Earl Grey, Irish Breakfast and Prince of Wales prospects area was via a range of tracks that traversed the length and width of the prospect. These provided excellent access to the entirety of the survey area.
Experience levels (e.g. degree of expertise in plant identification to taxon level).	**Not a constraint**. All botanists had extensive experience working in a range of botanical districts across the state, and all had all botanists had experience working in the Coolgardie/Goldfields region.

6.2 Flora

A total of 184 vascular plant taxa which are representative of 86 genera and 35 families were recorded in the Earl Grey, Irish Breakfast and Prince of Wales prospects. The majority of taxa recorded were representative of the Myrtaceae (46 taxa), Fabaceae (30 taxa), and Proteaceae (19 taxa) families. The majority of families (23 of 35) were represented by three or less taxa. The taxa recorded during the survey are set out in Appendix C. A list of plant taxa recorded at each survey quadrat within the Earl Grey, Irish Breakfast and Prince of Wales prospects is set out in Appendix E.

Annual species represented 9.9 % of all recorded plant species within the Earl Grey, Irish Breakfast and Prince of Wales prospects. The average species richness for the 43 survey quadrats was 21.27 ± 1.13 (mean ± s.e.m.), with a range of 11 to 42 species per quadrat.

6.2.1 Proportion of Flora Surveyed

A species accumulation plot, based on accumulated species recorded versus sites surveyed within the Earl Grey, Irish Breakfast and Prince of Wales prospects was used to provide an indication as to the level of adequacy of the survey effort. As the number of survey sites increases, and correspondingly the size of the area surveyed increases, there should be a diminishing number of new species recorded. At some point, the number of new species recorded becomes essentially asymptotic. When the number of new species being recorded for survey effort expended approaches this asymptotic value, the survey effort can be considered to be adequate.

The species accumulation curve (Figure 7), based on the species accumulation analysis of Colwell (2013) was used to evaluate the adequacy of sampling. The asymptotic value was determined using Michaelis-Menten modelling. Using this analysis, the incidence based coverage estimator of species richness (ICE, Chao 2004) was calculated to be 216.74. Based on this value, and the total of 172 species recorded in the 43 survey quadrats, approximately 79.35 % of the flora species potentially present within the survey area were recorded. The number of species used for the species accumulation analysis is lower than the number of species reported in the Earl Grey, Irish Breakfast and Prince of Wales prospects (Section 6.2) because opportunistically collected taxa (i.e. those taxa which were recorded outside survey quadrats) were excluded from this analysis.

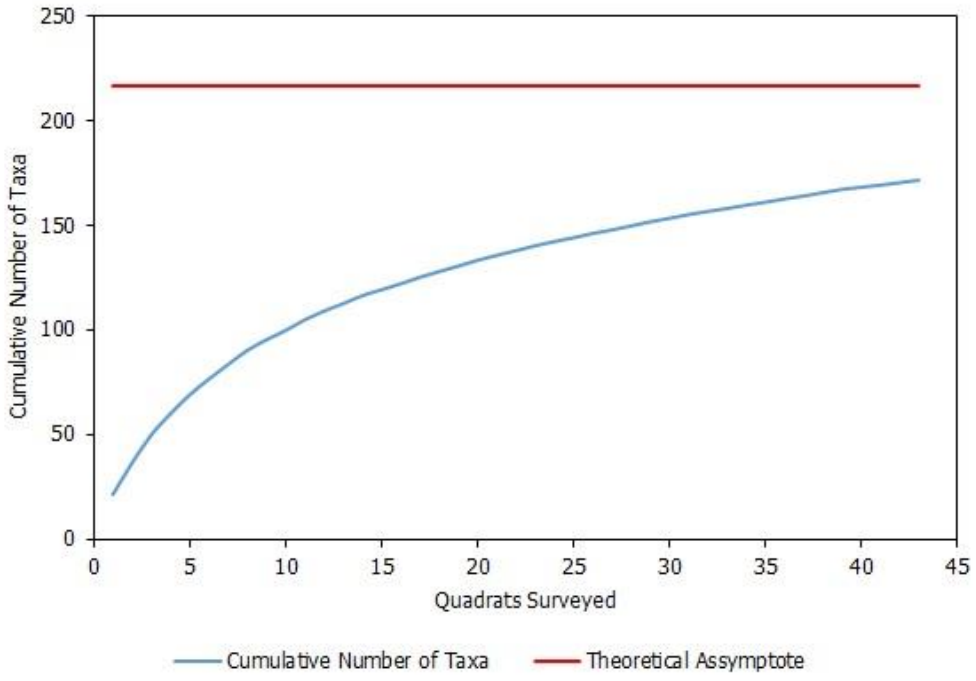


Figure 7: Average randomised species accumulation curve

6.2.2 Threatened and Priority Flora

No threatened flora pursuant to Schedule 1 of the *Wildlife Conservation Act 1950* and as listed by the DPaW (2017b) were recorded within the Earl Grey, Irish Breakfast and Prince of Wales prospects. No threatened flora pursuant to the *Environment Protection and Biodiversity Conservation Act 1999* and as listed by the DotEE (2017a) were recorded within Earl Grey, Irish Breakfast and Prince of Wales prospects. One threatened flora taxon pursuant to Schedule 1 of the *Wildlife Conservation Act 1950* and as listed by the DPaW (2017b) was recorded outside the eastern boundary of the Earl Grey prospect, at survey quadrat EG13 (Figure 9.1). This taxon was *Banksia sphaerocarpa* var*. dolichostyla* (T). *Banksia sphaerocarpa* var*. dolichostyla* (T) is listed as Vulnerable, pursuant to the *Environment Protection and Biodiversity Conservation Act 1999* and as listed by the DotEE (2017a). The geographical location where *Banksia sphaerocarpa* var*. dolichostyla* (T) was recorded is set out in Appendix F.

Four priority flora taxa, as listed by DPaW (2017g), were recorded within the Earl Grey, Irish Breakfast and Prince of Wales prospects. The four priority flora recorded were *Eutaxia lasiocalyx* (P2), *Acacia undosa* (P3), *Hakea pendens* (P3) and *Calamphoreus inflatus* (P4). These taxa, together with their geographical locations and populations, are listed in Appendix F. All priority taxa recorded were identified from specimens collected during the field trip. The population numbers listed in Appendix F are a minimum, and do not represent a population count based on a targeted search for the taxa.

DPaW threatened and priority report forms for the threatened and priority taxa recorded in the Earl Grey, Irish Breakfast and Prince of Wales prospects are presented in Appendix G.

6.2.3 Taxa with Range Extensions

Three taxa recorded during the survey of the Earl Grey, Irish Breakfast, and Prince of Wales prospects represented an extension to their currently known distribution. These taxa were *Hakea invaginata*, *Centrolepis strigosa* subsp. *rupestris* and *Pityrodia loricata*. The locations where these taxa were recorded within the Earl Grey, Irish Breakfast, and Prince of Wales prospects are set out in Table 7. *Hakea invaginata* was recorded at six locations (Table 7). The recording of *Hakea invaginata* in the Earl Grey and Irish Breakfast prospects represents an approximately 150 km south-eastern extension to its currently known range. The recording of *Centrolepis strigosa* subsp. *rupestris* in the Irish Breakfast prospect represents an approximately 200 km southern extension to its currently known range. The recording of *Pityrodia loricata* in the Prince of Wales prospect represents an approximately 200 km southern extension to the currently know range. All three taxa are not considered to be of conservation significance. In this report, 150 km has been used as a basis to determine an extension to the currently known range for a taxon.

6.2.4 Other Taxa of Significance

Six specimens collected within the Earl Grey, Irish Breakfast and Prince of Wales prospects, representing three taxa, were deemed to be species of interest by the WAH. These taxa were identified as:

Microcorys sp. (aff. *macredieana*)

From three separate collections (DA2397, DA2363, AB077), recorded at four survey quadrats (EG03, EG07, EG15, EG22). Advice from M. Hislop of the WAH is that these specimens are most closely related to *Microcorys macredieana*, but differ in regard to some significant taxonomic characters. Typical *Microcorys macredieana* occurs in the Great Victoria Desert. Currently, only one collection of this morphotype exists at the WAH. M. Hislop advises that in the near future it is likely that a new phrase name will be recognised for this morphotype. The specimens collected within the Earl Grey prospect will be added to the WAH collection.

Table 7: Locations of taxa with extensions to their known range, recorded within the Earl Grey, Irish Breakfast, and Prince of Wales prospects

Taxon	Prospect	Quadrat	Location (GDA94, zone 50)	
			Easting (mE)	Northing (mN)
Hakea invaginata	Earl Grey	EG07	758733	6446439
Hakea invaginata	Earl Grey	EG23	758813	6445504
Hakea invaginata	Earl Grey	EG06	758855	6446449
Hake invaginata	Earl Grey	EG10	759746	6446223
Hakea invaginata	Irish Breakfast	IB09	758957	6447250
Hakea invaginata	Irish Breakfast	IB08	760048	6447290
Centrolepis strigosa subsp. *rupestris*	Irish Breakfast	IB04	760166	6447657
Pityrodia loricata	Irish Breakfast	opportunistic	759874	6449800

Baeckea sp.

From two separate collections (DA2405, AB017), recorded at two survey quadrats (EG04, EG25). Advice from M. Hislop of the WAH is that these two collections belong to a group of species that are to be published as a new genus '*Tilophloia*'. At the present time there are numerous phrases names recognised, with many occurring in the Forrestania area. The specimens collected within the Earl Grey prospect are being held by the WAH for further assessment.

Lepidosperma sp.

From a single collection (DA2408) recorded at quadrat EG04. M. Hislop of the WAH advises that due to the incomplete state of research related to genus *Lepidosperma* in Western Australia, it is difficult, and often impossible, to provide authoritative identifications in *Lepidosperma*.

6.2.5 Introduced (Exotic) Plant Species

One introduced (exotic) plant taxon was recorded during the survey of the Earl Grey, Irish Breakfast and Prince of Wales prospects. The introduced taxon recorded was **Centaurium tenuiflorum*. This taxon is listed as Permitted (s11) pursuant to the *Biosecurity and Agriculture Management Act 2007* according to the DAFWA (2017). **Centaurium tenuiflorum* was recorded at a single location within the Irish Breakfast prospect at quadrat IB04 (760166 mE, 6447657 mN, GDA94, zone 50).

**Centaurium tenuiflorum* (Gentianaceae) is an erect hairless herb that can grow to 50 cm high. It produces pink flowers from the months of August to December and is known to occur along drainage lines, in swamp, and disturbed areas (DPaW 2017g; Hussey *et al.* 2007).

6.3 Statistical Analysis of Data

Cluster analyses derived from a species-by-site resemblance matrix (Bray-Curtis similarity) grouped survey sites into discrete clusters based on species composition (dissimilarity/distance increased) (Clarke and Gorley 2006). Only taxa which could be identified to species level were included in the analysis. Classification and ordination analyses were conducted on a data matrix of perennial taxa, with singularly occurring species and annual taxa omitted prior to analysis. This was justified on the basis that singleton taxa add little additional information, and annuals (desert ephemerals) exhibit high inter-annual variation in distribution and abundance (Mott 1972, 1973). In addition, the omission of annual species from the statistical analysis allows for comparison of data from surveys undertaken in different seasons or survey years. Hierarchical Clustering was used in conjunction with Similarity Profile (SIMPROF), Similarity Percentages (SIMPER), site descriptions, site photos and aerial photographs; combining these methods increased the understanding of site inter-relations and thus the ability to accurately delineate those sites based on species composition.

To down weight the relative contributions of quantitatively dominant species a 4^{th} root transformation of the data was used for statistical analysis. Preliminary data analysis indicated that this form of transformation demonstrated discrimination between the survey quadrats which was more reflective of the vegetation patterns observed in the field. Introduced species, singletons (species recorded at only one quadrat), annuals and specimens that were not identified down to the species level were excluded from the analysis. Taxa which were identified to the subspecies and variety levels were revised to the specific level to reduce the tendency for this to create further statistical variation in analysis which was considered unwarranted. Computation of similarity matrices was based on the Bray Curtis similarity measure.

Where appropriate, outliers and small groupings were assigned to broader comparative vegetation units based on factors including species composition and site descriptions; this is particularly relevant where survey quadrats were established on ecotones. For the purposes of vegetation mapping, i.e. extrapolating quadrat data to generalised vegetation communities over broad areas, an inclusive rather than exclusive approach was adopted for outliers.

Survey quadrat data from the four prospects surveyed in October/November 2016 (Earl Grey, Irish Breakfast, Prince of Wales and Van Uden) were incorporated into the statistical analysis to delineate statistically associated groups of quadrats. Although reported separately, Van Uden was included in the analysis to maintain a holistic and consistent approach to delineating vegetation communities across the project. Similarity Profile Analysis (SIMPROF) of the 52 survey quadrats identified 13 significantly associated groups of quadrats. The dendrogram representing the results of the cluster analysis, and the corresponding 13 statistically dissimilar vegetation types is illustrated in Figure 8. The primary split in

the dendrogram (groups a to e, as compared to groups f to m) was based on the relative abundance of some key species. Quadrats which formed groups a to e had a greater contribution from of *Eucalyptus flocktoniae* subsp. *flocktoniae*, *Melaleuca pauperiflora* subsp. *fastigiata*, *Eucalyptus salubris*, and *Eucalyptus salmonophloia*. In contrast, quadrats which formed groups f to m were more defined by the contribution from *Melaleuca laxiflora*, *Eucalyptus eremophila*, *Melaleuca hamata*, *Thryptomene kochii*, *Acacia acuminata*, *Allocasuarina acutivalvis* subsp. *acutivalvis*, *Allocasuarina spinosissima*, and *Eucalyptus capillosa* subsp. *polyclada*. Two groups (g and j) were defined by a single quadrat.

Based on the statistical analysis, and field observations, the 13 statistically dissimilar groups derived from the cluster analysis were used to delineate 13 vegetation communities across the Earl Grey, Irish Breakfast, Prince of Wales and Van Uden prospects. Based on field observations, the 13 groups of quadrats identified from the cluster analysis broadly reflected the vegetation communities observed in the field.

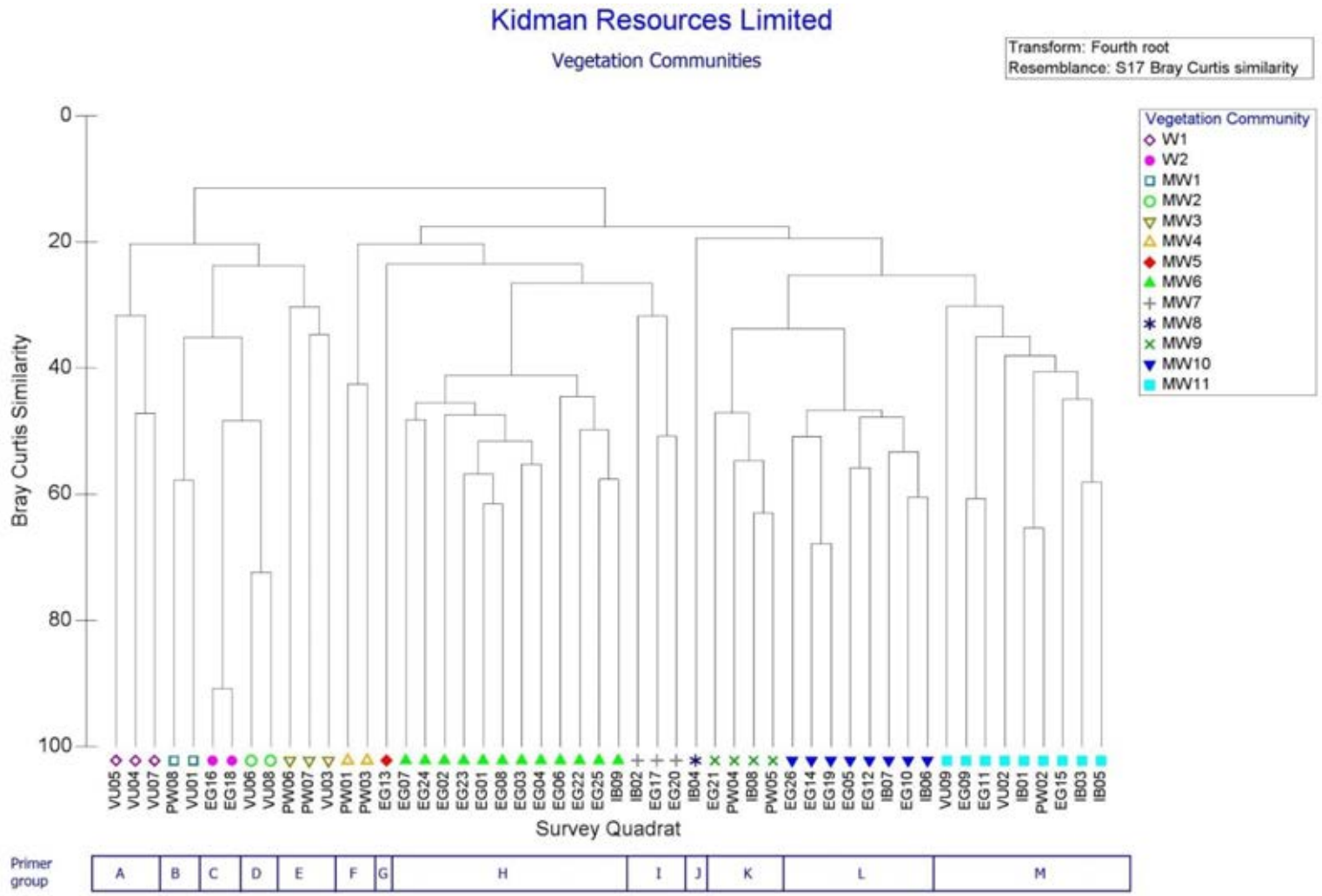


Figure 8. Dendrogram of the 52 survey quadrats established across the Earl Grey, Irish Breakfast, Prince of Wales and Van Uden prospects

Note: Sites pre-fixed with 'VU' are located within the Van Uden prospect which is not included in this report, however to accurately present the results are included in the relevant Figures and text.

6.4 Vegetation Mapping

Based on the statistical analysis (Section 6.3), 13 vegetation communities were defined and mapped within the Earl Grey, Irish Breakfast, Prince of Wales and Van Uden prospects. Ten of these vegetation communities occur within the Early Grey, Irish Breakfast and Prince of Wales prospects and are described in detail below. In addition to the statistical analysis, survey quadrat physical data and aerial photographic maps were used to delineate the boundaries of the vegetation communities in the Earl Grey, Irish Breakfast, Prince of Wales and Van Uden prospects. The descriptions of the vegetation communities were based on Alpin's (1979) modification of the vegetation classification system of Specht (1970), to align with the NVIS. Vegetation communities were described at the association level of the NVIS classification framework, as defined by the ESCAVI (2003), and are summarised below. A listing of species recorded within each vegetation community is set out in Appendix H. Detailed descriptions of each vegetation community together with representative photographs are presented in Appendix I. The occurrence of each vegetation community in the Earl Grey, Irish Breakfast and Prince of Wales prospects is set out in Table 8. The vegetation mapped in the Earl Grey, Irish Breakfast and Prince of Wales prospects is presented in Figures 9.1-9.2.

Table 8: Occurrence of mapped vegetation communities within the Earl Grey, Irish Breakfast and Prince of Wales prospects

Vegetation Community	Prospect		
	Earl Grey	Irish Breakfast	Prince of Wales
W2	x		x
MW3			x
MW4			x
MW5	external[1]		
MW6	x	x	
MW7	x	x	
MW8		x	x
MW9	x	x	x
MW10	x		
MW11	x	x	x

[1] community situated external to Earl Grey prospect; community W1, MW1 and MW2 occur only in Van Uden prospect.

Woodlands

W2 *Eucalyptus salubris*, *Eucalyptus flocktoniae* subsp. *flocktoniae* low woodland over *Melaleuca pauperiflora* subsp. *fastigiata*, *Melaleuca halmaturorum*, *Daviesia argillacea* mid open shrubland over *Microcybe ambigua* low sparse heathland on pale orange clayey sand flats.

Mallee Woodlands

MW3 *Eucalyptus eremophila*, *Eucalyptus flocktoniae* subsp. *flocktoniae*, *Eucalyptus prolixa* mid open mallee woodland over *Daviesia argillacea*, *Acacia hemiteles* low sparse shrubland over *Acacia deficiens*, *Coopernookia strophiolata* low sparse heathland on brown clay loam, occasionally with ironstone pebbles, on flats.

MW4 *Eucalyptus capillosa* subsp. *polyclada* mid open mallee woodland over *Baeckea elderiana*, *Allocasuarina acutivalvis* subsp. *acutivalvis*, *Grevillea didymobotrya* subsp. *didymobotrya* mid-tall sparse shrubland on orange-brown clay, occasionally with ironstone pebbles, on flats and mid slopes.

MW5 *Eucalyptus burracoppinensis*, *Allocasuarina acutivalvis* subsp. *acutivalvis*, *Callitris canescens* low open mallee woodland over *Banksia purdieana*, *Beaufortia orbifolia*, *Allocasuarina spinosissima* mid open shrubland over *Gompholobium hendersonii*, *Goodenia pinifolia* low isolated shrubs on yellow-brown clay loam on flats.

MW6 *Eucalyptus burracoppinensis*, *Eucalyptus eremophila* mid open mallee woodland over *Thryptomene kochii*, *Melaleuca laxiflora*, *Acacia acuminata* mid open shrubland over *Drummondita hassellii*, *Microcybe ambigua* low sparse heathland on grey-brown to orange-brown clay to clay sand, often with scattered ironstone pebbles on flats.

MW7 *Eucalyptus capillosa* subsp. *polyclada*, *Eucalyptus eremophila* mid open mallee woodland over *Allocasuarina acutivalvis* subsp. *acutivalvis*, *Hakea subsulcata*, *Melaleuca hamata* mid-tall sparse shrubland over *Hibbertia exasperata*, *Phebalium megaphyllum* low sparse shrubland on orange-brown to brown clay to loamy clay, with occasional ironstone pebbles, on flats and slopes.

MW8 *Eucalyptus eremophila* mid open mallee woodland over *Melaleuca hamata*, *Leptospermum erubescens*, *Melaleuca lateriflora* mid sparse shrubland over *Thomasia* sp. Salmon Gums (C.A. Gardner s.n. PERTH 02708639), *Darwinia* sp. Karonie (K. Newbey 8503) low sparse shrubland on orange brown clay in minor drainage channel.

MW9 *Eucalyptus rigidula*, *Eucalyptus capillosa* subsp. *capillosa* mid mallee woodland over *Melaleuca acuminata* subsp. *acuminata*, *Melaleuca hamata*, *Melaleuca laxiflora* mid open shrubland over *Grevillea acuaria*, *Cryptandra minutifolia* subsp. *brevistyla*, *Dodonaea bursariifolia* low sparse heathland on brown to red-brown clay loam soils on flats and lower slopes.

MW10 *Eucalyptus rigidula*, *Eucalyptus eremophila*, *Eucalyptus flocktoniae* subsp. *flocktoniae* mid mallee woodland over *Melaleuca laxiflora*, *Melaleuca lateriflora*, *Melaleuca hamata* mid open shrubland over *Daviesia argillacea*, *Acacia hystrix* subsp. *hystrix*, *Grevillea acuaria* low sparse heathland on yellow to pale orange-brown clay sands with occasional scattered ironstone pebbles on flats.

MW11 *Eucalyptus eremophila*, *Eucalyptus incrassata*, *Eucalyptus prolixa* mid mallee woodland over *Melaleuca halmaturorum*, *Melaleuca lateriflora*, *Melaleuca hamata* mid sparse shrubland over *Daviesia scoparia*, *Acacia mackeyana* low sparse heathland on grey-brown to orange-brown clay and clay sands on flats and slopes.

CL Cleared land

6.5 Area Coverage of Vegetation Communities

The total areas mapped for each vegetation community across the three prospects is set out in Table 9. The areas mapped and percentage cover for each vegetation community delineated in the Earl Grey, Irish Breakfast and Prince of Wales prospects is set out in Table 10. In terms of the areas surveyed, cleared land occupied the greatest proportion of the total area surveyed, comprising 16.20% of the total area. Eucalypt mallee woodlands with a myrtaceous, predominantly *Melaleuca,* understorey was the most dominant vegetation type mapped (communities MW6, MW10, MW11), comprising 58.90% of the three prospects. Several vegetation communities (W2, MW4, MW7, MW8 and MW9) occupied less than 10% of the total areas mapped, but were variations on the eucalypt mallee woodlands over *Melaleuca*

shrubland type vegetation. Average species richness across all 52 quadrats was 20.87 ± 1.11 (mean ± s.e.m.). The MW6 vegetation community exhibited the highest species richness (28.33 ± 2.49).

6.6 Condition of the Vegetation

The condition of the vegetation within the Earl Grey, Irish Breakfast and Prince of Wales prospects ranged from Excellent to Completely Degraded, according to the Trudgen (1988; Appendix A7) scale. Within the Earl Grey, Irish Breakfast and Prince of Wales prospects these areas can be delineated as follows:

Excellent: Areas of vegetation where no exploration or drill tracks encroach, typically at least 20 m distant from tracks.

Good to Very Good: Areas between tracks and drill lines, typically 5 m to 20 m from track/drill line edge.

Poor: Areas bordering tracks and drill lines.

Very Poor: Old waste mounds and old tracks which have had some past attempts at rehabilitation.

Completely Degraded: Old mine pits and surrounds.

Considering the extent of past mining operations and the degree of impacts associated with tracks and drill lines, the absence of weed species is remarkable.

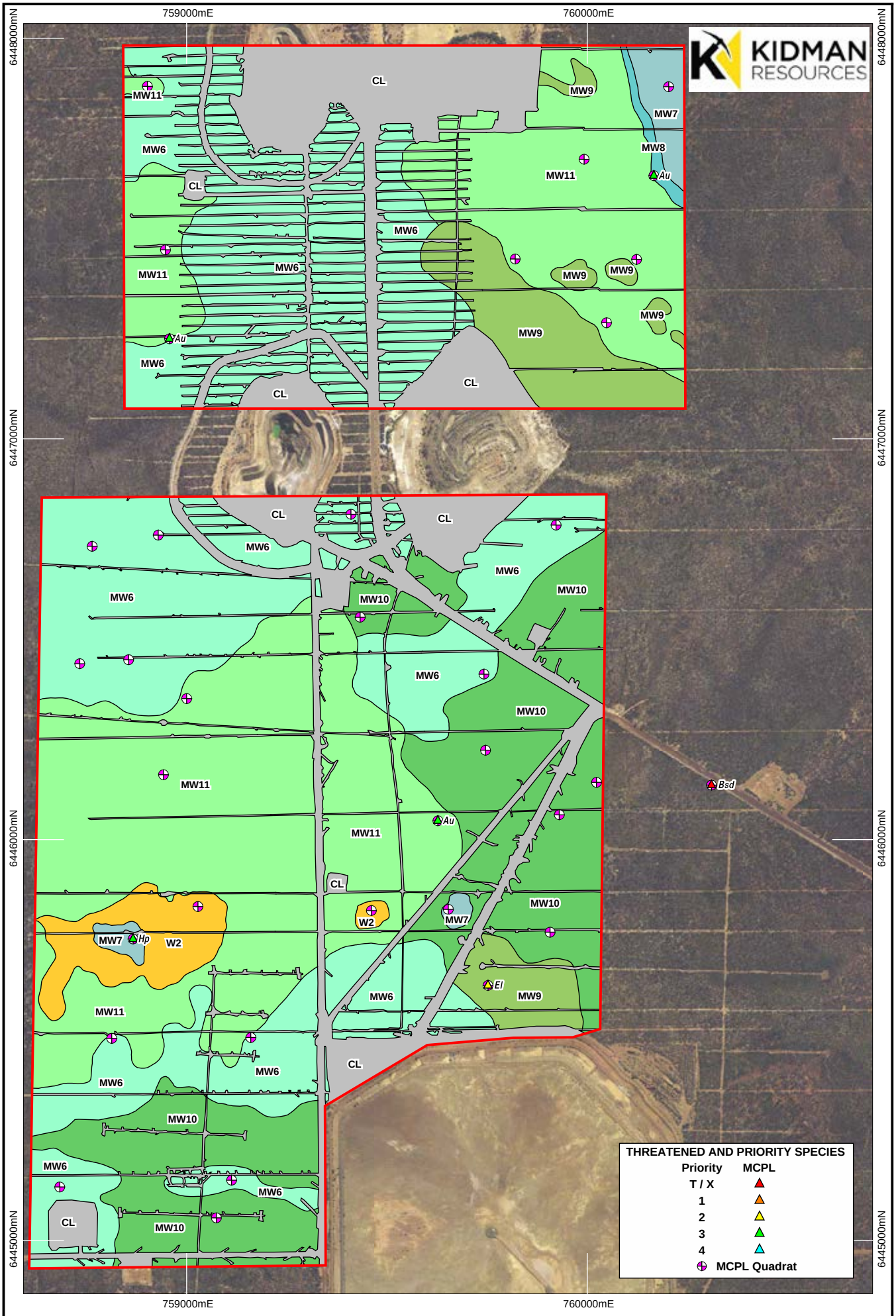
Table 9: Total area coverage of each vegetation community mapped across the Earl Grey, Irish Breakfast and Prince of Wales prospects.

Vegetation Community	Area (ha)	Percentage of Total Area Surveyed
W1	0.00	0.00
W2	12.31	2.45
MW1	0.00	0.00
MW2	0.00	0.00
MW3	79.46	15.81
MW4	3.52	0.70
MW5	0.00	0.00
MW6	101.01	20.10
MW7	4.48	0.89
MW8	1.03	0.20
MW9	24.37	4.85
MW10	52.92	10.53
MW11	142.12	28.27
Cleared Land	81.42	16.20
Total Area	502.64	100.00

Community MW5 was derived from a single survey quadrat located external to the Earl Grey prospect; community W1, MW1 and MW2 occur only in Van Uden prospect.

Table 10: Area coverage of each vegetation community within the Earl Grey, Irish Breakfast and Prince of Wales prospects.

Vegetation Community	Area (ha)	Percentage of Survey Area
Earl Grey prospect		
W2	8.24	3.50
MW6	64.94	27.58
MW7	1.39	0.59
MW9	4.78	2.03
MW10	52.92	22.47
MW11	69.18	29.38
Cleared Land	34.03	14.45
Total Area	**235.48**	**100.00**
Irish Breakfast prospect		
MW6	36.08	28.42
MW7	3.09	2.43
MW8	1.03	0.81
MW9	14.18	11.17
MW11	35.35	27.85
Cleared Land	37.20	29.31
Total Area	**126.92**	**100.00**
Prince of Wales prospect		
W2	4.07	2.90
MW3	79.46	56.66
MW4	3.52	2.51
MW9	5.41	3.86
MW11	37.59	26.80
Cleared Land	10.18	7.26
Total Area	**140.23**	**100.00**



0 200m

Scale 1:12,500
MGA94 (Zone 50)

CAD Ref: g2445_R007

Date: Feb 2017 | Rev: B | A4

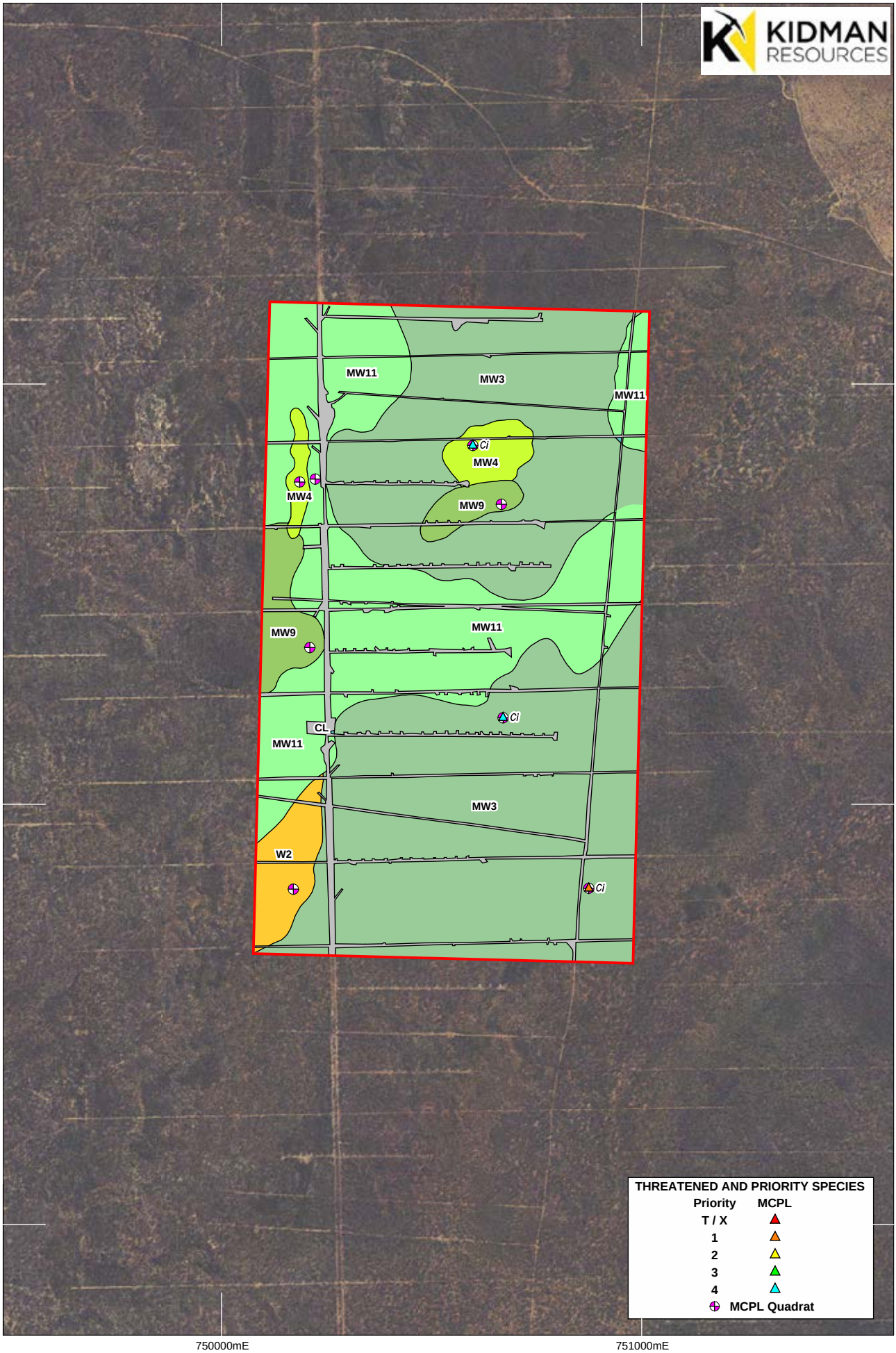
Mattiske Consulting Pty Ltd
28 Central Road, Kalamunda WA 6076 ~ Tel: 9257 1625 ~ Fax: 9257 1640
Author: E M Mattiske | MCPL Ref: KID1601/022/16
Drawn: CAD Resources ~ www.cadresources.com.au
Tel: (08) 9246 3242 ~ Fax: (08) 9246 3202

Kidman Resources Ltd.

Earl Grey & Irish Breakfast Vegetation

Figure: **9.1**

Aerial: Landgate (March 2011) ~ Threatened & Priority Flora: MCPL



KIDMAN RESOURCES

N	0 200m Scale 1:12,500 MGA94 (Zone 50) CAD Ref: g2445_R008 Date: Feb 2017 | Rev: B | A4	Mattiske Consulting Pty Ltd 28 Central Road, Kalamunda WA 6076 ~ Tel: 9257 1625 ~ Fax: 9257 1640 Author: E M Mattiske | MCPL Ref: KID1601/022/16 Drawn: CAD Resources ~ www.cadresources.com.au Tel: (08) 9246 3242 ~ Fax: (08) 9246 3202

Kidman Resources Ltd.

Prince of Wales Vegetation

Figure: **9.2**

7. DISCUSSION

Mattiske was commissioned by Kidman to undertake a survey of the Earl Grey, Irish Breakfast and Prince of Wales prospects. The three prospects occupy a combined area of 502.64 ha and are situated at the historic Mt Holland Project, south of Southern Cross, near Mt Holland. During the survey a concurrent search was made to determine if any flora of conservation significance were present in any of the three prospects. This was particularly important as the threatened taxon, *Banksia sphaerocarpa* var. *dolichostyla* was known to be present in the vicinity of the Mt Holland Project area (Convergent Minerals Limited 2014).

The field surveys of the Earl Grey, Irish Breakfast and Prince of Wales prospects took place in October and November 2016. A review of the potential constraints associated with these surveys determined that the surveys were not subject to constraints that would adversely affect the outcome of the surveys nor the conclusions formed from the results (section 6.1). A total of 43 vegetation survey quadrats were established across the three prospects – 26 in the Earl Grey prospect, nine in the Irish Breakfast prospect and eight in the Prince of Wales prospect. These quadrats were established to help verify the results from the desktop assessment and provide data to broadly map the vegetation communities present. The data recorded in the vegetation quadrats, together with observation made whilst traversing the three prospects also assisted in determining if the area supported any conservation significant flora or vegetation.

Flora

A total of 184 vascular plant taxa which are representative of 86 genera and 35 families were recorded in the Earl Grey, Irish Breakfast and Prince of Wales prospects. The majority of taxa recorded were representative of the Myrtaceae (46 taxa), Fabaceae (30 taxa), and Proteaceae (19 taxa) families (Appendix C). Species which were classified as strictly annual represented 9.9 % of all taxa recorded. Of the 407 plant specimens collected during the October and November 2016 surveys, six could not be identified to the species level, either because they were from burnt specimens which lacked sufficient diagnostic features, or as was the case with specimens identified as *Baeckea* sp. or *Lepidosperma* sp., current taxonomic revisions precluded making accurate determinations (M. Hislop, WAH, pers. comm.). A further 20 specimens were identified to the species level with some degree of uncertainty. Specimens which could either not be identified accurately by Mattiske or which were suspected of potentially being of conservation significance were submitted to the WAH for formal identification.

Rainfall in the months preceding the surveys was close to average (Figure 3) for the area. The majority of flora were either flowering or were nearing the end of their flowering period during the surveys. This afforded a good opportunity to collect excellent specimens to enable accurate identifications. However, there were less annual species recorded than expected. Given the number of Orchidaceae which were recorded as part of the desktop assessment, where they represented the third most commonly represented family after the Myrtaceae and Fabaceae, they were virtually absent during the October and November 2016 field surveys. There was a similarly low level of annual taxa recorded during October and November 2016 field surveys, and those that were recorded were already either dead or close to

senescence. This suggests that an earlier survey in late winter may be more appropriate to record annual species in the area.

Several flora of conservation significance were recorded during the October and November 2016 field surveys. The most significant taxon recorded was *Banksia sphaerocarpa* var. *dolichostyla* (T). This taxon was not recorded within either the Earl Grey, Irish Breakfast or Prince of Wales prospects. It was recorded at a location approximately 200 m from the eastern side of the Earl Grey prospect, in a vegetation community which is bisected by an old haul road (Figure 9.1). This taxon, nor the soil or landforms on which it was growing, was recorded in any of the three prosects surveyed. However, its proximity to the Earl Grey prospect, and hence potential for disturbance as a result of future mining operations, warrants management to minimise impacts. This is particularly important given that this taxon is generally restricted to the Mt Holland area (Convergent Minerals Limited 2014). Four priority listed taxa (DPaW 2017g) were recorded within the Earl Grey, Irish Breakfast or Prince of Wales prospects. These were *Eutaxia lasiocalyx* (P2), *Acacia undosa* (P3), *Hakea pendens* (P3), and *Calamphoreus inflatus* (P4) (Figure 9, Appendices C and F). All four taxa were recorded infrequently. However, given that the October and November 2016 surveys were of a reconnaissance nature, it is highly probable that more records of these taxa would be made during an intensive search. *Calamphoreus inflatus* (P4) was recorded only in the Prince of Wales prospect in areas which had been burnt approximately 18 months prior to the currently reported field survey. This was consistent with this taxon being known to occur on disturbed sites (DPaW 2017g). The desktop assessment recorded 54 taxa of conservation significance with the potential to be recorded in the vicinity of the Earl Grey, Irish Breakfast or Prince of Wales prospects (Table 4). Twenty-three of these taxa were assessed (Table 4; Appendix D) as having a high (one taxa) or medium (22 taxa) potential to be recorded within the Earl Grey, Irish Breakfast or Prince of Wales prospects. Similarly, records of the DPaW and WAH indicate a range of conservation significant flora recorded near to the Earl Grey, Irish Breakfast or Prince of Wales prospects (Figure 6).

Two flora taxa, considered by the WAH to be of significance, either in terms of their potential to represent new taxa or to be in need of further assessment, were collected during the October and November 2016 field surveys of the Earl Grey prospect. These two taxa are listed (Appendix C) as *Microcorys* sp. (aff. *macredieana*) and *Baeckea* sp. *Microcorys* sp. (aff. *macredieana*) is most closely related to *Microcorys macredieana*, but differs in regard to some significant taxonomic characters (M. Hislop, WAH, pers. comm.). Typical *Microcorys macredieana* occurs in the Great Victoria Desert. Currently, only one collection of this morphotype exists at the WAH. M. Hislop, of the WAH, advises that in the near future it is likely that a new phrase name will be recognised for this morphotype. *Baeckea* sp. belongs to a group of species that are to be published as a new genus '*Tilophloia*' (M. Hislop, WAH, pers. comm.). At the present time there are numerous phrases names recognised, with many occurring in the Forrestania region. The specimens of these taxa collected during the October and November 2016 surveys have/will be submitted to the WAH. Similar to the comments made in regard of conservation significant taxa recorded, it is likely that more specimens of *Microcorys* sp. (aff. *macredieana*) and *Baeckea* sp. would be recorded during a more intensive survey of the Earl Grey, Irish Breakfast or Prince of Wales prospects and their surrounds.

Only one introduced flora taxon was recorded in the Earl Grey, Irish Breakfast or Prince of Wales prospects during the October/November 2016 field surveys. This was **Centaurium tenuiflorum*, an introduced species which is listed as Permitted (s11) pursuant to the BAM Act according to the DAFWA (2017). Given the extent of disturbance, in terms of drill tracks, old mine pits and waste mounds, it is notable that more introduces species were not recorded.

Vegetation

Quadrat based species data from the four prospects (including van Uden) surveyed in October and November 2016 was used for the statistical analysis used to inform vegetation community delineation and definition. The four prospects: Earl Grey, Irish Breakfast, Prince of Wales and Van Uden, are close to each other (Figure 2). It was not appropriate to analyse the quadrat based data for each prospect in isolation. The reasons for this are that: 1) given the close proximity of all four prospects to each other there is the likelihood that there would be shared vegetation communities, and 2) undertaking a statistical analysis of each prospect in isolation may result in greater, and unwarranted vegetation community delineation.

The results of the statistical analysis, based on the combined 52 survey quadrats across the four prospects are presented in the form of a dendrogram (Figure 8). Two of the 13 statistically different groups (groups a and e) were uniquely associated with the Van Uden prospect and are not included in this report. Another two statistically different groups were represented by a single quadrat (groups g and j). The remaining nine statistically different groupings were variously distributed amongst the four prospects (Table 8). The single quadrat groups were also noted as being unique during the course of the field survey work. Group g, which occurred outside the eastern boundary of the Earl Grey prospect not only comprised a unique assemblage of species, but was also the location of the threatened species *Banksia sphaerocarpa* var. *dolichostyla*. The other single quadrat represented statistical group was group j, which occurred in the north eastern section of the Irish Breakfast prospect, and comprised an assemblage of species which are situated in a low lying drainage area at the base of a low rise to the north east of the Irish Breakfast prospect. The remainder of the statistically differentiated groupings of quadrats comprise variations on the dominant vegetation patterning in the prospect, particularly the dominant *Eucalyptus* or *Melaleuca* species. Overall much of the vegetation of the Earl Grey, Irish Breakfast and Prince of Wales prospects can be broadly described as *Eucalyptus* mallee woodlands over *Melaleuca* shrubland. The patterning of the vegetation observed represented a mosaic of mallee woodland interspersed with *Allocasuarina* scrub. The mapping of the vegetation communities made use of low level resolution aerial maps - high resolution imagery was not available at the time of the surveys or report preparation. Given that the present survey was a reconnaissance survey, with an appropriately low density of survey quadrats, the mapping of the vegetation communities may be subject to future refinement and boundary modification should further survey work be undertaken. Verbal advice from Kidman indicates that higher resolution aerials will become available in 2017. Should additional survey work be undertaken in the Earl Grey, Irish Breakfast, or Prince of Wales prospects, the combination of higher quality aerial maps and establishment of additional survey quadrats should enable a finer resolution of the vegetation present in these prospects.

Notwithstanding these limitations, 13 vegetation communities were defined and mapped, based on the results of the statistical analysis of the data from the 52 quadrats (Figures 9.1-9.2). There may be some justification in merging some communities into larger, more generalised groups of mallee woodlands. This was not undertaken for this report because the vegetation communities mapped broadly reflected the different vegetation communities observed in the field. The dominant vegetation communities, MW6, MW10 and MW11 accounted for 55% of all the survey quadrats. *Eucalyptus eremophila* was a common species in all three communities, with *Eucalyptus burracoppinensis* forming a dominant component of community MW6, *Eucalyptus flocktoniae* subsp. *flocktoniae* in community MW10 and *Eucalyptus incrassata* and *Eucalyptus prolixa* being co-dominant in community MW11. All three communities had varying levels of dominance of a range of *Melaleuca* and *Acacia* species. Parts of the Prince of Wales prospect had been burnt approximately 18 months prior to the October/November 2016 field survey. Whilst efforts were made to select undisturbed vegetation for quadrat establishment, there is the potential that some of the variation observed in the Prince of Wales prospect may be attributed to species successional changes associated with the recent fires.

Overall, the species recorded during the field survey, and the vegetation communities subsequently defined, are typical of the flora and vegetation which has been previously reported historically in the Forrestania region by Beard (1972, 1990), and in the more recent surveys in the vicinity of the Mt Holland gold mine (Craig 2006, Native Vegetation Solutions 2014, Convergent Minerals Limited 2014, Native Vegetation Solutions 2016a). The latter surveys (refer to Section 5.6) describe both flora species (Appendix C) and vegetation communities similar to those recorded during the present survey. That is, *Eucalyptus* mallee woodlands over *Melaleuca* shrublands and *Eucalyptus salmonophloia* woodlands. Given that Native Vegetation Solutions (2016a) have completed a Level 1 survey associated with drill lines in the Jilbadji Nature Reserve, approximately 800 m to the north of the Prince of Wales prospect, the incorporation of the quadrat based data from this survey, together with quadrat based data from the survey of the Blue Vein Mine (Native vegetation Solutions 2014), some 5 km to the south of the Earl Grey prospect, should be considered, assuming the data is available in a suitable format. This would enable a geographically broader assessment of the vegetation communities present, and ultimately any potential impacts to each community resulting from clearing associated with mine development to be assessed.

In terms of the areas surveyed, cleared land occupied the greatest proportion of the total area surveyed, comprising one fifth of the total area. Eucalypt mallee woodlands with a Myrtaceous, predominantly *Melaleuca,* understorey was the most dominant vegetation type mapped (communities MW6, MW10, MW11), comprising 43.48% of the areas surveyed. Several vegetation communities (MW4, MW7 and MW9) occupied less than 5% of the total areas mapped, but were variations on the eucalypt mallee woodlands over *Melaleuca* shrubland type vegetation.

In term of area coverage of the defined vegetation communities, eucalypt mallee woodlands with a myrtaceous, predominantly *Melaleuca,* understorey were the most dominant vegetation type mapped across the Earl Grey, Irish Breakfast and Prince of Wales prospects (communities MW6, MW10, MW11), comprising 58.90% of the areas surveyed. Cleared areas of land, comprising old pits, waste mounds,

access and drill tracks amounted to nearly one fifth (16.20%) of the total area surveyed. Whilst some of the defined vegetation communities had a low level of representation within the Earl Grey, Irish Breakfast, or Prince of Wales prospects, with the exception of community MW5, which lies external to the Earl Grey prospect, none comprised species or species assemblages which represent vegetation which is especially unique. Vegetation community MW5 was unique both in its species assemblage, and in particular that it is the location of *Banksia sphaerocarpa* subsp. *dolichostyla* (T). Other examples of this community were not recorded within either the Earl Grey, Irish Breakfast, or Prince of Wales prospects. Whilst this vegetation community is not specifically within the Earl Grey prospect, its proximity to an existing haul road and potential area to be mined, warrants measures being taken to minimise impacts to this vegetation.

The Earl Grey, Irish Breakfast and Prince of Wales prospects are situated wholly within the buffer of the Ironcap Hills Vegetation Complexes (Mt Holland, Middle, North and South Ironcap Hills, Digger Rock and Hatter Hill) (banded ironstone), a Priority 3 ecological community (Figure 6). All three prospects are situated near the western boundary of this PEC. Gibson (2004a) established a number of survey quadrats on the Middle, and South Ironcap, Digger Rock and Hatter Hill, as part of a series of detailed floristic studies of the ranges of the Eastern Goldfields. The survey quadrats established by Gibson (2004a) were principally sited on skeletal soils derived from banded ironstone and massive laterites, or on deeper soils derived from greenstone or decomposing laterites (Gibson 2004a). Gibson delineated four principal vegetation community types:

Community 1: Species rich shrubland or mallee shrubland on massive outcrops along the Middle Ironcap, South Ironcap, Digger Rock and Hatter Hill);

Community 2: Mallee shrublands or *Allocasuarina* thickets found on massive laterites;

Community 3: Eucalypt woodlands dominated or co-dominated by *Eucalyptus urna* and *Eucalyptus salubris* occurring on colluvial deposits on the flats below the outcrops or on the broad flat ridges along the ranges, with an understorey dominated by *Melaleuca* spp.; and

Community 4: Species poor mallee community generally dominated by *Eucalyptus calycogona* with large emergent *Eucalyptus salmonophloia* on small colluvial flats in the ranges.

Banded ironstone formations or any form of outcropping was not present within the Earl Grey, Irish Breakfast or Prince of Wales prospects. The terrain of the three prospects was gently undulating flats with occasional low rises, none of which exhibited any outcropping. Whilst the above listed community types are not necessarily the only vegetation types which would be associated with the Ironcap Hills Vegetation Complexes (P3), the absence of any of the listed communities, and associated landforms, together with the peripheral location of the Earl Grey, Irish Breakfast and Prince of Wales prospects with respect to the PEC buffer, would support the proposition that the three prospects are not of consequence in relation to the Ironcap Hills Vegetation Complexes (P3). For this these reasons, and because the present survey was reconnaissance in nature, no statistical analysis was undertaken to compare data from Gibson's (2004a) survey quadrats with the data recorded in the present survey to determine any level of similarity, and hence potential association with the PEC.

8. CONCLUSIONS AND RECOMMENDATIONS

Overall, the vegetation communities mapped and species recorded in the Earl Grey, Irish Breakfast, and Prince of Wales prospects were consistent with the historical mapping of Beard (1972, 1990) and the more recent localised surveys (Craig 2006, Native Vegetation Solutions 2014, Convergent Minerals Limited 2014, Native Vegetation Solutions 2016a). The majority of the Earl Grey, Irish Breakfast and Prince of Wales prospects are situated on sandy, sandy clay or clay loam flats and gentle slopes supporting *Eucalyptus* mallee woodlands over *Melaleuca* shrublands. The priority taxa *Eutaxia lasiocalyx* (P2), *Acacia undosa* (P3), *Hakea pendens* (P3), and *Calamphoreus inflatus* (P4) were recorded infrequently across the three prospects. The threatened taxon, *Banksia sphaerocarpa* var. *dolichostyla* (T), was recorded approximately 200m outside the eastern boundary of the Earl Grey prospect.

None of the vegetation communities defined within the three prospects represents vegetation which could be classified as unique or restricted in the region. There is a considerable degree of disturbance in all three prospects, in terms of access tracks and drill tracks, particularly form past mining and exploration activities. In addition, both the Earl Grey and Irish Breakfast prospects have large areas of disturbance and clearing associated with old mine pits and waste mounds. These cleared areas totalled 16.20% of the areas surveyed. Whilst the Earl Grey, Irish Breakfast and Prince of Wales prospects are situated wholly within the buffer of the Ironcap Hills Vegetation Complexes (P3) PEC, given that the vegetation present in all three prospects was typical of the region and that there were no banded ironstone hills outcropping present, it is likely that impacts to the PEC are peripheral and minor in their extent.

The principal issue with respect to the flora and vegetation surveyed is in relation to the presence of *Banksia sphaerocarpa* var. *dolichostyla* (T) in the vicinity of the Earl Grey prospect. It would be appropriate, in the event of future mine development, to put in place a management plan to minimise impacts to this species and the associated vegetation.

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10. LIST OF PERSONNEL

The following Mattiske Consulting Pty Ltd personnel were involved in this project:

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Ms N, Murdock	Senior Botanist	assisting in editing report	N/A
Mr A. Barrett	Experienced Botanist	fieldwork	SL011707
Mr B. Ellery	Experienced Botanist / Taxonomist	plant identifications	N/A

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